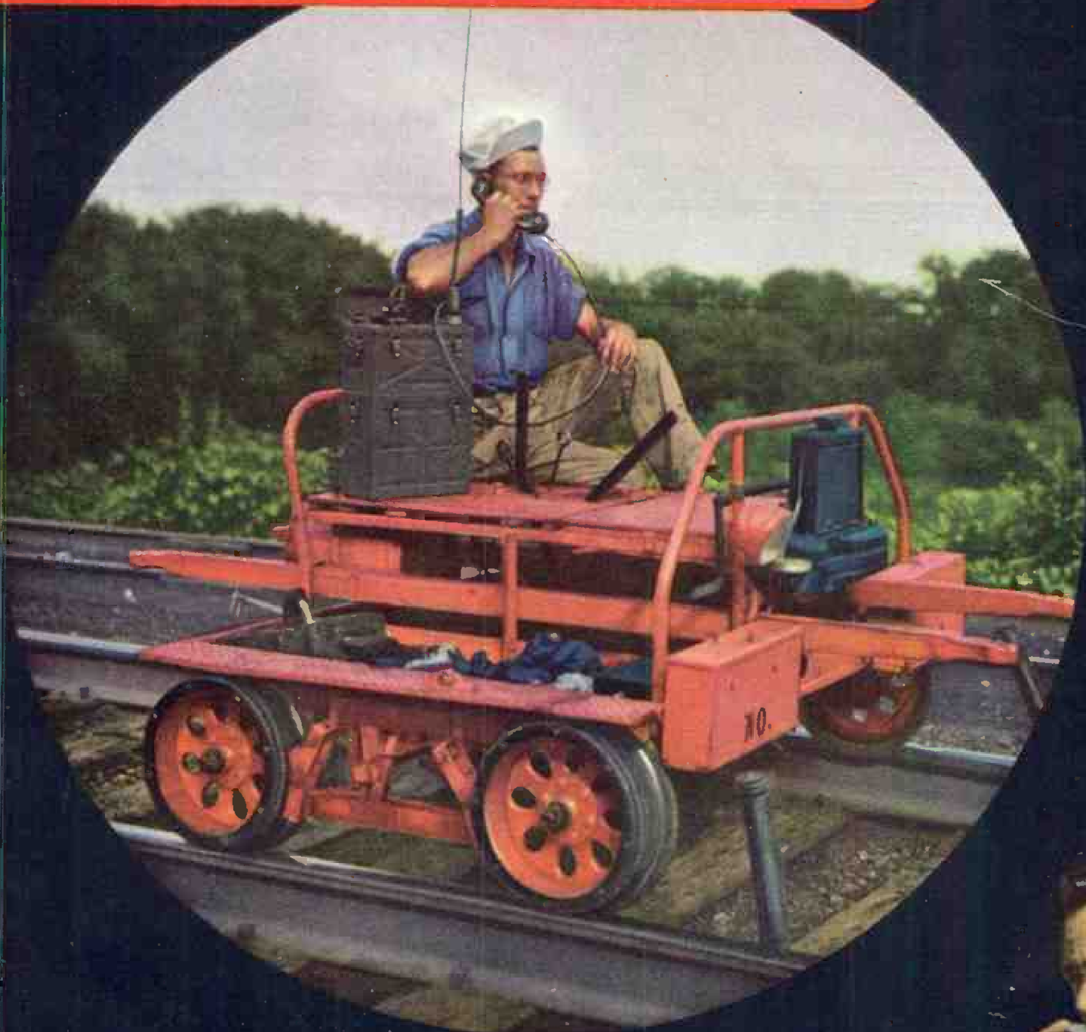
RADIO NEWS

NOVEMBER
1945
35c
In Canada 40c



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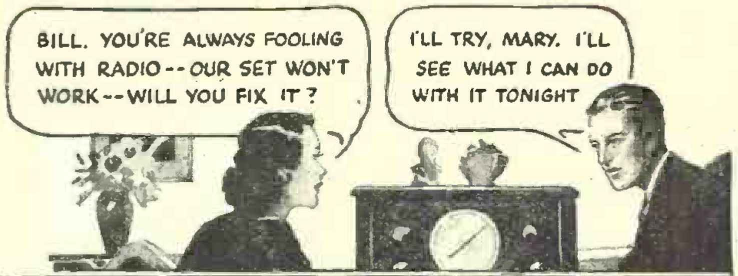

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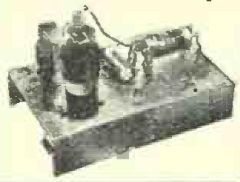

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NOVEMBER, 1945

RADIO NEWS

REG. U.S. PAT. OFF.

VOLUME 34, NUMBER 5

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SERVICE

GENERAL

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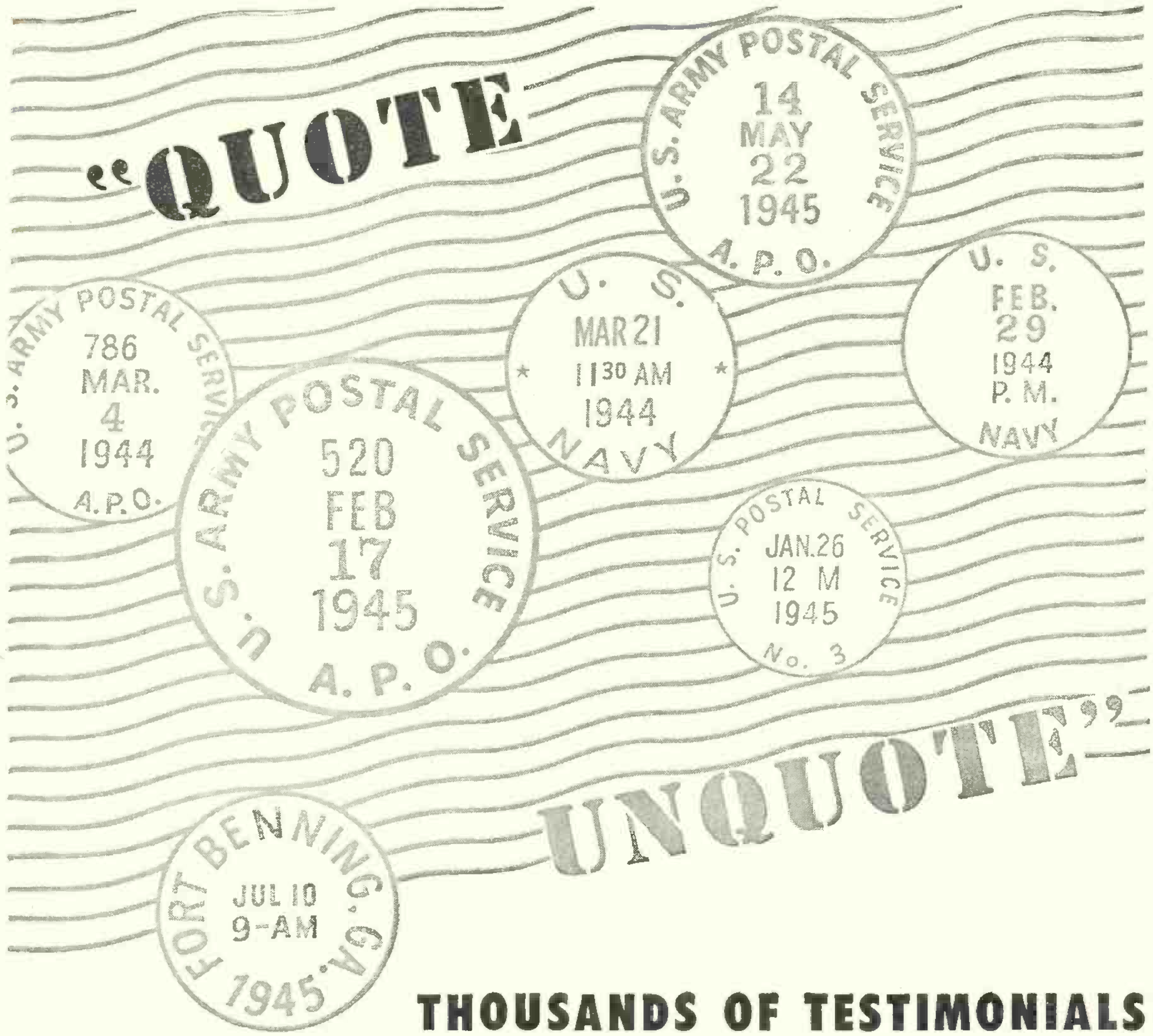

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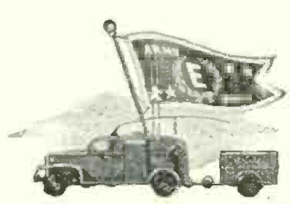

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For the RECORD

BY THE EDITOR

HOW MANY PROSPECTIVE AMATEURS?

WE RECEIVED a letter the other day from W1GAG, W1HIL, and W1EKT that begins as follows: "We have read with interest during the war years many articles appearing in RADIO NEWS bearing upon the innumerable and valuable contributions directly attributable to the radio amateur, justifying the small amount of the frequency spectrum allocated for his personal pleasure and experimentation. Without doubt, this material was in no small measure related to your own interest in and regard for amateur radio." Our reaction to this follows:

Not only do I, as a radio amateur, have a personal interest in ham radio, but we, as publishers, have a very definite obligation to our thousands of ham readers if we are to follow through with the groundwork which has already been laid in bringing to the attention of the public and our readers the many contributions made by the radio amateur.

Many thousands of prospective hams are or will soon be available to augment our depleted ranks. A great many of them are still overseas. Fortunately, we have been able to keep in touch with them and to keep them informed on subjects of particular interest. How has this been done?

To start with, we've done a bit of figuring in order to find out just how many eligibles are familiar with amateur radio. Overseas editions of RADIO NEWS (only radio publication purchased by Special Services Division, Army Service Forces) have been read by more than 6,500,000 GIs and others in various branches of the Army overseas. Many of these new readers learned about amateur radio for the first time. Many of them are trained in radio communications.

In addition, our normal monthly distribution of approximately 112,000 kept our readers at home informed on amateur radio matters. Many trips were made to talk to interested personnel at military training centers. While on our visits we discovered that approximately 15,000 copies per month had been sold to individuals at army PX's. Copies were widely shared by these readers. It is reasonable to estimate that since December, 1941, a minimum of 665,000 copies have been purchased in Army camps here in the states alone. These GIs are quite aware that amateur radio would welcome them into its ranks when they return to civilian life. They know what the qualifications are and their interest has been aroused.

Months before the FCC handed down their amateur frequency allocations, RADIO NEWS informed its readers (April, 1944, issue) that not only would amateurs get most of their frequencies back after the war but probably additional frequencies as well.

We don't claim that all of these returning GIs will be interested in amateur radio, but we certainly do believe that many thousands will show a definite interest. Many thousands have received training in radio. They will form the backlog for amateurs in the draft age bracket, but what about the teen agers? How can we sell them on amateur radio?

First of all, we must direct our primary efforts to the American youth if we are to gather young blood and maintain a large number of active hams throughout the years. We cannot question that the most logical source is the Boy Scouts of America. Figures show that on May 31, 1945, there were 1,919,000 active Boy Scouts. Further breakdown discloses that this figure includes 1,059,345 regular Scouts averaging fifteen years of age, 452,304 Cub Scouts, 327,197 Scouters (troop leaders, etc.), and approximately 80,000 Cubbers (cub leaders, fathers, etc.). *A total of 79,140 Scouts have seen military service.* Many of them are, or have been, radio amateurs. As a matter of fact, the magazines *Boy's Life* and *Scouting* have for many years featured articles on amateur radio subjects. So, we find that nearly 2,000,000 Scouts do know about amateur radio.

Yes, they even had their own *Boy Scout Radio Relay League* which comprised from 4000 to 5000 active hams up to Pearl Harbor. Many of them have seen emergency radio service. We believe, therefore, that one of our greatest potential mediae is with these Boy Scouts who, for the most part, would welcome further information on how they can become radio amateurs.

To accomplish this objective should not be too difficult. If each licensed ham would devote but just one evening to drop in at his local Scout meeting, we feel sure that much could be done to arouse the enthusiasm of these lads.

Ham radio need not be an expensive venture. In fact, it can be a very economical one. New frequencies just assigned simplify to a great degree

(*Continued on page 76*)

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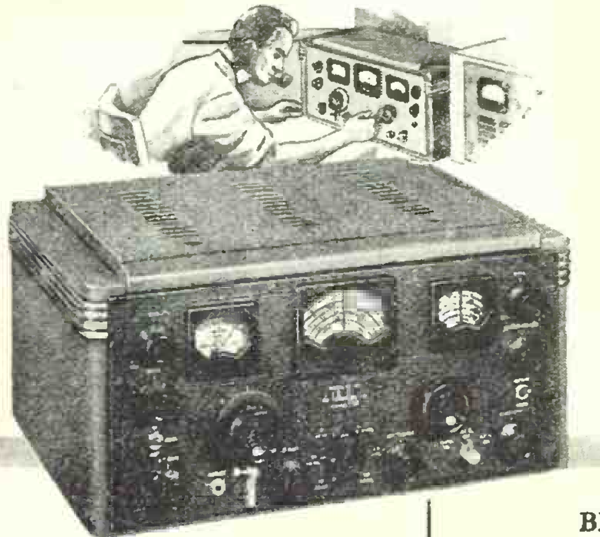

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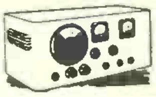

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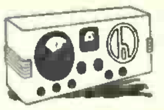

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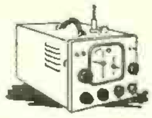

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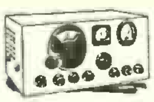

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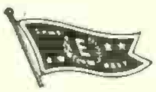

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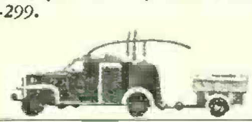

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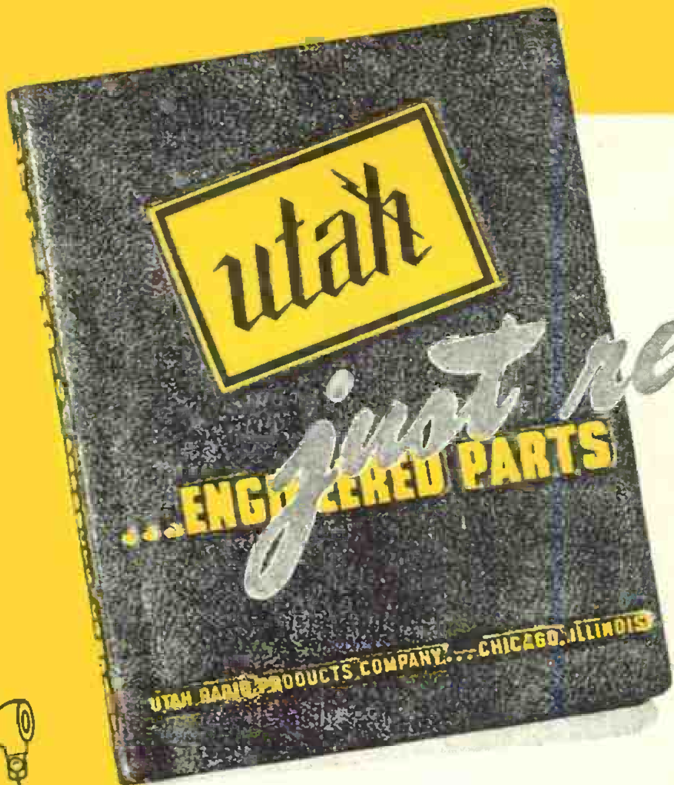

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Spot Radio News

★ Presenting latest information on the Radio Industry.

By F. D. WALKER
Washington Reporter, RADIO NEWS

THE FEDERAL COMMUNICATIONS COMMISSION recently announced, along with a list of assignments for present FM licensees and those who have been issued permits, that the United States has been divided into two areas for the purpose of FM allocations. Area 1 includes southern New Hampshire; all of Massachusetts, Rhode Island and Connecticut; southeastern New York as far north as Albany, Troy, and Schenectady; all of New Jersey, Delaware and the District of Columbia; Maryland as far west as Hagerstown; and eastern Pennsylvania as far west as Harrisburg. Area 2 comprises the remainder of the United States.

In Area 1, 20 channels beginning with 104.1 mc. and ending with 107.0 mc. (channels 81 through 100) are allocated for community stations, which are limited to a maximum effective radiated power of 250 watts and a maximum antenna height of 250 feet over the average height of the terrain 10 miles from the transmitter. All these 20 channels are available in any community which is not the principal city of a metropolitan district. Ten of these channels also are available for assignment in principal cities of metropolitan districts which have fewer than 6 stations. In Area 2, 10 channels beginning with 104.1 mc. and ending with 105.9 mc. (channels 81 through 90) are available for community stations and may be used by any city which is not the principal city of a metropolitan district. The main studio of a community station must be in the city served and the transmitter must be as near the center of the city as is practicable.

Metropolitan stations in Area 1 are limited to a maximum of 20 kilowatts with a non-directional antenna having a height of 500 feet. Where higher antennas are available, they should be used but in such cases FCC will authorize less than 20 kilowatts so that the coverage will be substantially similar to that provided by 20 kilowatts of power and a 500-foot antenna. Where the antenna height is less than 500 feet, the FCC may authorize its use but will not permit power in excess of 20 kilowatts. In Area 1, the service area of metropolitan stations will not be protected beyond the 1000 µv/m contour and the stations must be so located that a maximum of FM service to all listeners, whether urban or rural, is possible.

Those metropolitan stations in Area 2 are primarily for service to a single metropolitan district or a principal city, and to rural areas surrounding each metropolitan district. The Commission will designate service areas for metropolitan stations in Area 2 and authorize appropriate power and antenna height to cover the designated area.

Sixty frequencies are available for metropolitan stations in Areas 1 and 2. These frequencies begin at 92.1 mc. and end at 103.9 mc. (channels 21 through 80). The main studio of a metropolitan station must be within its 5000 µv/m contour. However, on a special showing of need, FCC may authorize it to be situated beyond that point but not beyond the 1000 µv/m contour.

Rural stations are primarily for rural listeners. The area of such stations may include the service areas designated for metropolitan stations if it can be shown that the additional area the station will serve is predominantly rural. As a guide, FCC will consider the additional area, beyond the area of a metropolitan station, is predominantly rural if at least 50 percent of the population live in rural areas or in communities smaller than 10,000 population. Rural stations will not be included in Area 1 as it is presently defined. The 60 channels allocated for metropolitan stations also are available for rural stations.

Two plans were studied in making the assignments in New York city. Under the first plan, stations would be allocated in the new band in approximately the same order as they are in the present FM band. Under that method, some of the existing networks would be given facilities which initially would be considerably better than those of other networks and an unequal competitive situation would result. Moreover, under this system, some of the independent stations which were pioneers in FM—including the inventor of FM—would be given the least desirable assignments. Finally, this method would result in saving for latecomers the best facilities in New York, instead of making them available to those who pioneered FM broadcasting.

In making the assignments in New

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York city, FCC decided to assign the frequencies with the maximum service area beyond the 1000 µv/m contour to existing stations since these stations were pioneers. The FCC has attempted to assign substantially equivalent facilities for all the networks. As a result, the facilities assigned to the network pioneers have a somewhat smaller service area beyond the 1000 µv/m contour than in the case of the non-network pioneer stations. This should result in maximum service to listeners in the New York area. The programs of the network stations are available either from the network-owned stations or from their affiliates. Hence, listeners living beyond the 1000 uv/m contour of the network-owned station will have an opportunity of receiving network programs. All networks will have an opportunity to compete for affiliates in such areas. So far as non-network stations in New York are concerned, their programs are not sent from any other station. Thus, the listening public gains by making available to non-network stations those frequencies which have a maximum service area beyond the protected 1000 uv/m contour.

The Commission has received inquiries from men now in military service regarding the possibility of filing applications for FM facilities at this time, with engineering data to be submitted at a later date after their discharge from the service. The Commission announces that it proposes to make "conditional grants" of FM applications, giving the applicants a period of 90 days to file engineering details of proposed operations. It is believed this procedure will expedite the filing of applications by service men and will enable them to qualify for FM licenses. The FCC recognizes the difficulties confronting military personnel in completing their applications for broadcasting and intends to give consideration to requests by applicants in the armed services for reasonable extensions of time to submit engineering data. Since it is not possible to reserve FM channels for future assignments, service men planning to enter the broadcast business are urged to submit their applications promptly.

E. K. Jett of FCC is advising radio listeners to buy combination AM-FM sets when the new models appear on the market. The speed with which FM broadcasting develops will depend, he said, on "how rapidly you listeners accept this new method of program transmission." For those who have good AM receivers now, an FM adapter can be purchased at low cost. Commissioner Jett predicts that within four or five years after civilian production is resumed, at least half of the homes of America will be equipped to receive FM broadcasts. He believes that FM eventually will replace local and regional AM reception in metropolitan areas. The high-power, clear-channel AM stations must be retained throughout the years to serve rural audiences which cannot get good reception from FM stations, he said. It is Commissioner Jett's prediction that within two or three years some 500 FM stations will be in operation.

Price Administrator Bowles announced that ceiling prices for radio receiving tubes and parts sold for installation as *original* equipment in radio sets would be increased five to 11 per-cent, but his announcement was the signal for a renewed demand within the industry for a more lenient pricing program. Publication of his increase factors brought a barrage of telegrams, telephone, and mail protests to OPA and the Radio Manufacturers' Association headquarters in Washington. General tenor of the complaints was that manufacturers would have to continue to refuse orders and shipments because of inability to meet production costs under OPA decisions. A sheaf of RMA manufacturers' protests was submitted to Senator Mead, chairman of the special Senate war and reconversion investigating committee, and to Administrator Bowles by President R. C. Cosgrove of RMA. Along with the letter and telegrams to the Mead committee went an appeal for relief and a detailed explanation of the reasons for the general suspension of civilian radio production. Senator Mead promised speedy action with OPA and a committee investigation, which may be followed by formal hearings. RMA members also made direct appeals to their senators and representatives, supplemented by similar action of union leaders.

In his announcement of increase factors for original equipment, Administrator Bowles said, "The reconversion pricing factors will permit radio tube and parts manufacturers to determine quickly their new ceiling prices for postwar production and, at the same time, permit manufacturers of completed domestic radio sets to calculate quickly what their costs will be for sets returning to market." He emphasized that the increase factors are for use only in computing ceilings for radio tubes and parts sold for use as original equipment to manufacturers of radio sets. Radio tubes and parts for replacement in the repair of sets are not affected by the new action, and continue to be the highest prices sellers charged during March, 1942.

Administrator Bowles pointed out that, as a result of the failure of parts and tube manufacturers to supply as much financial data as OPA requested, OPA was forced "to provide factors for parts other than tubes that are interim increase factors." If for any items, they should prove too low, OPA will adjust the parts increase factors upward later, he said. He declared, however, that "we will adjust them upward only if additional cost data are supplied us by parts manufacturers, and such cost data demonstrated a need for higher prices."

The increase factors are as follows: Radio receiving set tubes, 10.4 per-cent; coils for radio equipment, 11 per-cent; radio transformers and chokes, 11 per-cent; variable capacitors, 9 per-cent; speakers and speaker parts, 9 per-cent; fixed capacitors, 7 per-cent; parts for electric phonographs and radio phonograph combinations, 7 per-cent; resistors, all types, 5 per-cent; all other radio parts, 5 per-cent.

To calculate his ceiling prices for a radio tube or part sold for use as original equipment in a radio set, the manufacturer takes his Oct. 1-15, 1941, price for the part and multiplies it by the increase factor. The sum of the resulting figure and the Oct. 1-15, 1941, price is the manufacturer's reconversion ceiling price.

Component manufacturers are submitting additional data to OPA to support their requests for upward revision of the increase factors. This will require several weeks and it will, therefore, delay the OPA receiving set increase factors, which will be partially based on the final component price percentages. Applications for individual company relief also are being made, but OPA officials said that its "general rescue" clause issued early in September, for the benefit of companies facing production losses, is not available to radio manufacturers.

In the absence of a pricing formula acceptable to OPA and the manufacturers, OPA has offered to write a special adjustable pricing order providing that parts manufacturers may sell to set manufacturers on "memo billing," or billing subject to subsequent upward revision of price increase factors. Such an order was issued, but OPA made the point that neither the issuance of the order providing for adjustable pricing or the promise of price revisions made any change in the interim increases already announced.

Preliminary returns from a cross-section survey being made by the WPB Radio & Radar Division indicate that only about 30 per-cent of the radio industry's pre-VJ Day employment of over 450,000 has been dropped. This estimate was based on reports from companies representing about a third of the wartime production of both end equipment and component manufacturers. WPB officials said that the 70 per-cent of employees retained should not be considered an accurate barometer of future and long range postwar employment in the radio industry. More complete figures, covering a larger segment of the industry, will be tabulated by the WPB. Officials pointed out, however, that a significant aspect of the preliminary tabulations is that the employment level of the radio industry, despite cutbacks, is at a higher level than the industry's peak of 110,000 workers for 1941. This would seem to indicate, officials believe, that the radio industry's employment level will remain much higher than it was before the war.

THE STORY HAS BEEN RELEASED of how a single American broadcasting station, built to wage psychological warfare against the Japs, "doubled in brass" by saving 20 Superfortress bombers, the lives of 200 flyers and property worth more than $15,000,000.

In November, 1944, James O. Weldon, chief of the OWI bureau of communications facilities, and five members of his staff embarked from Saipan to undertake the installation of a Western Electric broadcasting transmitter whose special antenna was capable, in effect, of concentrating the energy of five of the most powerful broadcasting stations of the U. S. toward Japan. By working night and day, the huge station was ready for the air 31 days later.

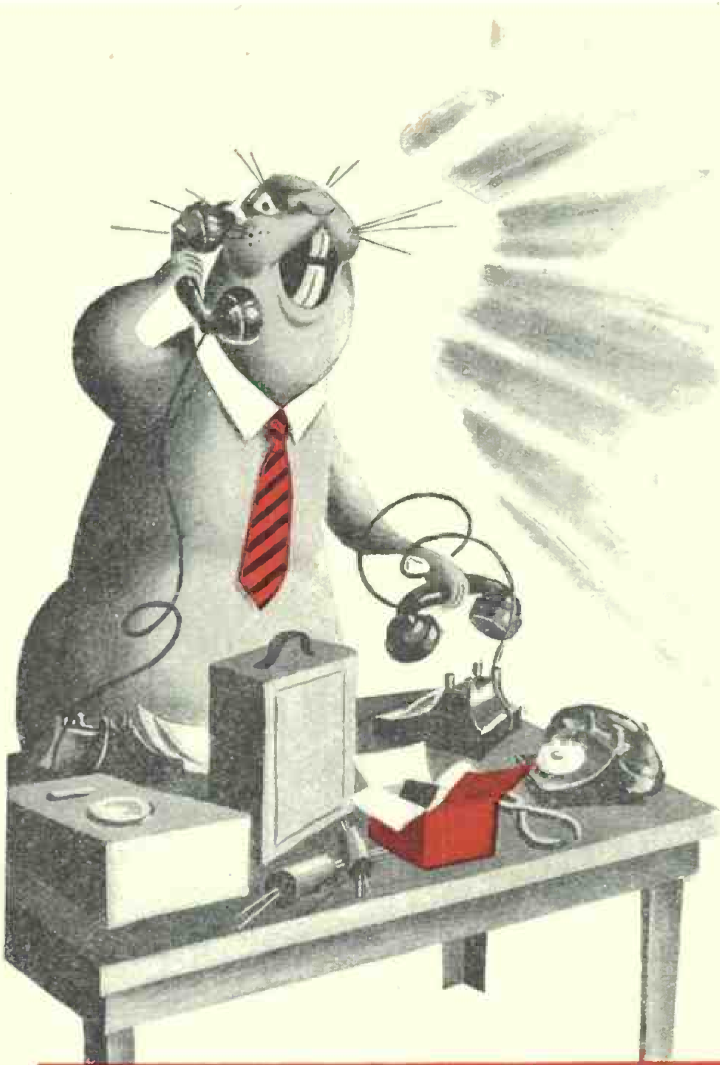
The results were immediate. Scarcely had KSAI, the call letters by which the new station was known, begun operations than Jap engineers tried unsuccessfully to jam it. The next evening, radio Tokyo urged its audience, "And now let us all turn off our radios, go to bed early, and conserve our strength through refreshing sleep."

Then came an unexpected pay-off. OWI men received an urgent order from the Army: "Keep that transmitter on 24 hours a day permanently from now on." The explanation quickly followed. A crippled Superfortress, its navigating equipment smashed, had "homed" on the station with its radio compass and rode the powerful beam to safety. Soon many a crippled bomber crew winged its way home to the crooning of Bing Crosby and Dinah Shore—and request for "position" from lost fliers dropped from the previous average of 140 a day to a mere 20. Few single instruments made during the war paid such high dividends.

PREPARATIONS TO JOIN the National Association of Broadcasters in an all-industry celebration, probably late in the fall, of the 25th anniversary of radio broadcasting have been made by the RMA advertising committee. A formal request by RMA to establish a federal technological museum, including radio and radar equipment used in the war, will be recommended by the advertising committee to the Association's Board of Directors.

THE MANAGEMENT of the Products of Tomorrow Exposition has been advised by Frank Perrin, secretary of the War Committee on Conventions, that their event will not be confronted with any restrictions in the showing to take place in 1946. The showing has definitely been set at twenty-four days, instead of the previously planned seventeen days, in order to accommodate the expected crowds. Should postponement become necessary, exhibitors have been assured by the management that they will be given sufficient warning.

—30—



busy as a beaver?

Telephones buzzing...shopping for parts...accounts to balance...and jobs lined up 10 deep. Doubling on "desk duty" sure cuts into a fellow's at-the-bench time, but not the smart servicer's. He gets extra working mph (minutes per hour) by buying replacement parts he can trust. parts that do the job right first shot.

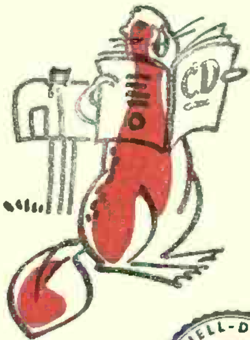
★ Take these C-D dry electrolytic "Beavers." 35 years of capacitor research and manufacturing experience make them better. Conscientious workmanship and rigid inspection make them longer-lasting. That's why C-D Beavers have been working for the experts. They're reputation builders.

high temperatures don't bother them

You don't catch these C-D Beavers wilting under heat and humidity. They're "over-size" in quality, "under-size" in physical dimensions. They come in a wide range of capacities and voltage ratings.

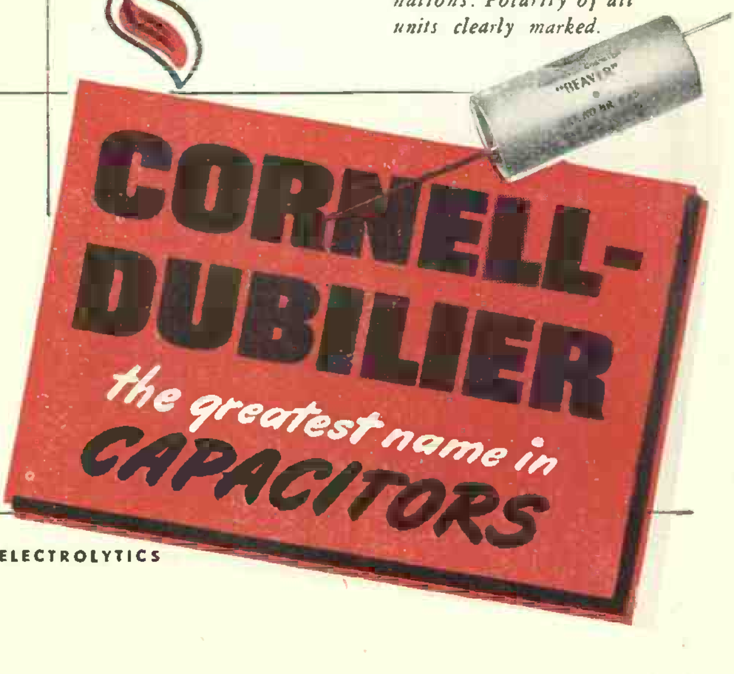
real time savers

C-D Beavers are quick, sure-fits for tight spot, under chassis mounting Two or more can be strapped together to obtain a wide variety of capacity combinations. Polarity of all units clearly marked.



get this free catalog

A couple of minutes reading time gives you the lowdown on the most complete line of capacitors in the business. Write for catalog No. 195 today! Cornell-Dubilier Elec. Corp., Jobber Division, New Bedford, Mass.



CORNELL-DUBILIER CD CAPACITORS

MICA • DYKANOL PAPER • WET AND DRY ELECTROLYTICS

Yes we're all set...

-and ready to go!

Yes, FADA is back in the groove, ready to take care of pent-up civilian radio requirements!

FADA radios will offer a combination of modern technical experience, forged in the crucible of wartime necessity, plus a thorough understanding of civilian wants and modern merchandising principles, acquired over a long period of time in the making of hundreds of thousands of radios.

FADA is proud of its achievements in the Radio Industry over a period of many years. You, too, will be proud to display the new FADA line of radio receivers.

We suggest that you contact your distributor to learn more about FADA's profit-building merchandising plans. Or — write to us direct!

PLACE YOUR FAITH IN THE

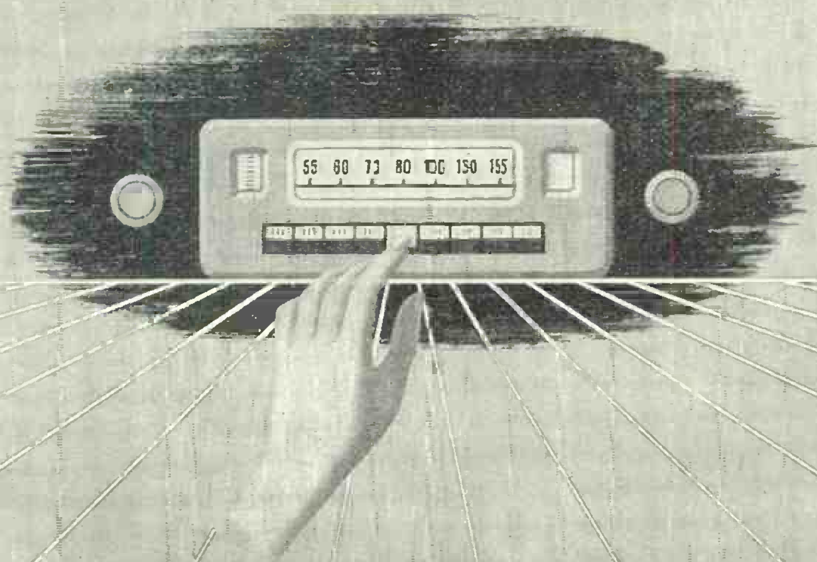
FADA Radio

OF THE FUTURE

Famous Since Broadcasting Began!

FADA RADIO AND ELECTRIC COMPANY, INC., LONG ISLAND CITY, N. Y.

The best of all that's new in home radios



Yes, there will be F-M and A-M Delco home radios . . . combinations, too . . . styled to win the eye and engineered to delight the ear . . . in console models, table models *and portables* that cover the range of customer demand. Delco home radios and Delco auto radios will offer the best of all that's new . . . backed by Delco Radio's long experience in radio building and merchandising . . . distinguished by the combination of *engineering vision* and *manufacturing precision* that made Delco Radio a major supplier of radio and electronic equipment for the armed forces.

ENGINEERING VISION— MANUFACTURING PRECISION

Delco Radio
DIVISION OF
GENERAL MOTORS

BUY VICTORY BONDS FOR A LASTING PEACE

DELCO RADIO UNITED SERVICE MOTORS **A UNITED MOTORS LINE**

ALL NEW — incorporating new techniques, new circuits, new tubes.

NEW TRANSMITTERS . . . with impressive high fidelity, low harmonic distortion, low hum level . . . with outputs of 1, 3, 10 and 50 kilowatts . . . plus ample operating safeguards.

The basic unit is the exciter, generating 250 watts of RF power. Its design permits adding power units as desired . . . at any time . . . in selected steps that make possible the different outputs.

NEW ANTENNAS . . . of two or more loops with two or more half-wave elements, are factory tuned for easy installation. Standard coaxial lines feed them.

NEW POWER TUBES . . . highly efficient, incorporate notable Federal achievements in design and production. They assure long, dependable performance in FM broadcasting.

Look to Federal for the finest in FM equipment.

FEDERAL TELEPHONE & RADIO FTR

Federal Telephone and Radio Corporation

AN IT&T ASSOCIATE

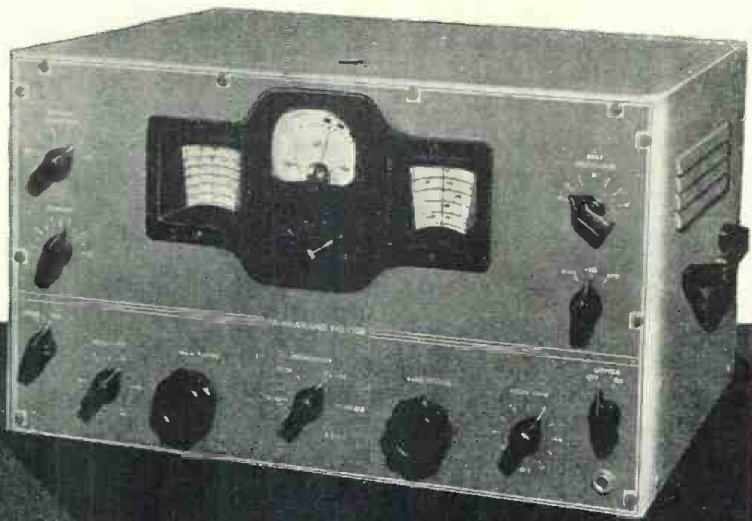
Newark 1, N. J.

NEW!

"HQ-129-X"

$129.00* AMATEUR NET

LESS SPEAKER



*PRICES SUBJECT TO CHANGE WITHOUT NOTICE

WRITE TODAY

A postcard will bring description of this outstanding new receiver.

FINEST LOW COST RECEIVER

By all measurement this is unquestionably one of the greatest values ever offered to amateurs . . . Here is "ham" communication at its best, streamlined for highest performance at a modest cost . . . WRITE TODAY. Send card for descriptive folder.

HAMMARLUND

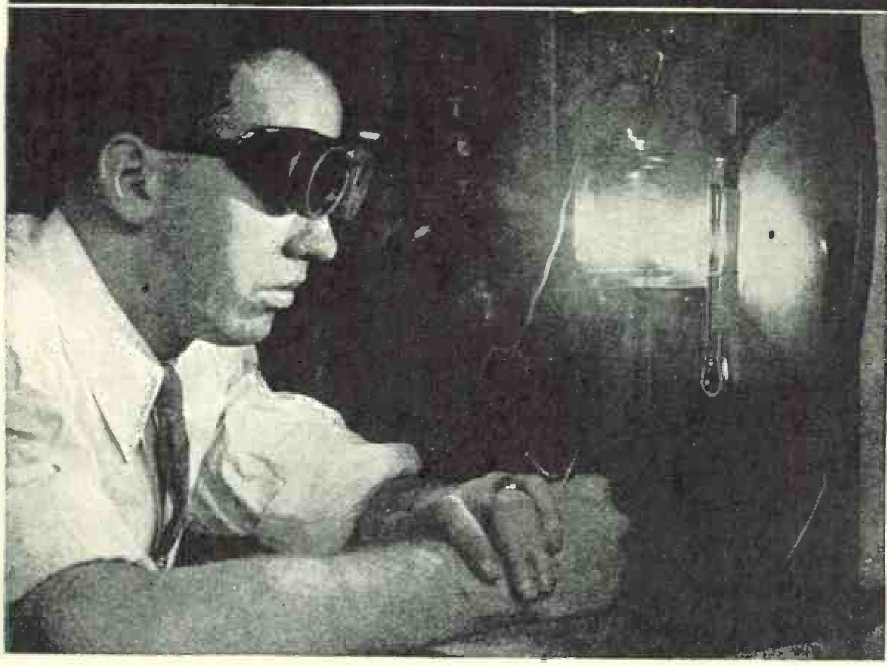
THE HAMMARLUND MFG. CO., INC., 460 W. 34TH ST., NEW YORK 1, N.Y.

MANUFACTURERS OF PRECISION COMMUNICATIONS EQUIPMENT

RADIO JOBS *for* G. I. Joe

By
TONY WAYNE

The radio industry looks toward the returning GI to help meet immediate reconversion problems.



Research scientists studying electric high-current arcing in gasses at low gas pressure. High scholastic standing or practical experience is a definite requirement for all returning veterans who desire to enter this field.

RETURNING to a field of endeavor, or entering it for the first time, is a major step in the life of any man, especially when that field has made such vast strides forward in the past four years.

Radio, an encompassing word, is just such a field and this article, written by a radio man, is intended to serve as a *beacon,* lighting the pathway of those returning veterans who feel it is a "sure thing." Most of them have given serious thought to their future in civilian life, a future of their own choice and one in which they can utilize their interest and capabilities.

Choosing to enter the field of radio will, in most cases, be based upon their prewar experience supplemented by additional knowledge and experience gleaned from service duty, or an interest acquired through virtue of the fact of their eleven or twenty weeks' service training in radio. Are these returnees then entitled to a rightful place in this "bumper" field?

We intend to speak frankly and straight from the shoulder, without double-talk, factually stating what we mean—what many accepted authorities in radio and allied fields mean—not what we think we mean—or they think they mean. While some of the ideas herein may appear remote and intangible, it is to be understood that they are not intended to discourage anyone who has a burning desire to board the radio "band-wagon." Nor, are the following ideas intended to open the returnee's mouth with awe, and not fill it.

Let's stop psychoanalyzing the serviceman and, instead, let him in on the "know" without obscuring the meaning of things behind a smoke-screen of meaningless words, and phoney committees and commissions. GI Joe does not want your sympathy; he wants a job with a future—one of his own choice, in a field which holds appeal for him.

There are such jobs in the radio field and they can be adequately manned by the returning GIs. American manhood does not want to be treated as a problem child. True, suffering has been experienced through combat, but, basically, the veterans are the same men, matured by experience, and anxious to find their rightful niche in life.

Some veterans will, naturally, require more help than others, due to the fact that their interests no longer lie in those fields of prewar days.

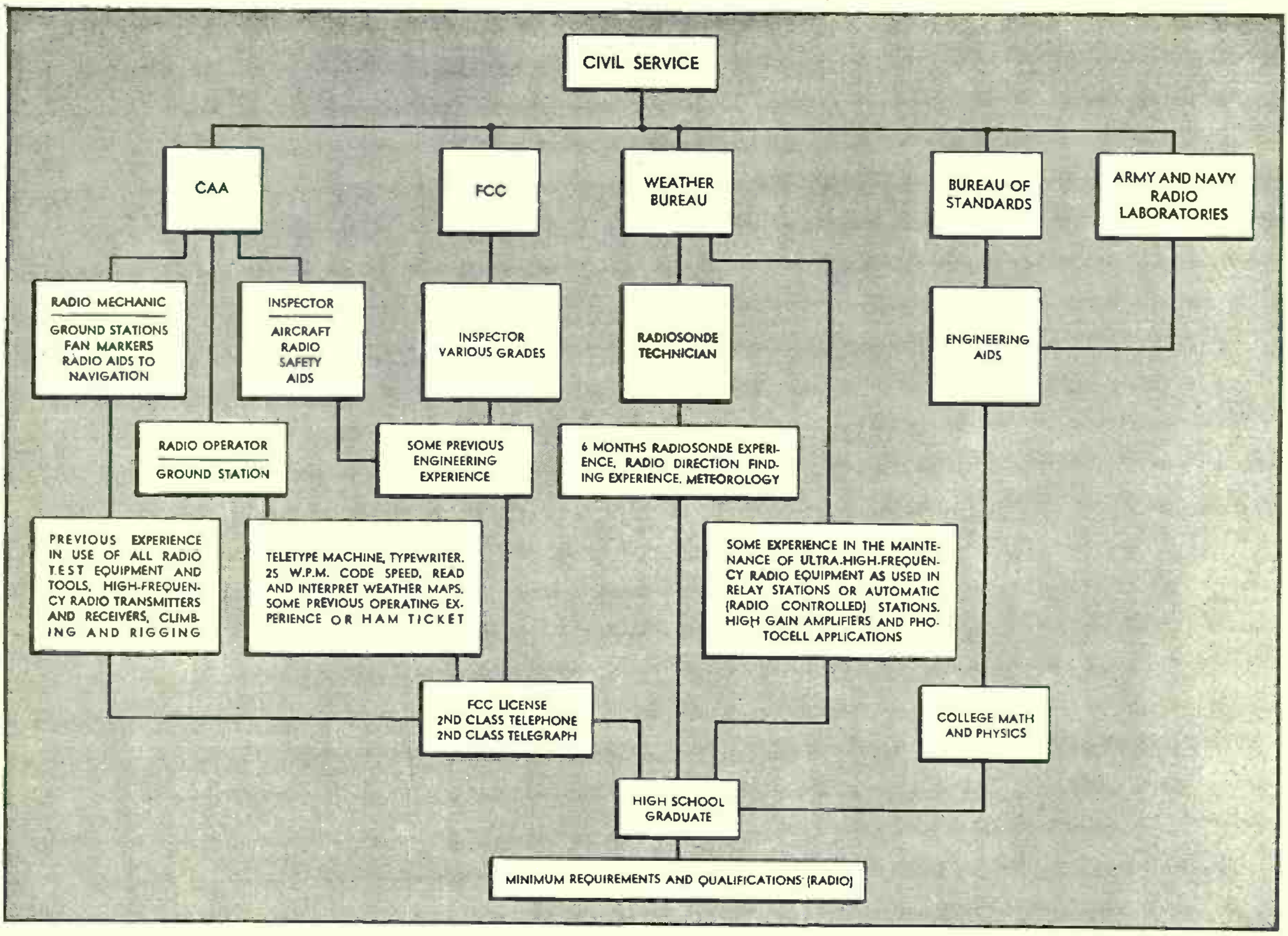
Introspection should be one of the first things a veteran does upon completion of his service duty. What does he have, from pre-war days, to fall back upon? What did he learn or experience during those weeks, months, perhaps years, of life spent in an alien atmosphere, that can now be of bene-

EMERGENCY ISSUE

Chicago: "Publishers of nearly 200 business papers, of scores of general magazines and of hundreds of house organs, catalogs, etc., have been thrown into turmoil here by a strike that has shut down Chicago's printing industry"—Advertising Age.

This publication was one of those affected. We know it does not meet our usual standards of presentation and appearance, but we believe you would rather have such an issue than none at all. We hope, therefore, that you will bear with us until next month, when we can again resume the publication of a normal issue.

THE PUBLISHERS



Civil Service will be an excellent placement medium for certain types of radio jobs. The CAA and FCC will soon inaugurate many new Civil Service jobs in the field of radio which can be filled by returning veterans. Chart shows the minimum requirements.

fit to his future? These are two vital questions which must be anansewered after careful self-examination.

We intend to aid him in his quest for a stable future in the field of radio, by pointing out facts upon which he can rely and by guiding his thinking along concrete lines instead of allowing him to build his plans on hearsay.

Directly, or indirectly, radio and allied industries will require thousands of employees in the very near

Radio laboratories throughout the nation have numerous immediate positions open.

future—executives, engineers, mechanics, technicians, camera men, lighting specialists, operators, clerks, and hundreds of other type positions too numerous to mention here.

Instead of wearing out shoe leather or beating their heads against blank walls, veterans should chart their course of action systematically, in planning their life's undertaking. After taking stock of themselves and their potentialities, they should review their job or duty in the service. For instance, if they held the rank which made them communications officers, or if they carried a radio pack set, or even operated or repaired radio equipments, just what were the qualifications necessary for that job? What jobs then, in civilian radio, television, or communication industries require experience or qualifications parallel to those learned in service?

Radio and allied fields have actually advanced a quarter of a century in progress in the past four years, stimulated of course, by the lash of war. The most sensational development to which we may look forward, in these years following the cessation of war, will be television. Television is expected to climb to the top rung of the ladder of American industries, as a billion dollar business, absorbing between four and five million employees.

Relatively few new employees entered the radio and allied industries in the years prior to the war, due to the small amount of manufacturing or activity in the field during the depression, coupled with the fact that there existed few uses of radio then, in new and unexplored fields. Since television, radio, and related industries will open up jobs for so many, far-sighted concerns are already drawing plans for the institution of vocational education of new employees, plans which will produce rapid instruction in order to meet the expected fast-moving expansion of these fields.

There are, roughly speaking, from ten to fifteen thousand television home receivers now in use, a "drop in the bucket" compared to the millions which will roll from assembly lines just as soon as the manufacturers get the "green light." The above figures do not include the millions of standard broadcast and FM receivers which are in demand. It is estimated that 398 television broadcast stations will be in operation, 45 FM stations, and 935 standard broadcast stations, in various areas of the United States.

Too, chains of micro-wave relay stations, are springing up in all sections of this country. *Western Union* is contemplating a chain of stations from Camden, N. J., to New York City. *Raytheon Manufacturing Company* has already established a micro-relay system on the West Coast, with stations extending from Washington to California, through Nevada, Utah, and Colorado. Now, it is extending the relay to New York to the north, where it will eventually reach Boston, and southward along the Atlantic Coastline. All these stations will require numerous skilled radio men to operate and maintain them.

The writer was informed recently, that men with experience in microwaves or ultra-high-frequency radio, with a knowledge of direction finding equipment, holding an FCC second-class radio-telephone or second-class radio-telegraph license, will, after a satisfactory interview, be employed and stationed at one of the plants engaged in the design and construction of equipment intended for use in the above mentioned stations. There they will actually work on and become familiar with the equipment. The knowledge of direction finding equipment will not only be necessary, but useful, since it is planned that the stations will also function as automatic warning beacons for aircraft.

After becoming familiar with the equipment, these men who have been trained will be sent out, not as operators, but as maintenance men, to supervise or assist others in the operation and maintenance of relay stations. This promises to be a very interesting venture for those who are anxious to combine a romantic element with their work.

Recently, the FCC allocated sixty radio channels for use by the railroads, for two-way radio communication. This item should be of interest to those who have had carrier current communication experience and are anxious to put it to use.

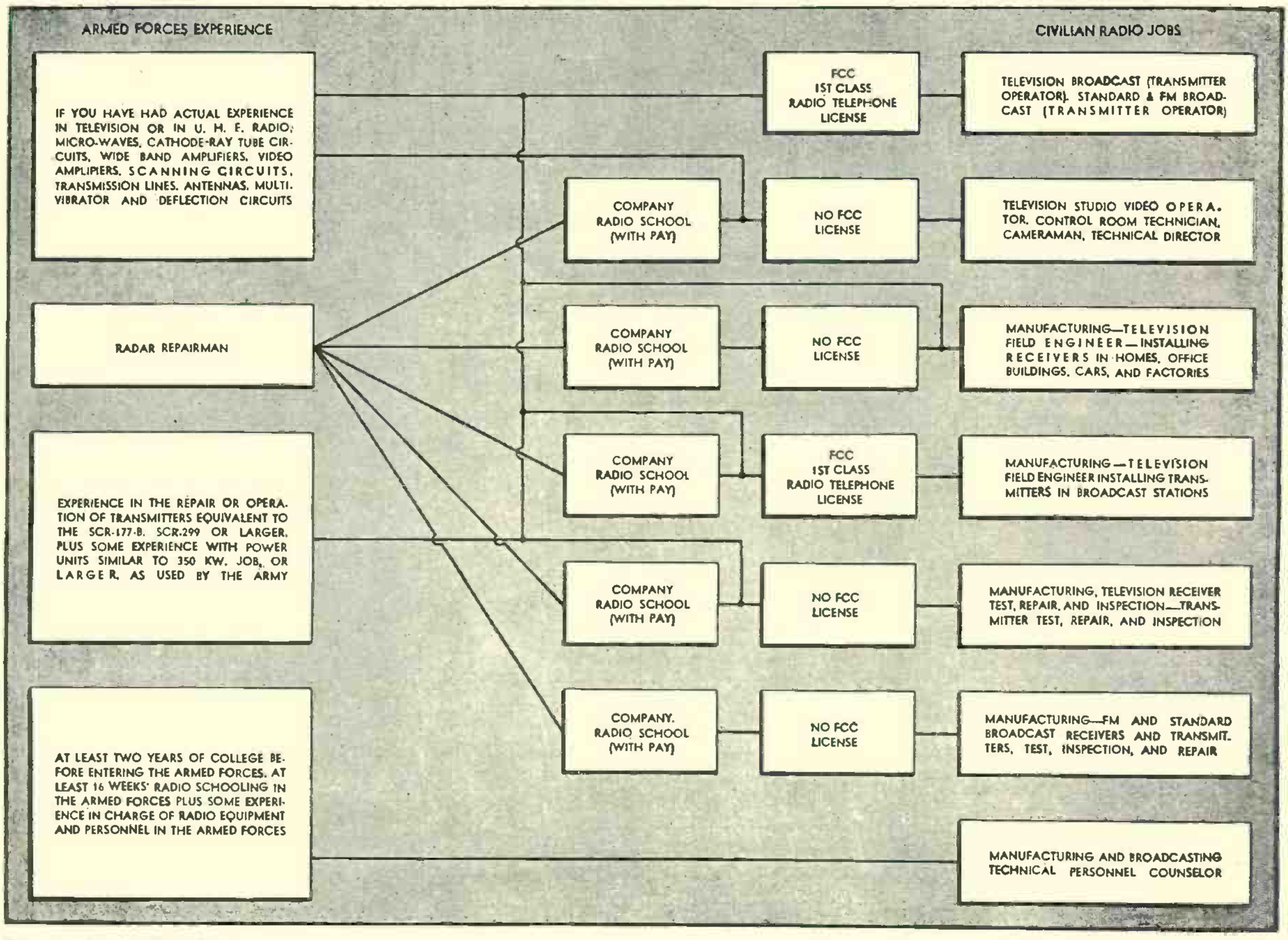
The world's first taxi-cabs equipped with two-way radio are being tried out by the *Yellow Cab Company,* of Cleveland, Ohio. It is anticipated that other transportation companies will follow suit, thus offering still more jobs to radio technicians. The writer predicts that the *Bell Telephone* system will invade the communications field by including service to buses, trucks, taxi-cabs, and other automotive vehicles both in cities and on highways—to farmers and others in remote and sparsely settled areas—to moving trains, airplanes, and ships at sea.

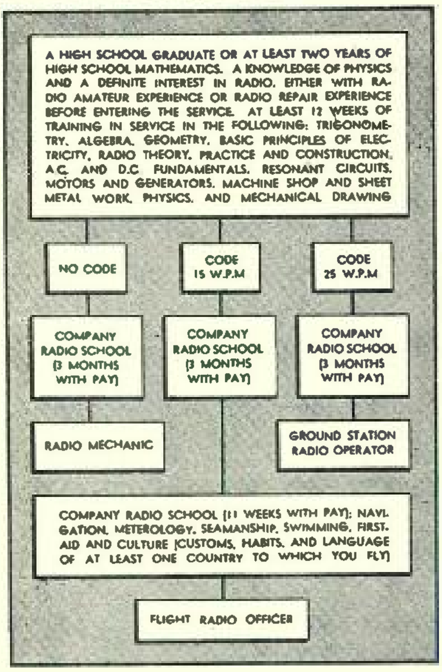
One very large communications field which should not be overlooked

Student receiving instruction on the action of filament contactor in a 15 kw. transmitter at the Press Wireless School, at Hicksville, N. Y. Veterans with ham tickets will find many ideal positions in this field awaiting their return.

is that of the commercial airline, with all the talk of the large luxury liners that are soon to crowd the "blue yonder," spanning the entire continent and flying to every corner of the globe. The huge six-motored, 204-passenger ships will require flying radio operators and ground technicians to keep the radios, direction

The manufacturing of home receivers and broadcast equipment is the largest branch of the radio industry. More veterans will find placement in this branch than in any other, especially those who have had extensive training paralleling along these lines. Television, a relative new-comer to the radio industry, will have its greatest period of development in the near postwar period, offering vast opportunities to those veterans who have an understanding of and interest in this field.





If you have the minimum requirements listed and are between the ages of 21 and 29, you are an ideal potential employee of the civilian airlines. While an FCC second-class radio telegraph license is required for these jobs, veterans without this "ticket" will be accepted and trained for one.

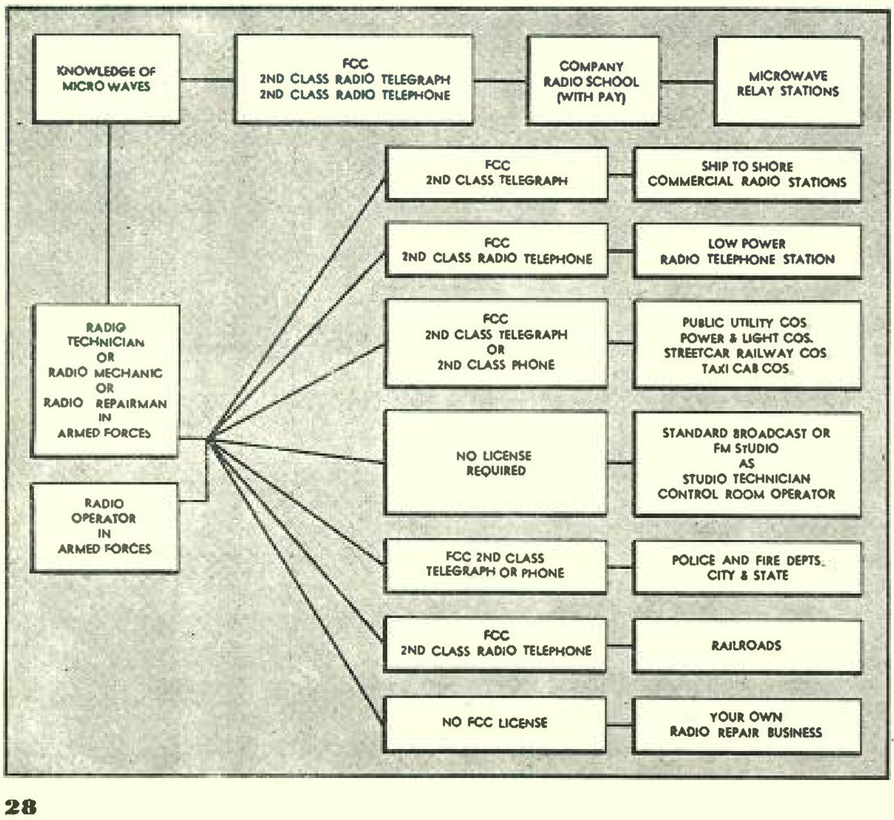
finding and other allied radio equipment in operating condition.

Yes, the radio, television, communications, and airline industries are really leading the field and are honestly ready and willing to lend a hand to veterans. They want veterans because the vigorous training they have received has produced better leaders and skilled individuals; because the disciplined life they have led in service has not only instilled respect for procedure, but has also made these men self-sufficient and resourceful. In fact, the veterans will return to civilian life as ideal potential employees and the radio and allied fields are anxious to acquire and utilize the services of men of such caliber. Men just out of uniform are certain they can handle any job of their choosing and these fields are willing to give them the chance.

As a fine example of the genuine interest industry is showing, there is Eddie Rickenbacker, President and General Manager of *Eastern Air Lines, Inc.* In speaking to the amputee veterans at Lawson General Hospital recently, he said, "After a careful analysis of all of the different job classifications in our company, we found that ninety per-cent of them could be filled efficiently by a veteran with one arm or hand off, or one leg or foot off, or both off. In fact, every job can be handled by these men, after proper training, with the exception of the pilot's job in the cockpit. They can even fill the "hot seat" I am sitting in because it does not take two feet, hands or legs, but it takes something from the chin up and something from the chest—a desire for a job to make themselves self-supporting and at a salary on which they could get married and raise a family."

While the civilian airlines will expand to a degree never before thought possible and, at the same time, outmode many present day practices by this expansion, it will be impossible to give out as many jobs to radio operators and technicians as there will be men clamoring for them. This will also be true of the entire radio industry and, as a result, it will be the man who can "sell his own product," who will get in on the "ground floor."

If you have had experience in the Armed forces, as shown, you will find listed the civilian radio occupation that will most closely parallel your service experience.



Many of the radio, television, and communication companies are reluctant to say anything definite about postwar salaries, publicly. However, because of the close cooperation existing in the radio industry, it can be expected that salaries of competitive companies will be approximately the same. All salaries, however, will be definitely variable, depending as always, on a great many factors—day and night shifts, geographical location, experience, and education, as well as training and initiative of the individual.

In most cases, physical examinations will be required, but will be confined only to insuring capability in performance of duties for which applicant is seeking employment.

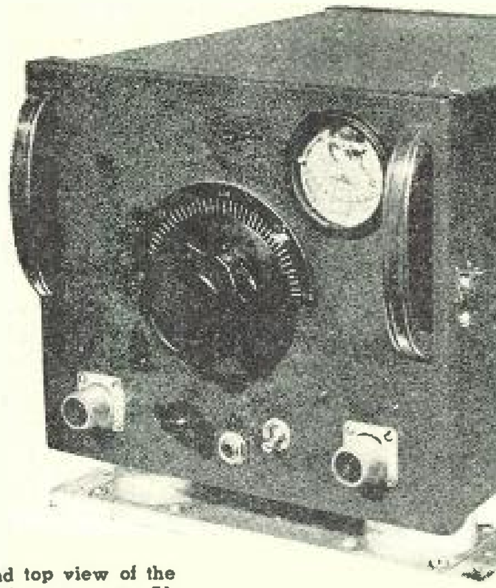
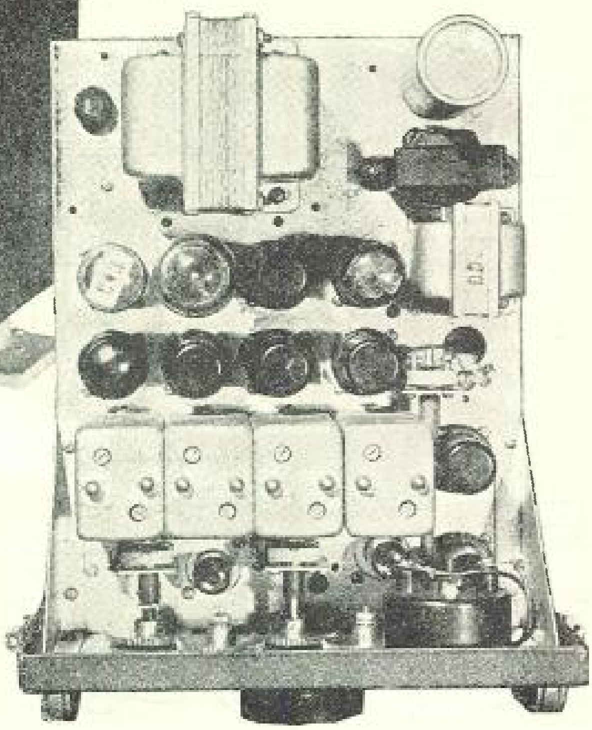
Recently, the writer visited *Pan American Airways* system's field at Miami, Florida, (LAD),[1] for the purposes of determining what types jobs were available in radio for veterans and exactly what was required of the returning GIs, in the way of experience.

Using Pan American as typical of all airline communications, we will attempt to show just what they have to offer. We say airlines, because airline companies seem to be the postwar goal of many returning veterans with radio experience and the opportunities in airline communications vary only slightly with various companies.

In visiting the radio overhaul and repair shop, the writer was informed that there are quite a few radio mechanics' jobs going begging. The purpose of this shop is, as its name implies, to overhaul and repair aircraft and ground station radio equipment, such as radio transmitters, receivers, direction finding equipment, and other allied equipments. Some special equipment is also built in this shop. Applicants for jobs as radio mechanics in this shop will be trained at the Pan American radio school for a period of three months, after which time, they will be brought to the shop proper for further training which will include actual work on the equipment. While an FCC second-class radio-telegraph license is desirable, it is not necssary, as one will be attained during the training period. It is assumed, of course, that the applicant will have had some radio repair experience, either in civilian life or in the service. As for salary during the training period, Pan American pays the trainee. That pay is also upholstered by Uncle Sam, as stipulated under the GI Bill of Rights.

(*Continued on page* 133)

[1] Latin American Division.

Front and top view of the completed instrument. Although panel layout and mounting is for mobile operation, this can easily be altered to meet the needs of the constructor.

Home Constructed 112mc. RECEIVER

By JOSEPH GAVIN, W9YES, and SOL HEYTOW, W9FAL

Design and construction of a v.h.f. ham receiver having sufficient sensitivity and selectivity to cope with already prevalent excessive QRM.

THE use of super-regenerative receivers for v.h.f. has been almost universal among the amateur fraternity for the past several years. This type of receiver, while offering high sensitivity, has several features that make its use undesirable in locations where there are many stations on the air. The selectivity in general is very poor, even when an r.f. stage is used, and the average "super-regen" causes considerable interference from radiation.

A survey was made of the available methods of overcoming these disadvantages and many attempts were made to solve the problems in a simple manner. One of the first tried was the use of a converter, using the regular communications receiver as the i.f. system. This method offered all that could be desired in the way of sensitivity and selectivity, but had the disadvantage that most modulated oscillators were too broad to be received satisfactorily on this type of receiver. Transmitters using crystal control were perfectly readable, but this type of station is sadly in the minority.

The logical answer seemed to be in a receiver designed especially for the existing conditions. However, with the parts situation being what it is at the present time, such a receiver would have to come mainly from the junk box. Now the contents of junk boxes are subject to wide variations from amateur to amateur, but by the combination of the two available here, the receiver described was constructed.

(EDITOR'S NOTE: As it was announced last month, the FCC has given permission to amateurs to resume their activities on the temporarily assigned 112 mc band This band will be replaced by the permanent 144 mc. band as soon as present services are taken off The receiver described, herein, can easily be changed to 144 mc. operation, by simply removing a portion of a turn from the various coils or by spreading This receiver has been designed to be used in conjunction with the 112 mc transmitter published in last month's RADIO NEWS.)

Common sense dictated that the design should begin with the front end. In an attempt to use available tubes it was decided to try and use readily available tubes such as the 6SK7 or 6AC7 for the r.f. stage. As the receiver was to cover the 112 mc. band this choice seemed a logical one. Trial however showed that no gain was obtained from the r.f. stage, and the tuning of this stage was unreasonably broad. The substitution of a 9003 for the r.f. tube eliminated this difficulty. For the mixer stage, experiment showed that the 9001 miniature gave the best conversion efficiency. Coupling the oscillator voltage directly into the grid circuit through a minute condenser, gave high sensitivity, but the *pulling* between the oscillator and mixer was bad. Accordingly, injection directly into the screen was tried and finally adopted. While this system requires more injection voltage and consequently causes more oscillator loading than grid coupling, it is free from the *pulling* effect.

The 6J5 is a stable and reliable oscillator at these frequencies, and no advantage was found in using a miniature in this position. To stabilize the plate voltage of the oscillator and minimize frequency variations caused by line and circuit variations, a VR150 was used to supply the plate voltage for this tube.

Choice of the i.f. frequency was the next problem. Here some compromise must be made between a high image ratio and gain. If the image ratio is made sufficiently high, the over-all gain of the i.f. drops, and the selectivity goes down. Fifteen mc. seems a fair value on which to compromise. An i.f. coil of this frequency has never been commercially available, to the writer's knowledge, and certainly could not be located at the present time. The only solution was to construct our own, using whatever parts were available. The junk box revealed several i.f.'s made for 456 kc. The particular ones on hand were of the air tuned variety, but mica tuned would have served as well.

Experience dictated the use of three stages of i.f. as it was felt that with the loading that would be necessary to obtain sufficient band width, high gain would be necessary. Accordingly, the use of high gain tubes in the i.f. system was a necessity. A 6AB7 was chosen for the first i.f. as it affords better control on a.v.c. For the second and third i.f., 6AC7's were used. A conventional diode detector follows the third i.f. A.v.c. control voltage is taken from the load resistor of this diode, filtered, and applied to all three i.f. stages. No a.v.c. is used on the r.f. or mixer stages as it is desirable to have these stages operate at maximum gain at all times to give maximum signal to noise ratio.

A conventional voltage amplifier follows the diode detector and can just as well be a combination diode-triode, combining the functions of the diode and voltage amplifier in one tube. The output stage is the regular pentode, with headphone output taken from the grid circuit of this tube.

Provision is made by means of a plug and socket arrangement to permit operation from an external power source such as a Vibrapack if desired. Thus, the receiver can do yeoman duty as a mobile or portable receiver, if desired.

All power requirements for a.c. operation are met by means of a regulation replacement type power transformer and filter system. A fuse is also provided in the primary of the power transformer to eliminate any damage to the transformer in the event of a failure of any of the components.

The "B minus" lead of the power transformer is returned to ground through a pair of terminals to permit simultaneous control of both the receiver and its attendant transmitter. This is accomplished by means of a d.p.d.t. switch which opens this B minus lead at the same time as it turns on the plate supply of the transmitter.

Provision for measuring the strength of incoming signals is made by means of a meter, located in the plate lead of the first i.f. As the meter in this type of circuit reads in the reverse direction

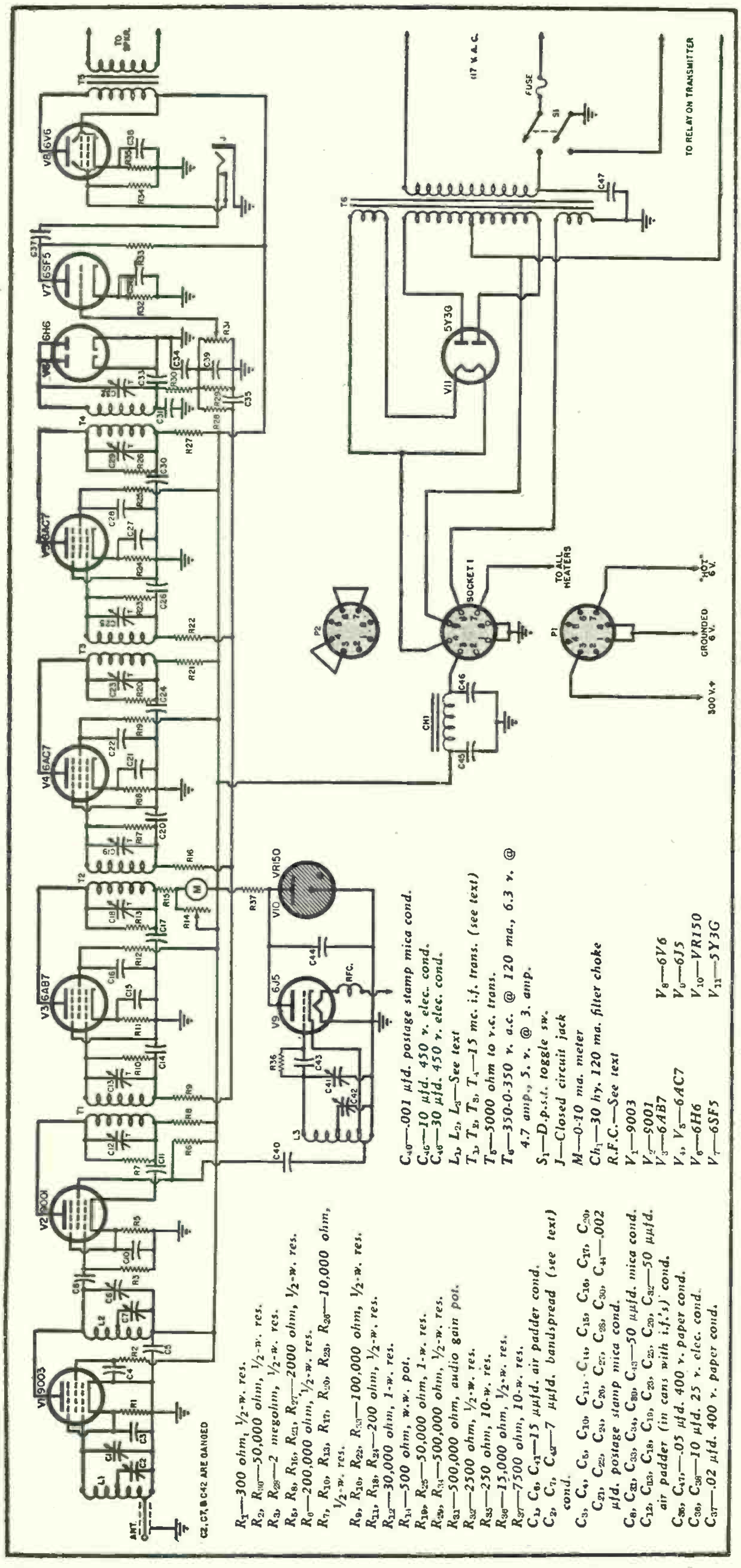


Fig. 1. Diagram of 11 tube v.h.f. receiver. Although a 117 volt a.c. power supply is included, provision is also made for mobile operation with remote power pack.

to the applied signal strength, it is mounted upside down in order that the reading may appear proper to the user. The meter used was originally a 0-5 volt d.c. type. The series resistor was removed and the full scale reading found to be about 10 ma. The variable resistor across the meter permits adjusting it to compensate for different tubes. When the photographs were taken the receiver used a separate meter tube in a v.t.v.m. circuit and this may be seen in the photograph just to the rear of the meter. The circuit shown, however, gave just as satisfactory results and resulted in eliminating one tube from the final version.

Construction

The entire unit was constructed on a 10"x13"x3" chassis, using a case that was originally designed for a mobile transmitter. The parts location is apparent from the top view of the receiver, with the three tuning condensers being driven from the main tuning dial by means of gears. These gears were used simply because they were on hand and may just as well be replaced by a belt and pulley arrangement. These condensers, C_2, C_7, C_{42}, were originally 15 μμfd. midgets and have all but one rotor and stator plate removed. The 9003 r.f. stage may be seen between the r.f. and mixer condenser. The oscillator condenser is mounted to the rear and just to the right of the i.f. transformers. Just below the meter, the 9001 mixer stage may be seen. The four i.f. cans from left to right are T_1, T_2, T_3, T_4, with tubes V_3, V_4, V_5, and V_6 located directly to the rear of them. The 6J5 oscillator tube is just to the right of T_4. Directly to the rear of the i.f. tubes are located the 5Y3G rectifier, VR150 voltage regulator, 6SF5 audio, and 6V6G output stage. Just to the right of the 6V6G, the output transformer T_5 is located.

The filter choke Ch_1 is located between T_5 and the filter condenser, C_{45}, C_{46} which is housed in the can at the right, rear corner of the chassis. The large transformer that occupies the rear of the chassis is the power transformer with its fuse just to the left.

Referring to the front view of the receiver, the connector at the left is the antenna input, with the gain control to its right. The large knob in the center is the main tuning control. Directly below this control, the phone jack may be seen, together with the on-off switch. The right hand connector is used for the speaker output.

The i.f. transformers are constructed as shown in Fig. 2. All four transformers are identical with the exception of T_4 which has no loading resistor across the secondary. Resistors R_7, R_8, R_{10}, R_{13}, R_{15}, R_{17}, R_{20}, R_{21}, R_{23}, R_{26} and R_{27} are all located in the cans with their respective i.f.'s. The particular i.f.'s used had bakelite bases with terminals which were used to support the resistors. It is essential that the leads from the primary and secondary of the i.f. coils to the terminals be of bus wire so that a shift of leads will not affect the coupling.

The coil forms used are miniature forms ¾" in diameter, with the primary windings located about ½" below the trimmer condensers. In all cases the primaries are located at the upper end of the form and are wound of 11 turns of #26 enameled wire, close wound. The secondary windings are ⅝" below the bottom of the primary windings and consist of 9 turns of #26 enameled wire, also close wound.

Both windings should be wound in the same direction with the plate and grid end of the windings at the upper and lower ends of the form respectively. In the event that the windings are reversed, the coupling and band width will be affected.

The placement of the various components may be seen in the under view of the chassis. Near the left edge, toward the front, the oscillator coil, L_3, may be seen, mounted directly on the terminals of the padding condenser, C_{11}. This coil consists of 3 turns of #12 tinned wire, ⅝" inside diameter and spaced to a length of 1". The bandspread tap to C_{42} is located at the center of the coil, while the cathode tap is one half turn from the ground end. C_{40} and the screen of V_2 are coupled through a tap one fourth turn from the ground end. The lead to the bandspread condenser C_{42} is brought through a hole in the chassis directly to the condenser.

Just to the rear of the power switch and the gain control, the mixer coil L_2 may be seen. This coil is also mounted directly on its condenser, C_6, and consists of three turns of #12 tinned wire, with an inside diameter of ⅜" and a length of ½". The bandspread tap is again located in the center.

The antenna coil, L_1, can be seen in the right front corner of the chassis. This coil is also wound of #12 tinned wire with four turns ⅜" in diameter

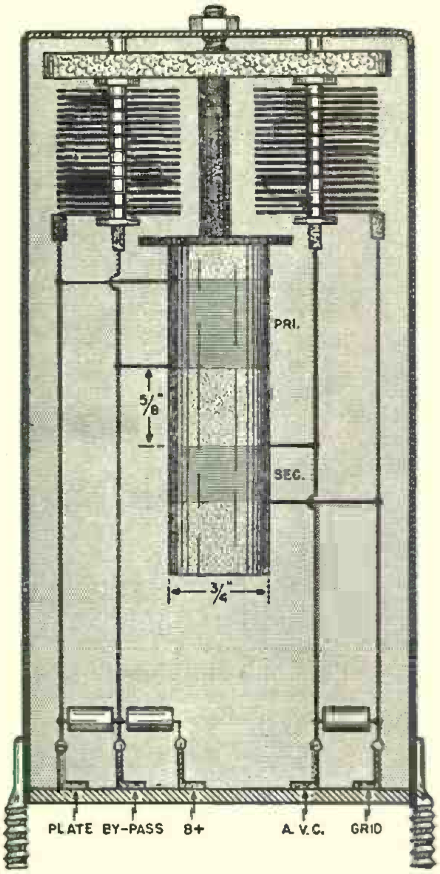
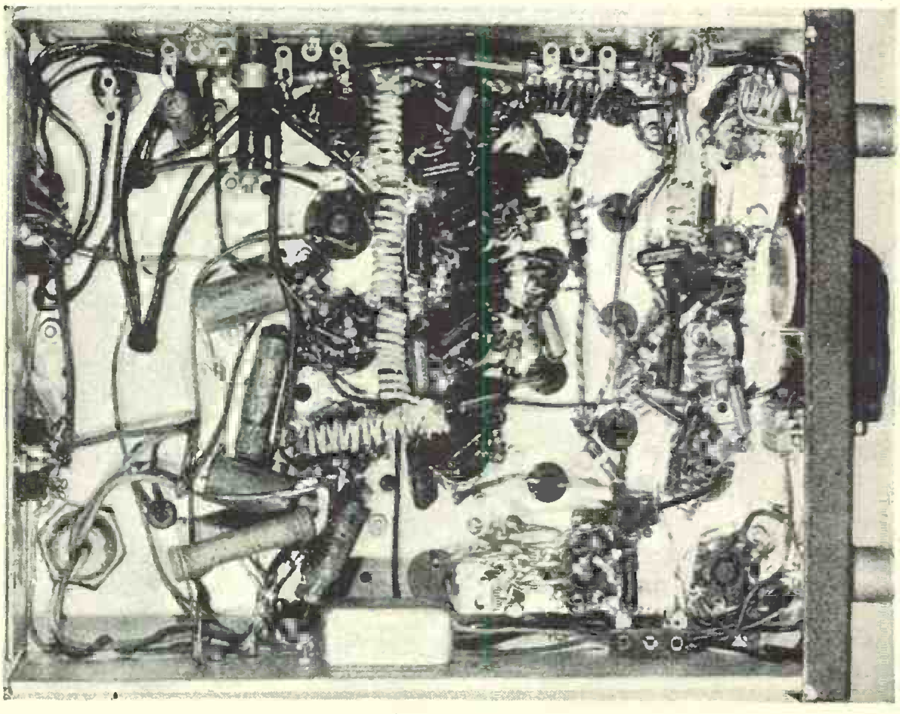


Fig. 2. I.f. transformer construction.

spaced to a length of 1". As in the other coils, the bandspread tap is in the center. As it was intended to use this receiver with a co-axial antenna lead of 70 ohms impedance, the antenna is tapped right on the coil one-half turn from the ground end. If it is desired to use a different antenna

(*Continued on page 128*)

Under chassis view of the completed receiver showing layout of parts and wiring.



BUSINESS RECORDING EQUIPMENT

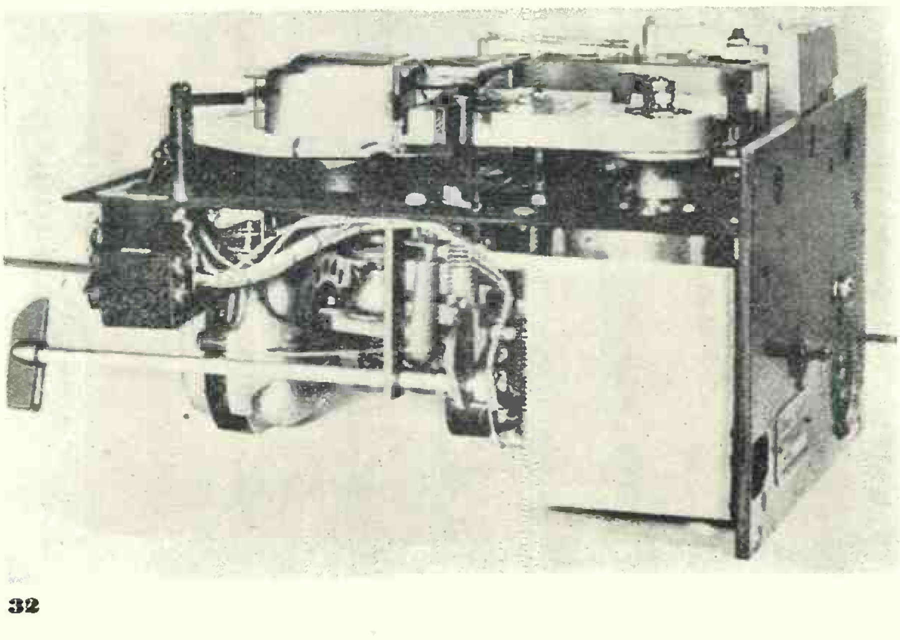
By ROBERT STONE
Chief Eng., SoundScriber Corp.

For dictation, the disc recorder is used with either a hand or desk microphone.

In playback operation, a loudspeaker is usually preferred. However, earphones can be used if desired.

Disc recorders, especially designed for the office, are finding increasing acceptance among executives. Not only is dictation simplified and error free but actual records can be had of important conferences.

Internal view of recorder shows motor mounting, recording arm and head, turntable, etc.



THE uses of sound recording in business have increased many fold in the last few years with the introduction of electronic recording and reproducing machines. Electronic principles applied to the familiar wax cylinder dictation machines have resulted in the introduction of new electronic dictating systems using permanent records. The more common applications of these electronic systems are dictation, conference recording and authorized telephone recording. In addition, the same machines find use in auxiliary fields in talking correspondence, radio monitoring, etc. In all these applications, there are certain basic requirements which must be met by any recording and reproducing system for satisfactory use in business. While these requirements may also be desirable in any recording-reproducing system, in business use they are imperative, and fidelity may have to be sacrificed in some degree to obtain them.

These requirements are:

1. Simple and foolproof operation of both recording and reproducing machines.

2. Low record cost. (Records inexpensive in terms of playing time per unit cost.)

3. The equipment must be compact, durable, free from need for frequent servicing, and, in some applications, should be portable.

4. The material on which recordings are made should be unbreakable, com-

pact, easy to handle, easy to log and refer to, and, in many applications, should be of a form suited for mailing or filing.

5. The reproducing machines used to transcribe the records to the typewritten page must have instantaneous start-stop, instantaneous stepback or repeat mechanism, logging system, and above all, comfortable listening devices.

Failure to meet the above requirements fully, will seriously militate against acceptance of any recording-reproducing system for business usage regardless of any unusual fidelity or other apparent merit. It must be borne in mind that the machines themselves become parts of a business system, thus necessitating full convenience and trouble-free operation.

Recording-reproducing systems which may be excellent for home, broadcast, or educational recording will often fail to meet these requirements often due to the recording medium itself or the method of making or reproducing the record.

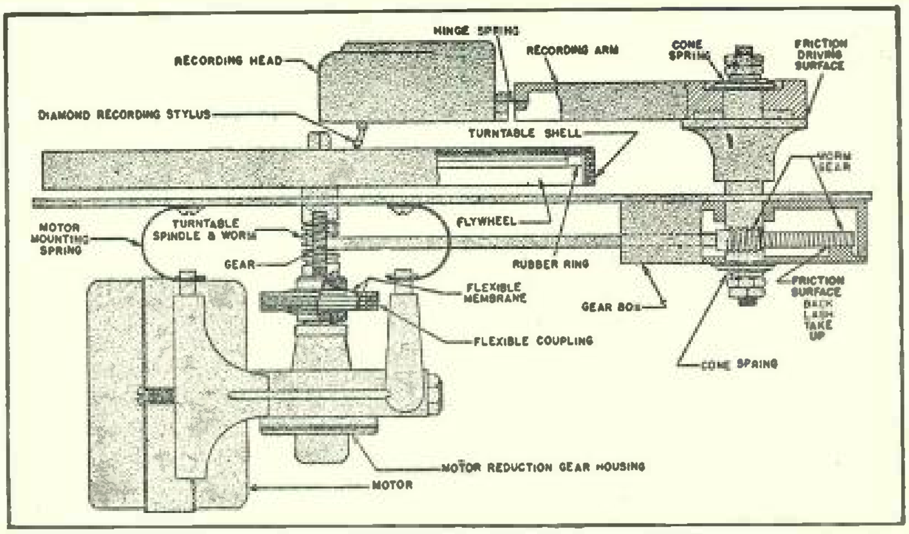
Photographic recording or other methods requiring processing of the record before playback are obviously out of the question. The handling of a wire spool, threading it for playback by a stenographer, need for rewinding before playback, time consumed in finding a definite place, and ability to quickly backspace for repetition may prove to be serious obstacles for magnetic recording in this field. Perfection of inexpensive, trouble-free magazines may partially answer some of these objections. Embossed groove film recorders seem to offer similar threading and other difficulties, which, while simple for the engineer, may prove impractical for the business man and his stenographer.

The SoundScriber electronic recorder using embossed discs which are wafer thin (.010"), seven inches diameter, giving 30 minutes of recording on both sides, fulfills all of these requirements as shown in the detailed analysis which follows:

The operation of SoundScriber equipment (both the recording and the transcribing models) is simplified to the point where anyone can operate it satisfactorily, with consistently good results, after a minimum amount of instruction. It is obvious that a machine using a familiar disc type record, with utter simplicity of handling of the disc (speed with which it may be changed, etc.) versus the much more complicated handling of spools of fragile wire, as in magnetic recorders, or bulky tape loops, as in tape recorders, reduces instruction to new users to a minimum.

However, use of a disc would not be practical if the recorder grooves were produced by the cutting process as in acetate high fidelity recorders, or some home recorders. The chip cut from the record surface by these recorders introduces the problems of chip removal together with recording stylus wear and breakage Stylus angles and pressures are critical and such equipment is not practical in the business office. By using the embossing process, a truly permanent non-breakable diamond stylus can be used and there are no chips to remove. The embossing process permits design of a simply operated system of recording in which stylus pressures and angles are not critical and in which no attention is required from the operator. It further permits the use of thin, inexpensive discs.

In order to reduce the number of controls to a minimum, a single *Talk-Listen* control switch simultaneously performs the operation of lowering and raising the recording head to the disc as well as selecting all the necessary electrical circuits for recording and playback. When in the *Listen* position, the recording head is clamped so when again turned to *Talk* the recording head will come down directly after the last recorded grooves. Separate volume controls are used for recording and playback and also selected by the *Talk-Listen* selector so that they can be pre-set at the customary level used in a given installation. Two toggle switches are used, one to turn the amplifier on at the beginning of the day, and the other to start and stop the



Mechanical arrangements of the turntable drive and feed mechanism.

Portable-type recorder. Microphone is connected on an extension bracket.

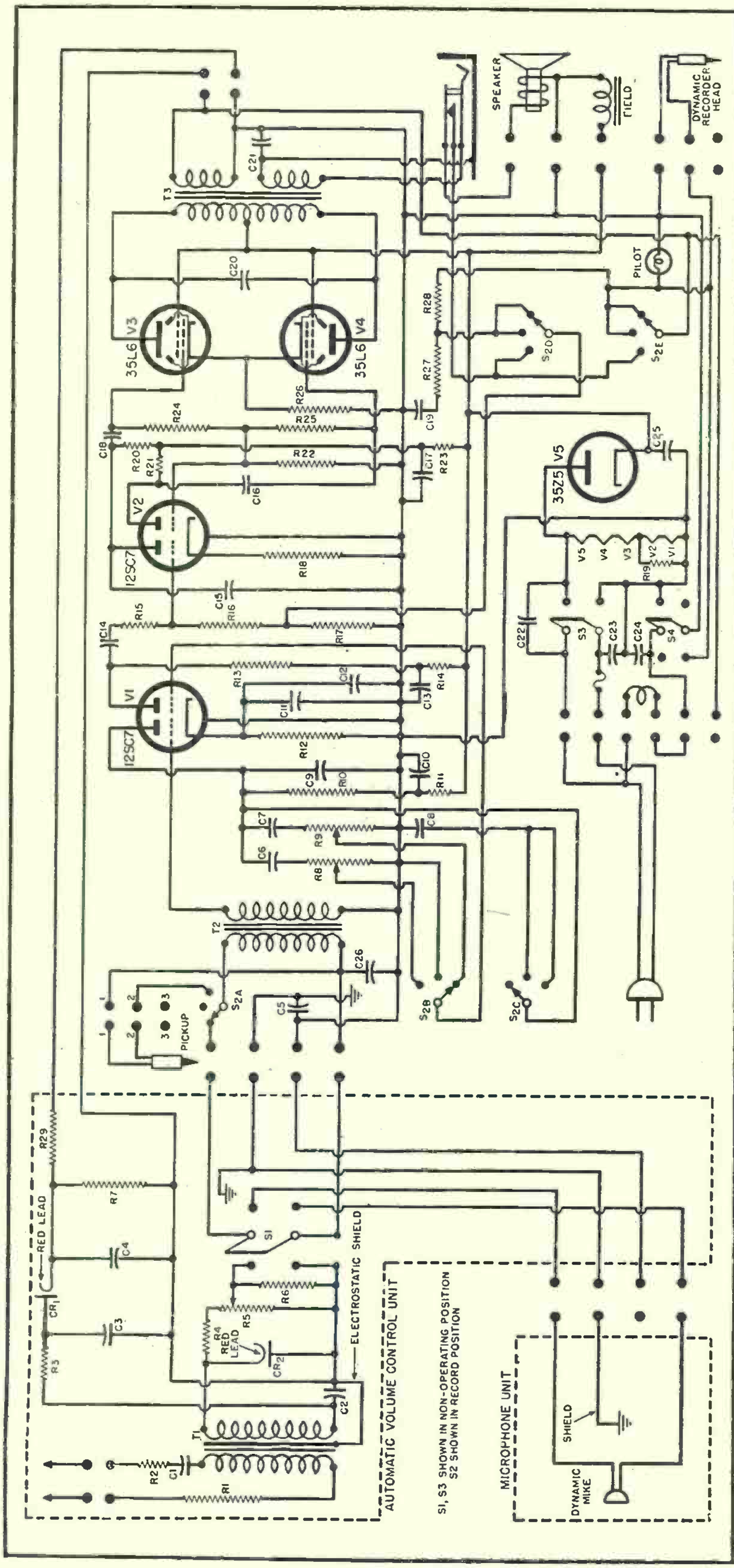
Dynamic microphones are used for recording, these being available in desk types or in hand-held types with inbuilt press-to-talk switch which starts and stops the turntable. An inbuilt loud speaker is used for playback.

The actual making of the record is only part of the problem to be solved in a business recorder. Obviously, the record would only be made in the first place, if subsequent use of the recorded material were contemplated. Therefore, it is very important that the equipment provide the means for simple, quick playback of any portion of the recorded material, and for easy put-on, removal, and handling by the dictator and stenographer. The thin disc meets these requirements and the playback head may be positioned instantly to any desired grooves on the disc just as quickly as can be done with conventional phonograph equipment. The stenographer's transcriber is provided with a convenient foot control with two pedals, one for instantaneous start and stop of the record and another for backspacing for repetition. In addition she has comfortable and convenient listening devices.

Low cost of the recording media is essential since business recorders are used many hundreds of hours-per-year. However, while intelligibility is of prime importance, in business recording the absolute fidelity expected of a studio or home recorder, which is used for musical recording, is not required. It is logical, therefore, to use much lower groove speeds and closer groove spacing to realize low disc cost. This results in some loss of absolute fidelity, but is acceptable as long as full intelligibility is retained. A comparative situation is that of ordinary telephone lines with acceptable intelligibility and low cost for ordinary telephone transmission as compared to leased broadcast telephone lines with high fidelity and correspondingly higher expense. SoundScriber machines use a seven inch plastic disc on which 30 minutes recording (on both sides) is obtained at a speed of 33 r.p.m. and groove spacing of 220 lines to the inch. This represents a recording cost to the user of less than 20 cents per-hour (discs cost a little under 10 cents each) as compared to a cost of approximately $5.00 per hour on high fidelity acetate recorders.

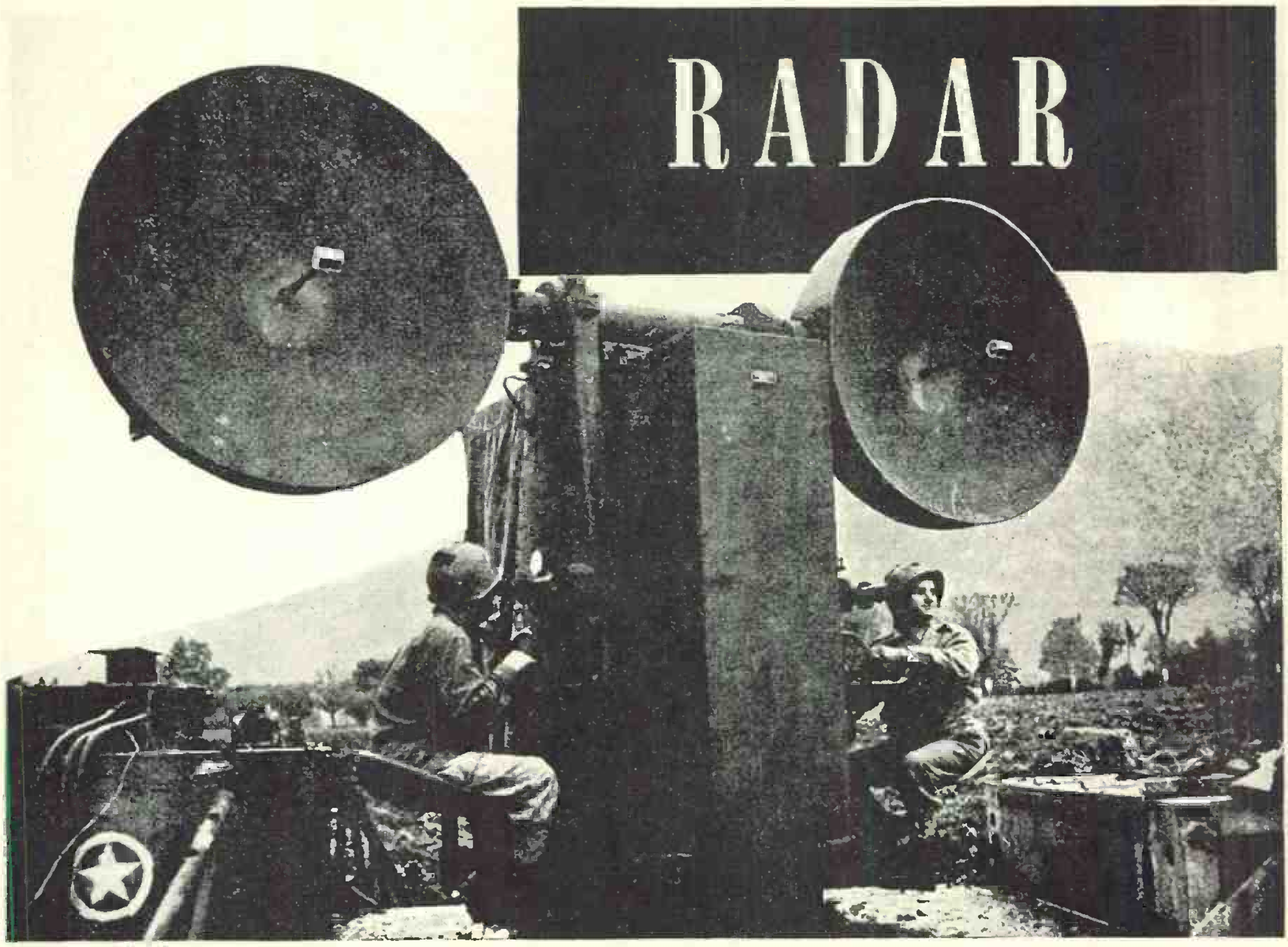
Low operating cost standards of this same order have been established by the wax cylinder dictating machines by precision shaving machines for rendering the cylinder surface reusable a number of times. Similar re-use would have to be achieved with any initial high cost medium. A magnetic wire magazine and the gauge of operating cost of any re-use method is represented by the cost of performing the re-use function (usually au-

(Continued from page 100)



Schematic diagram of the a.c.-d.c. operated five-tube, disc type recorder. Parts list for this diagram is shown on page 106

RADAR

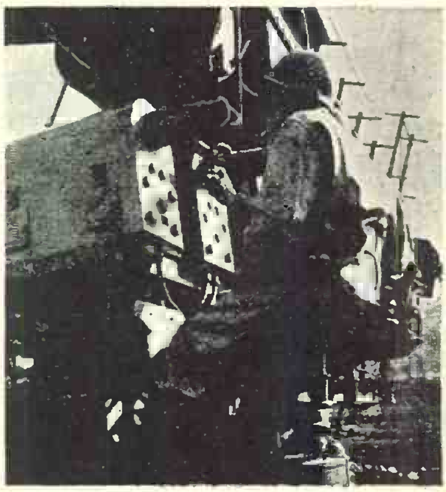


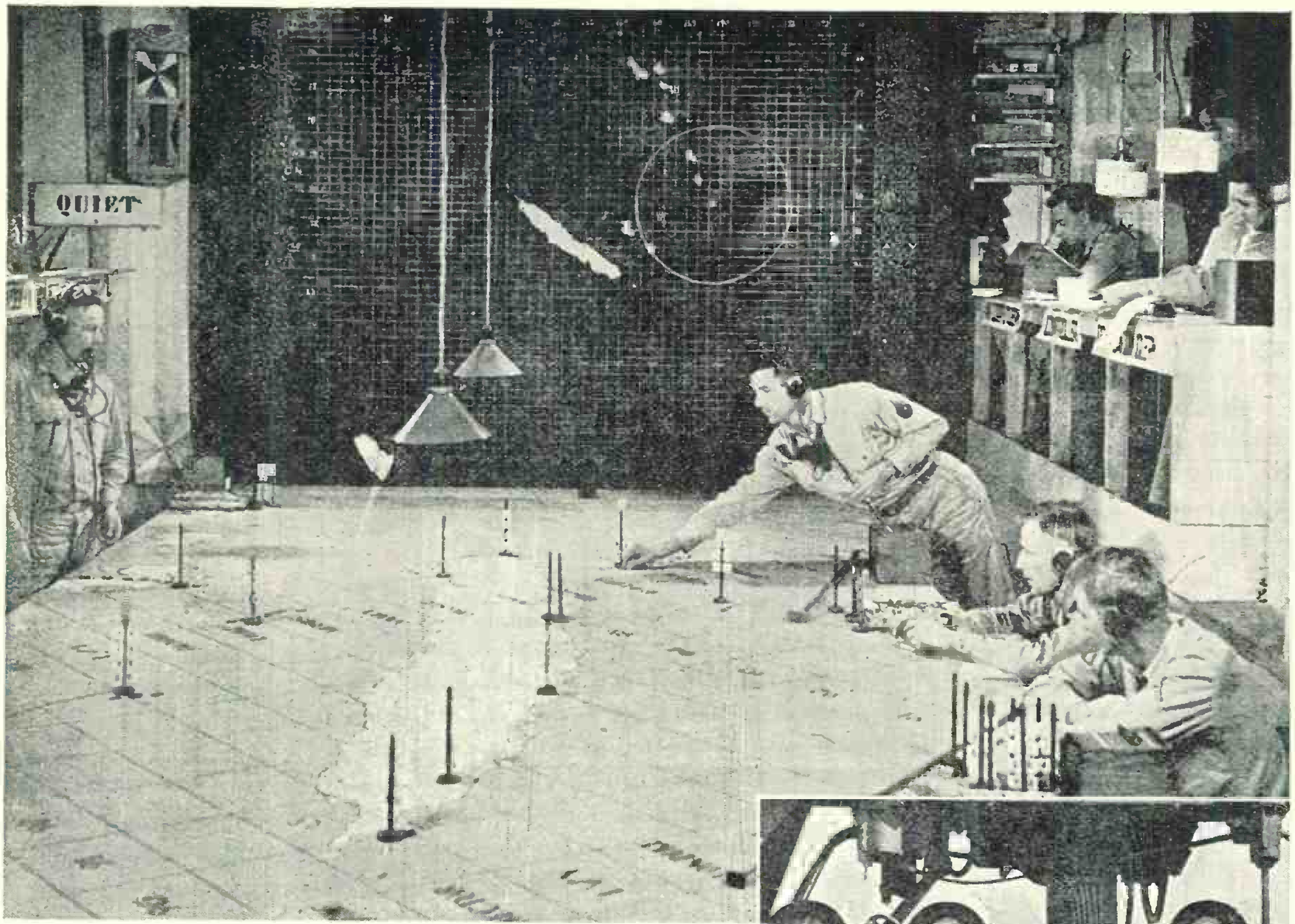
★ An SCR-547 radar maintains watch near an anti-aircraft emplacement at Mignano, Italy.

Radar—one of the most miraculous developments of World War 2—surpassed only by the atomic bomb, was made possible through the combined efforts of American production and engineering skill.

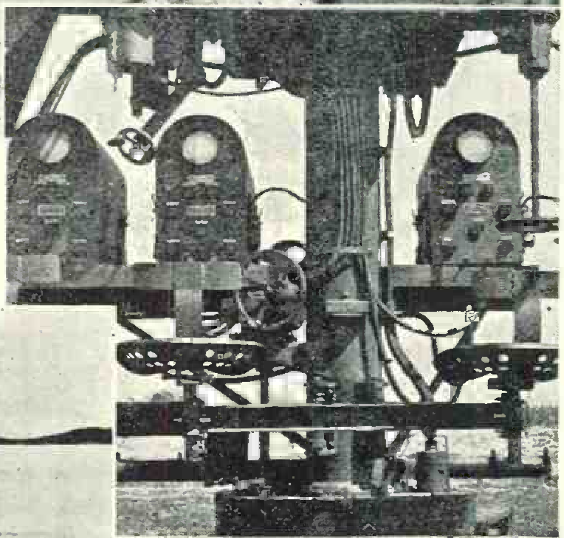
★ Shown here in a sandbagged revetment on Espiritu Santos, New Hebrides, is the SCR-547. Known as the "Mickey Mouse" because of the shape of its antennas, this set electronically measures the position of enemy planes and supplies this information to the anti-aircraft gunner.

★ Radar operators viewing oscilloscope screens of an SCR-268 radar set while maintaining a constant search for distant enemy planes.

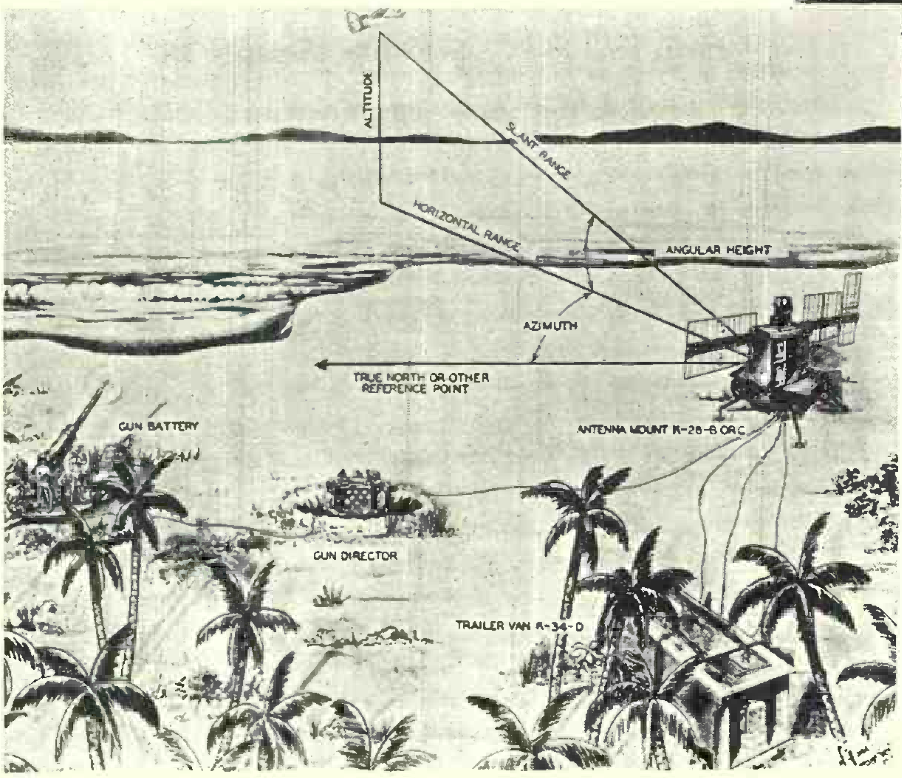




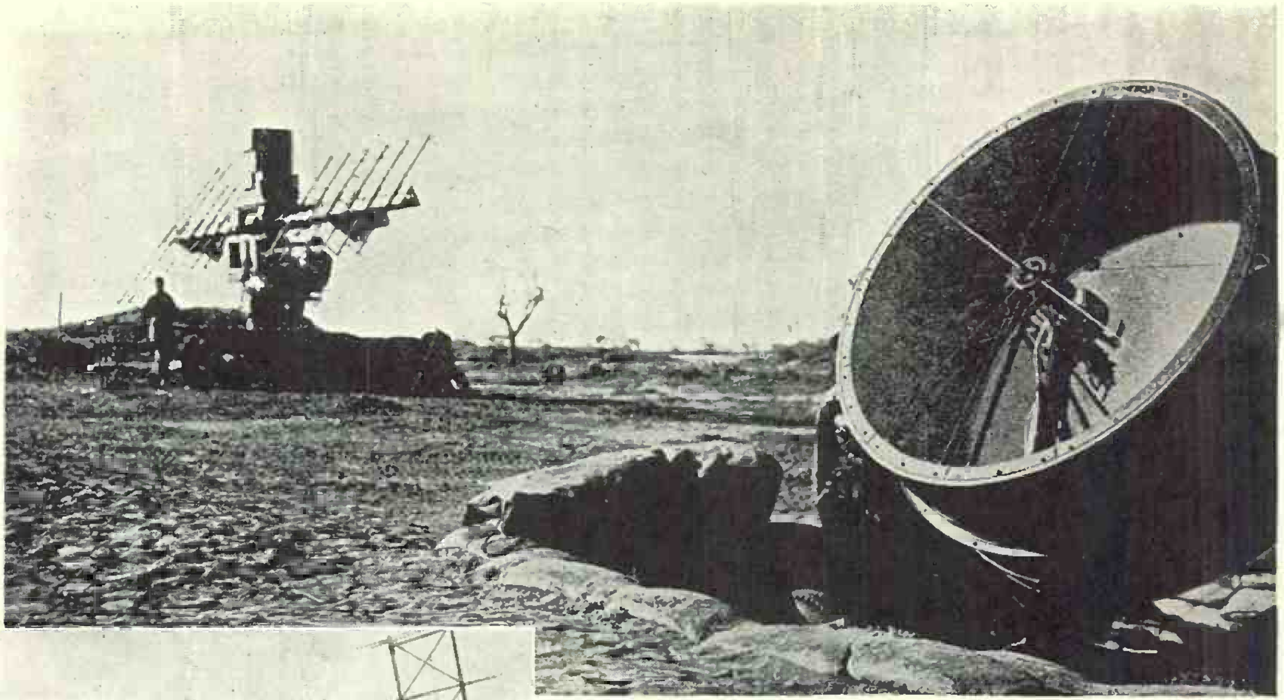
★ A complicated system of recording and coordinating the reports from many scattered radar sets has been evolved by the Signal Corps to provide maximum protection against enemy air attack. This plotting board serves an aircraft warning information center, 1st Island Command Headquarters, Noumea.



★ Three oscilloscopes are used in the army radar set SCR-268. 'Scope on left measures range to target, center 'scope measures azimuth, third 'scope measures angle of elevation which determines height of target.



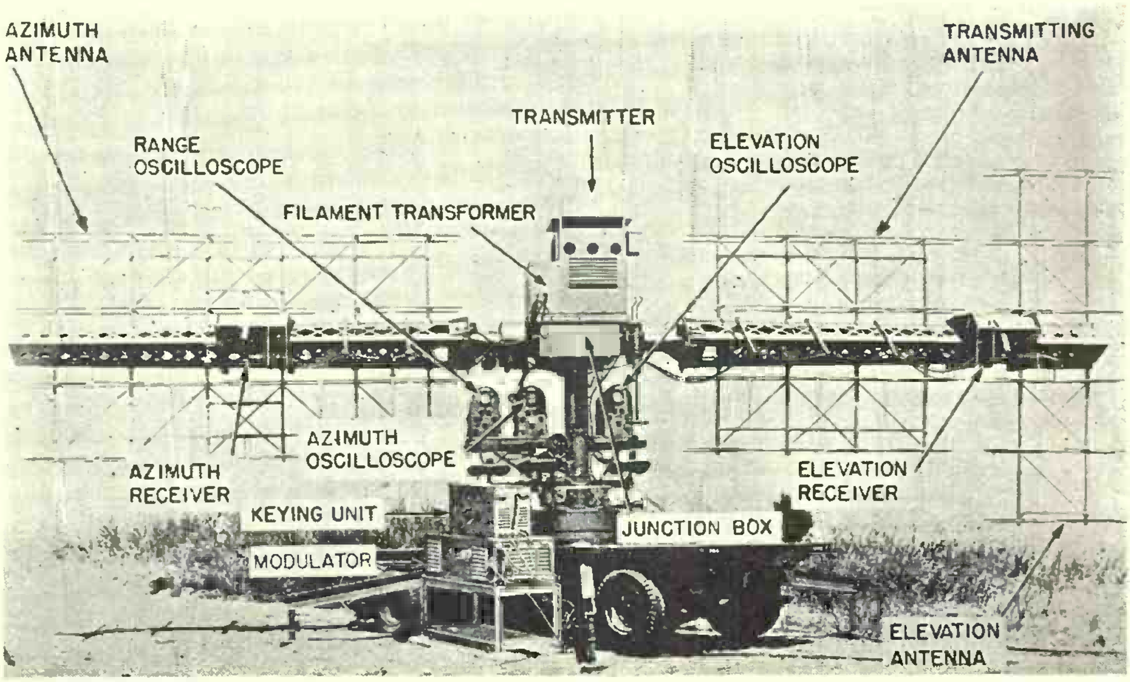
★ Radar control of anti-aircraft artillery fire is illustrated in this sketch of the SCR-268 radar supplying firing data to gun director. The electrical impulses from the radar are fed to the gun director which automatically points the guns and sets the shell fuses for the correct altitude.



★ In North Africa, the Army's radar set SCR-268 served to control anti-aircraft searchlights like that in the foreground. Searchlights controlled by these radar sets point automatically and continuously in the direction of incoming planes at night. Arcs may be kept off until the proper moment and when turned on, searchlight has plane in its beam. The SCR-268 was also used to direct anti-aircraft guns in much the same manner, and safeguarded our forces in North Africa in 1942 and 1943 against German air attacks.

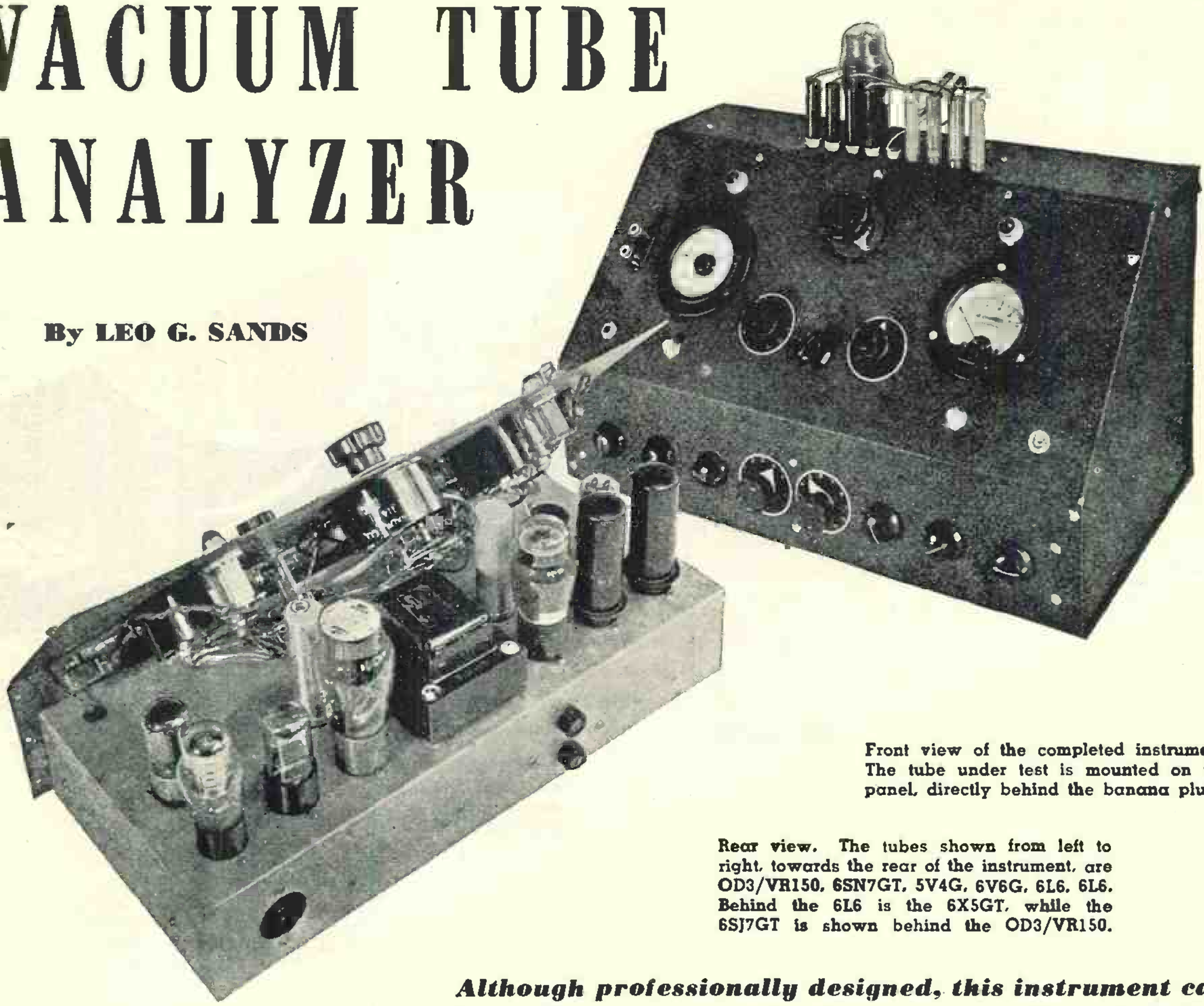
★ Radar set SCR-268, with five-man crew, in operation on an Italian hillside. The three operators seated on mount see indications of airplane echo on cathode-ray oscilloscopes. One operator tracks aircraft in azimuth (direction in degrees from north); another tracks in elevation (angular height); third measures the range.

★ The SCR-268—first radar set developed by the U.S. Army Signal Corps. The SCR-268 detects and locates aircraft in darkness or heavy weather and follows their course so accurately that the radar set can aim anti-aircraft gun so shells will explode within a few yards of the target. Set is also used to direct anti-aircraft searchlights. Principal components of radar set are shown in diagram.



VACUUM TUBE ANALYZER

By LEO G. SANDS



Front view of the completed instrument. The tube under test is mounted on top panel, directly behind the banana plugs.

Rear view. The tubes shown from left to right, towards the rear of the instrument, are OD3/VR150, 6SN7GT, 5V4G, 6V6G, 6L6, 6L6. Behind the 6L6 is the 6X5GT, while the 6SJ7GT is shown behind the OD3/VR150.

Although professionally designed, this instrument can be easily constructed by the average radio technician.

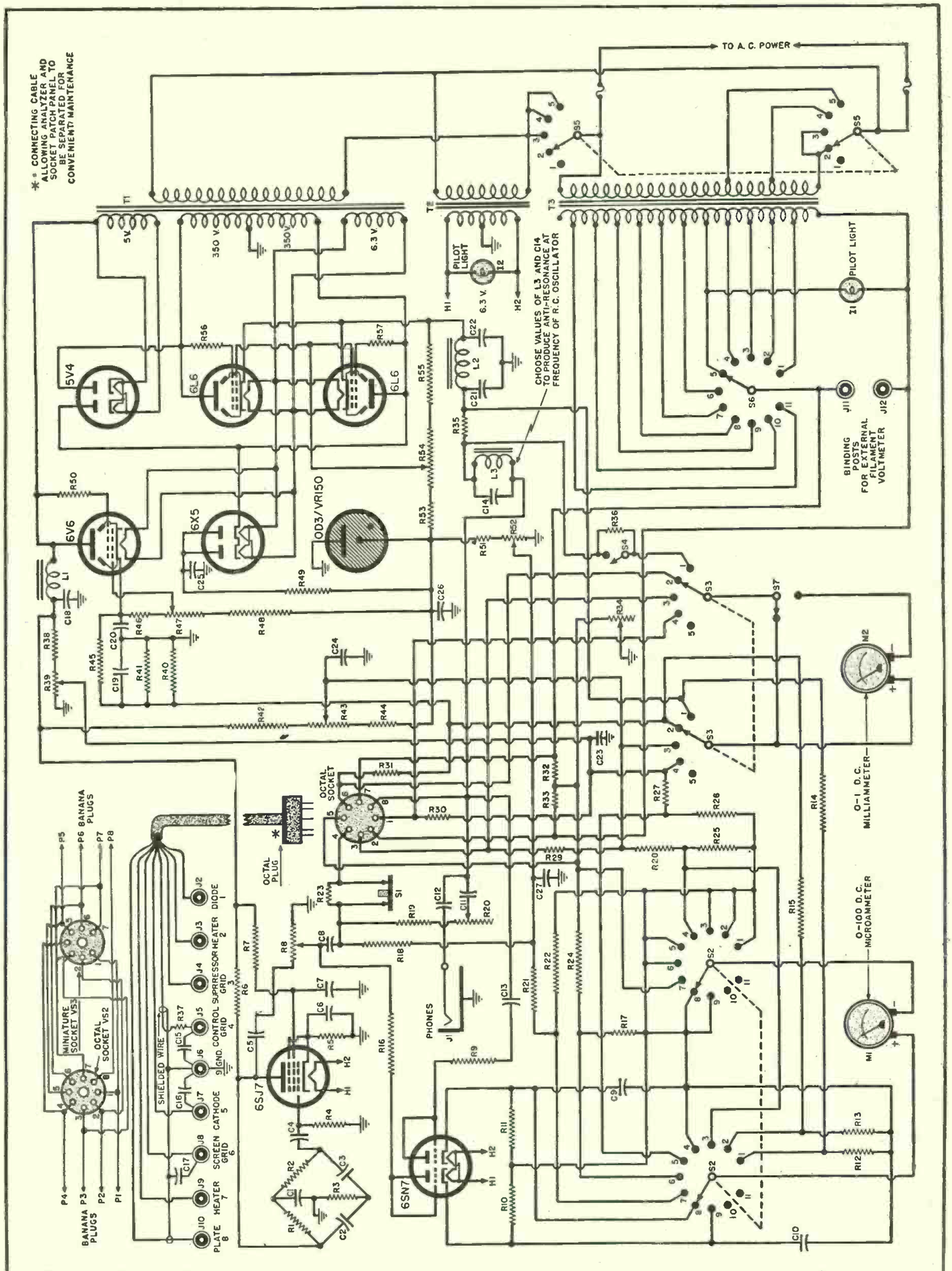
AN INSTRUMENT for studying vacuum tube characteristics is a valuable asset to any electronic laboratory. Such instruments, if they are to be of any great value, are quite complex and, in war times, next to impossible to buy. Much data on vacuum tube characteristics is available in handbooks supplied by vacuum tube manufacturers. This published data is sometimes incomplete and covers only average tube characteristics. The instrument described in this article is comparatively inexpensive, It is of value in determining the characteristics of any particular tube and for compiling data not available in printed form. It also provides a convenient and, at the same time, elaborate tube tester.

This instrument will supply information on certain dynamic and all static characteristics of vacuum tubes under actual operating voltages. Checks on emission, transconductance, and noise can be made. Emission checks are made in the conventional manner, *i.e.,* by reading the actual direct current through the various elements. Transconductance is measured by the "null" method, described later in this article.

The instrument is entirely self-contained and is built into a sloping-panel metal cabinet. An octal and a miniature socket are provided for tubes to be checked. Sockets for other types of tube bases were not provided, as a majority of tubes of interest, use either of the two above-mentioned socket types. Adapters can be used for other tube bases, however. For extreme versatility, cords with insulated banana plugs and jacks were used for circuit selection, rather than switching. Controls are provided to vary the plate and screen voltages separtely from fifty to three hundred volts; control grid voltage, from zero to minus fifty volts; diode voltage, from zero to fifty volts; suppressor voltage, from minus fifty to plus fifty volts; and heater voltages from 1.1 volts to seventy volts. By means of switching, it is possible to read all of these voltages on a meter built into the instrument, with the exception of the heater voltages. Binding posts are provided to read the heater voltages with an external meter, if desired. The exact heater voltages were not considered important as, in actual operation, these voltages are seldom if ever regulated, and are subject to some variation.

The method of controlling the plate and screen voltages was devised to eliminate the necessity of expensive wire-wound potentiometers, as would be the case if the conventional voltage divider system was used. Plate voltage is supplied from a conventional power transformer with a pair of type 6L6 tubes, used as grid control rectifiers. The voltage is varied by adjusting the bias voltage of these rectifiers. Screen voltage is obtained from the same transformer through a 5V4G full-wave rectifier tube and a 6V6GT control tube. This rectifier tube also supplies power for the built-in oscillator used for the mutual transconductance test.

The control grid voltage is supplied from the same transformer, and a 6X5GT/G tube used as a half-wave rectifier. An OD3/VR150 tube is used for regulation. As no current is drawn by the grid, a conventional volume control type potentiometer is used as a voltage divider to vary the grid voltage. The diode voltage is supplied



Schematic diagram of the vacuum tube analyzer. Only two test sockets, an octal and miniature, are shown. Where tubes of other base construction are to be tested, an adaptor must be employed. The parts list corresponding to this diagram is given on page 80.

LIST OF CONTROLS AND THEIR OPERATION

R_8—Signal level potentiometer

R_{20}—Mutual Transconductance measurement potentiometer

R_{34}—Cathode biasing control

R_{39}—Diode voltage control

R_{43}—Suppressor grid voltage control

R_{47}—Screen grid voltage control

R_{52}—Control grid voltage control

R_{54}—Plate voltage control

S_1—Gas test push button (normally closed)

S_2—Voltmeter circuit selector switch
- Pos. 1—Plate voltage, 500 v. scale
- Pos. 2—Screen voltage, 500 v. scale
- Pos. 3—Suppressor voltage, 50 v. scale
- Pos. 4—Suppressor voltage, 50 v. scale (negative voltage)
- Pos. 5—Diode voltage, 50 v. scale
- Pos. 6—Cathode voltage, 50 v. scale
- Pos. 7—Control grid voltage, 50 v. scale
- Pos. 8—Output meter
- Pos. 9—Input signal level meter
- Pos. 10 & 11 left blank. (Possible spares for future modifications of instrument.)

S_3—Milliammeter circuit selector switch
- Pos. 1—Plate current, 10 or 100 milliampere scale
- Pos. 2—Screen grid current, 10 milliampere scale
- Pos. 3—Suppressor current, 10 milliampere scale
- Pos. 4—Diode current, 10 milliampere scale
- Pos. 5—Off

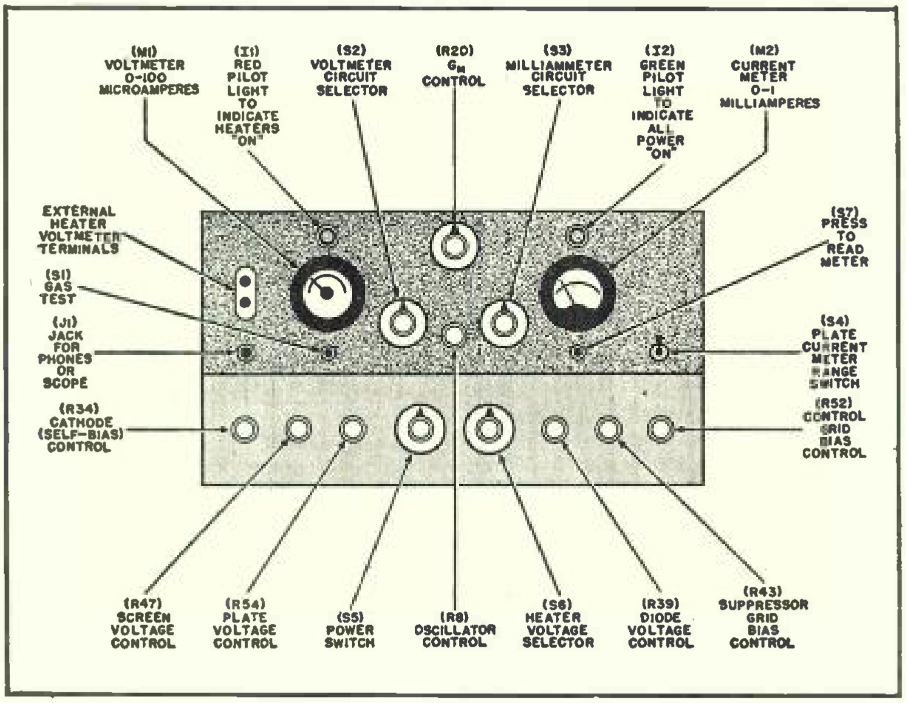
S_4—Plate current milliammeter scale change switch
When closed, meter reads 10 milliamperes full scale
When open, meter reads 100 milliamperes full scale

S_5—Power control
- Pos. 1—Off
- Pos. 2—Only heaters on (low). Lamp I_1 lights
- Pos. 3—Power on, heaters low. Lamps I_1 and I_2 both light
- Pos. 4—Same as 3, except heaters medium
- Pos. 5—Same as 3, except heaters high

S_6—Heater voltage selector switch
- Pos. 1— 1.1 volts
- Pos. 2— 2 volts
- Pos. 3— 2.5 volts
- Pos. 4— 5 volts
- Pos. 5— 6.3 volts
- Pos. 6— 7.5 volts
- Pos. 7—12 volts
- Pos. 8—25 volts
- Pos. 9—35 volts
- Pos. 10—50 volts
- Pos. 11—70 volts

S_7—Milliammeter safety switch
In normal position, no current flows through meter

Mechanical layout of the front panel, showing proper placement of operating controls.



from the 5V4G full-wave rectifier and is controlled by a potentiometer, also used as a voltage divider. Suppressor voltage is obtained by connecting a potentiometer across the grid voltage source and the diode voltage source to provide both a positive and a negative voltage. Heater voltage is supplied from a tapped step-down transformer. The desired heater voltage is selected by means of a wafer switch. The power switch is so arranged as to provide a stand-by position so that only heater voltage is supplied to the tube for preheating. This switch also provides for variation of the heater voltage by selecting any one of three taps on the primary of the filament transformer.

A resistance capacitance tuned oscillator is used to supply a signal at approximately one thousand cycles for the mutual transconductance test. A potentiometer is provided to control the amplitude of the signal fed to the tube under test. The plate load of the tube being tested consists of a choke and a capacitor tuned to the oscillator frequency. This method was chosen over a resistance load so that tubes drawing considerable plate current would be provided sufficient plate voltage. Although the Q of the circuit suffers when any great amount of direct current flows through it, satisfactory results have been obtained.

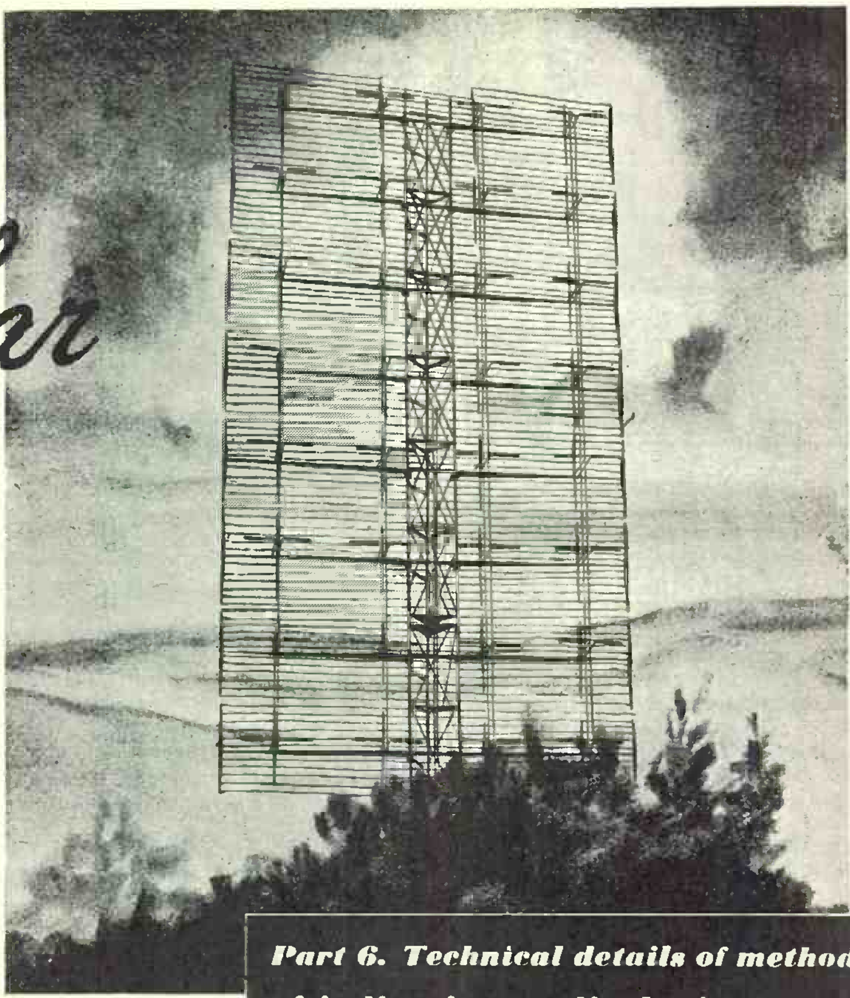
The method for checking transconductance consists of applying a signal to the grid of the tube under test and feeding it back from the plate to the grid through a d.c. blocking condenser and a variable resistance. The transconductance is determined by adjusting the variable resistance until a "null" position or minimum signal is noted in the headphones or on the voltmeter when used as an outputmeter. From the scale on the variable resistance, reference is made to a graph that indicates the amount of resistance in the circuit at that particular scale setting. The transconductance in micromhos is computed by the formula $Gm = 1/R$ (R in megohms). A graph can be constructed to transcribe scale readings directly into transconductance. It is also easy to calibrate a special scale to read transconductance directly in micromhos.

The meter used by the writer as a volt meter is a microammeter with a full scale rating of 100 microamperes. As this type of instrument is expensive or may be unavailable, a less expensive milliammeter with a full scale rating of one milliampere may be used by changing the values of the multiplier resistors. The resistor values indicated are based on the use of a meter having an internal resistance of 1800 ohms. As this particular meter has a movement that is not highly damped, it was not practicable to use its maximum sensitivity. A shunt resistance was used across the meter for damping and, at the same time, decreasing its sensitivity. The other meter is used to measure plate, screen, diode, and suppressor currents, and is a conventional zero-to-one d.c. mil-

(*Continued on page* 78)

Practical Radar

By JORDAN McQUAY



Echo reflections of radar pulses are received on antennas such as this. The echoes are detected and amplified by a sensitive receiver, and then displayed on the radar indicator.

Part 6. Technical details of methods of indicating or displaying target information obtained by radar set.

TRANSMITTING pulses of u.h.f. energy and then receiving *echoes* of the pulses, radar equipment can detect and locate targets in the sky or on the land or sea. Distance and direction of these targets are obtained almost instantly by precision measuring circuits of the *combined* components of a radar set.

All of the basic components—transmitter, receiver, antenna system, electronic timer, and indicator—play an equally responsible part in the transmission of pulses and the reception and measurement of echoes. But translating this complicated electronic action into practical, visual terms is the exclusive job of the radar indicator.

Modulated by the electronic timer, the radar transmitter generates short bursts or pulses of r.f. energy at a fixed rate known as the *pulse recurrence frequency*. These pulses are radiated in any given direction into space—within the confines of an extremely narrow beam—by the radar antenna system. Whenever an energy pulse strikes an object, target, or surface, the r.f. energy is reflected and part of this energy returns to the radar set as an echo.

The transmitter is turned off before any of the echoes arrive. Thus the same antenna system can be used for transmission and reception.

Each echo from a distant target is picked up by the receiver and amplified. As a video signal, each echo is then applied to the radar indicator for observation and measurement. The indicator measures the elapsed time between the transmission of each pulse and the reception of an echo from that pulse. This elapsed time is immediately translated into terms of distance.

Although slow to describe, the entire process of echo reflection takes place thousands of times every second—due to the extremely high speed of radio waves in space. Echoes are displayed on the oscilloscope of the indicator only a few microseconds after the original r.f. pulse is transmitted.

Because of this speed, any target will reflect a large number of echoes. These will be constantly repeated on the scope of the indicator and thus appear relatively stationary. Echo signals *will* move across the scope screen, of course, in relation to the actual movement of the target in the air or at sea.

All radar sets employ indicators. One, two, or three oscilloscopes usually are used. But any number of oscilloscopes *may* be used, depending upon the type of radar set and the target information desired. As shown in Fig. 1, any radar set may be conveniently divided into six basic components: a *transmitter* and *transmitting antenna*, a *receiver* and *receiving antenna*, an *electronic timer* to synchronize all components, and an *indicator* for recording the information obtained by the rest of the radar set. All of these components—except the *indicator*—have been discussed previously. Now, in the last installment of this series on "Practical Radar," we consider the technical operation of the final component of a radar set—the indicator.

(EDITOR'S NOTE: *This article concludes the series on Practical Radar. We extend our appreciation to Jordan McQuay, the author, for the part he has played in presenting the latest facts, to our subscribers, on the technical background of radar operation. There is much left to be said on the aspects of radar. We have been assured by the author that articles will be presented for publication as soon as security restrictions are released.*)

The Cathode Ray Tube

A radar indicator consists of one or more types of cathode ray tubes and associated control circuits. These additional circuits include a time base generator, limiter amplifier, phase inverter, synchronizing circuit, positioning controls, indicator gate, and power supply. Thus, in some respects the complete radar indicator resembles an elaborate cathode-ray test oscilloscope. A typical radar indicator is shown in block diagram form in Fig. 2.

The cathode-ray tube is the heart of the indicator unit and one of the most important parts of the radar set.

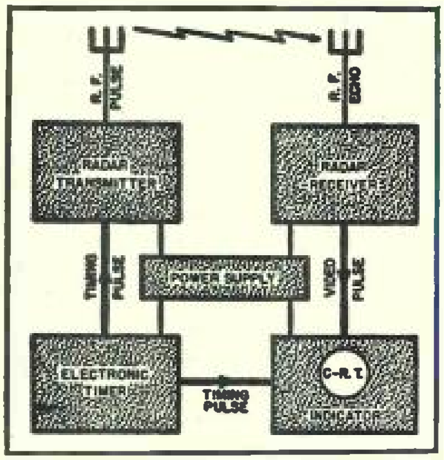


Fig. 1. Basic block diagram of a radar set. Although many types of radar equipment are in use, they all operate on the same basic principles.

Cathode-ray tubes used in radar do not differ radically from those employed in test oscilloscopes and television. However, radar has brought about many technical refinements of the tube. These should be given careful consideration. Many of these improvements in c.r.t. design will have far-reaching effects on future television and electronic design.

Essentially, a cathode-ray tube is a special type of vacuum tube in which electrons emitted from a thermionic cathode are focused and accelerated into a narrow beam by action of the grid and focusing fields.

The electron beam can be focused by either magnetic or electrostatic means. The entire electrode structure—from filament to final focusing field—is known as the *electron gun.*

After the beam is formed, it can be controlled by either a magnetic or electrostatic deflecting field—generally located close to the electron gun.

The beam is then allowed to strike a chemically prepared screen which fluoresces, or glows, at the point where the electron beam impinges. *Motion* of the beam is thus translated into *light.*

A typical cathode-ray tube is shown in Fig. 3. This type is known as an *electrostatic* tube, since it employs electrostatic deflection plates. If these internal electrode plates were replaced by external magnetic coils, the tube would be known as an electromagnetic or magnetic tube.

Based entirely upon the type of field deflection, there are two general categories of cathode-ray tubes—the *electrostatic* and the *electromagnetic.* Either type of tube may use electrostatic or magnetic focusing. Some tubes use combinations of these.

Radar makes wide use of both categories of cathode-ray tubes. For certain technical requirements and operating conditions, each has advantages over the other. But, in general, the magnetic tube finds more frequent use in radar equipment.

Radar tubes are of improved design, having greater accuracy, higher definition, longer life, and easier control than most prewar types of commercial cathode ray tubes.

Controlling the Electron Beam

The electron beam can be influenced or affected either by an electric field produced by two electrodes (plates) between which the deflection voltage is impressed, or by a magnetic field produced by two electromagnets (coils) energized by the deflection current.

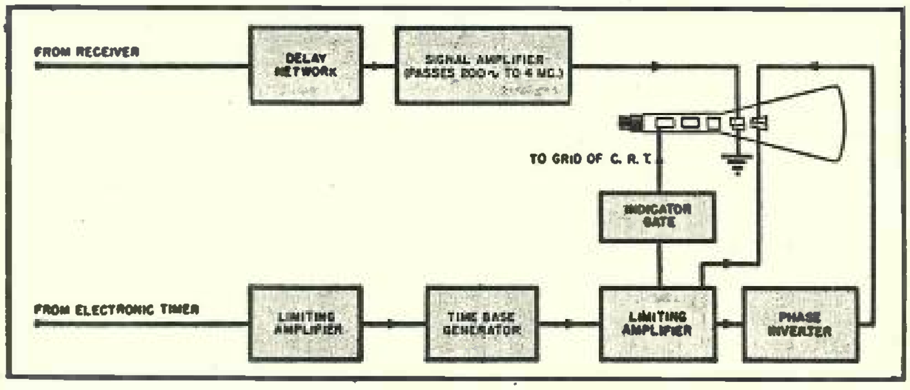
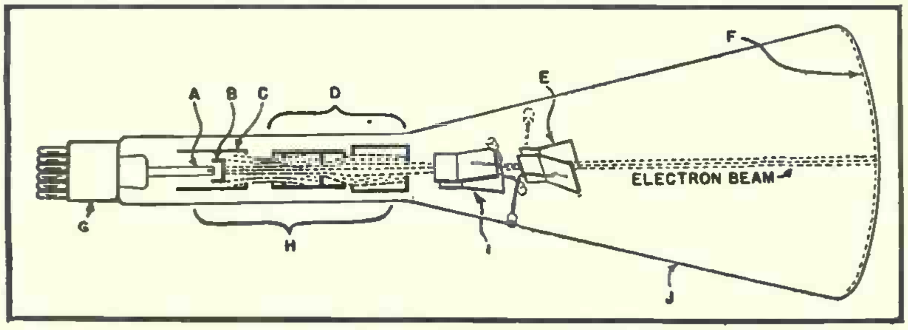


Fig. 2. Simplified block diagram of indicator.

Fig. 3. Cross sectional view of electrostatic cathode-ray tube, showing electron action. (A) Filament. (B) Cathode. (C) Grid. (D) Focusing plates. (E) Horizontal deflection plates. (F) Fluorescent coating on inner face. (G) Base. (H) Electron gun. (I) Vertical deflection plates. (J) Glass envelope.



The conventional electrostatic tube (Fig. 3) uses two pairs of deflection plates in order to move the beam in two dimensions. Combinations of deflection voltages will result in a movement of the electron beam proportionate to the amount of voltage applied to each of these pairs of plates.

The four plates are mounted on stems and brought to separate terminals on the sides of the tube. This tends to minimize capacity effects when the applied voltages are of high frequency. Sometimes one plate of each pair is grounded within the glass envelope.

Deflection sensitivity is important in all types of cathode-ray tubes, and there is usually a considerable discrepancy between theoretical and practical values of sensitivity. For electrostatic tubes, deflection sensitivity is considerably increased by making the plates parallel during a portion of their length, and divurgent during the remainder. This also permits mounting the deflection plates close together.

Electromagnetic tubes employ coils instead of plates to deflect the electron beam. There may also be only one pair of deflection coils, as we shall discuss later. In some cases the coils will be arranged to rotate around the neck of the tube, when a rotating radial sweep is required to give polar indications.

Since the beam acts as a current-carrying conductor, the electromagnets will deflect the beam perpendicular to the field in a direction depending upon the polarity of the energizing current. The magnetic deflection fields pass through the glass of the tube without appreciable distortion.

The neck of the envelope of electromagnetic tubes is generally of narrower shape than that of electrostatic tubes, because the deflection coils must be mounted as close to the electron beam as possible.

Deflection sensitivity of electromagnetic tubes depends upon the ampere turns, size, and physical arrangement of the coils.

Cathode-ray tubes designed for electromagnetic deflection generally use magnetic focusing, and electrostatic tubes generally use electrostatic focusing. However, combinations of these types are often used in radar.

The Fluorescent Screen

To convert the energy of the electron beam into visible light, the inside area of the screen (where the beam impinges) is coated with a phosphor chemical. When bombarded with electrons, this chemical coating emits light.

This is known as *fluorescence.*

Continued emission of light *after* the initial electron bombardment is known as *phosphorescence.*

Various chemical substances are used to coat the screens of cathode-ray tubes, most of them having a characteristic relationship between the intensity of the emitted light and the color of the light.

Compounds generally used are willemite and zinc sulphide, or zinc othosilicate. Use of these results in a green fluorescence, very acceptable to radar.

A blue fluorescence can be obtained by using a zinc oxide coating.

A mixture of blue-emitting and yellow-emitting phosphors results in a substantially white fluorescence, similar to that used in television picture-receiving tubes.

Most cathode-ray tubes used in radar require only a slight degree of phosphorescence, since targets are measured at an extremely high rate of repetition—and the results are continually retraced on the viewing tube.

However, in cases where tubes are used with equipment which searches or covers an expansive area—and, therefore, has a low repetition rate of search over any one part of the area —a tube with very high phosphorescence is required. This permits echo signals from targets to be held on the screen sufficiently long for observance and measurement.

Electrons are not allowed to pile up on the screen. During fluorescence there is a secondary emission of electrons *from the screen*. These secondary electrons are attracted to and collected by a special coating on the interior of the tube envelope—known as *aquadag*. If the number of emitted secondary electrons equals the number that originally strike the screen, there will be no change in screen voltage (with respect to the other electrodes of the tube) and the cathode-ray tube will function properly.

The *aquadag* coating also serves as a kind of shield for the electron beam to protect it from external, spurious disturbances of an electrostatic or magnetic nature.

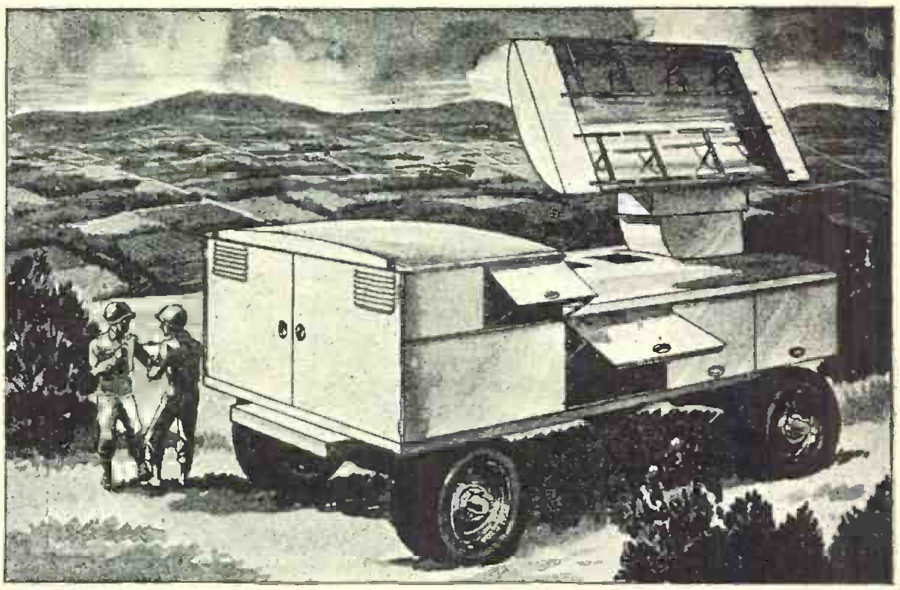
All types of cathode-ray tubes are extremely susceptible to the presence of such external fields, and the effect is usually direct—on the electron beam itself.

Viewing screens of radar tubes vary in size. But they are seldom smaller than about 5 inches in diameter. Larger tubes—up to 15 inches in diameter—are used in big sets and fixed installations. But tubes of any greater size have no practical value in radar, due to distortion effects and difficulties in controlling the electron beam.

Complete Oscilloscope

A cathode-ray tube with its associated time base, limiter amplifier, and positioning and control voltages constitutes a complete oscilloscope—known in radar as the *indicator*. Like the conventional oscilloscope, the radar indicator is capable of measuring at least two variable quantities.

For purposes of illustration, we've chosen the simplest and most common type of radar display—known as the "A" type. This type of indicator uses an electrostatic tube to measure distance in terms of time. But most of the general principles of operation apply equally as well to the electromagnetic type of tube.



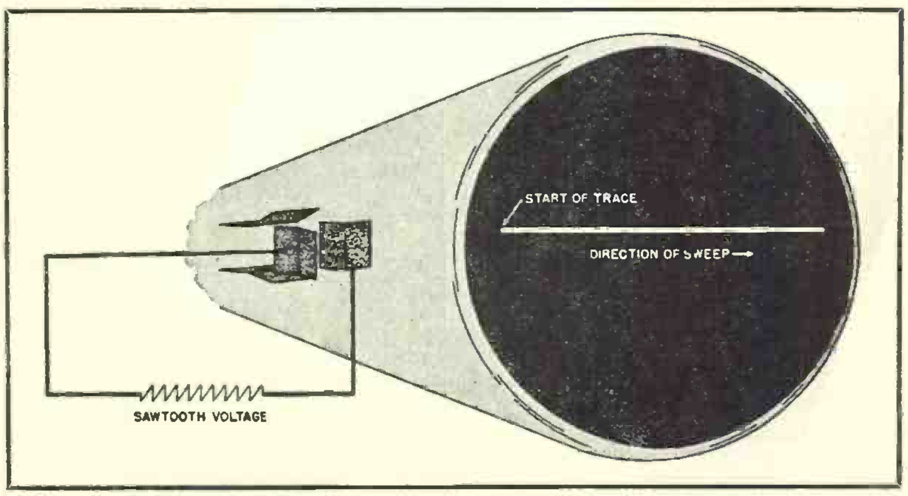
Artist's conception of a typical mobile radar set used for military operations.

To determine the distance or range to any target, we must know the elapsed interval between the time the pulse is transmitted and the time the echo is received. Since the u.h.f. energy travels to and from the target at the same rate of speed—the velocity of light—the elapsed time interval can be measured by linear means.

This is done by applying a linear time base—a sawtooth voltage wave —to the horizontal deflection plates of the electrostatic tube. This time base is synchronized with the other components of the radar system by means of a control impulse from the electronic timer which triggers the sawtooth voltage generator. In this way the electron beam crosses the oscilloscope screen linearly every time an r.f. pulse is radiated by the antenna system. At the end of each traverse, the sweep *flies back* quickly, and the cycle is repeated. The *fly back* is always blacked-out on radar indicators, so that the return of the sweep can't be seen. This is done by applying a black-out or nullifying voltage to the grid or cathode of the tube during the *fly back* period—so that *effectively* the tube does not function during the return trace. The physical length of the time base on the screen has no direct relationship to any time value or time scale. But the movement of the sweep is always linear, even though its speed is too fast for the human eye to discern.

The vertical deflection plates of the c.r.t. are connected through a suitable limiting amplifier to the output of the radar receiver, so that all echo signals received will be displayed on the oscilloscope. These echo signals usually appear as vertical deflections of the time base (Fig. 4).

Fig. 4. Typical radar oscilloscope. The vertical plates of the cathode-ray tube are connected to the radar receiver. All echo signals detected by the receiver will appear as vertical deflections.



GLOSSARY OF RADAR TERMS

A-type Scope—Radar indicator displaying only one coordinate, usually range or distance.
Alignment—Synchronizing the operation of two or more components of a radar system.
Antenna array—A symmetrical arrangement of dipoles with directional characteristics.
Antenna reflector—See reflector.
Antenna switch—See T-R switch.
Azimuth—Bearing or angular direction relative to true north.
B-type Scope—Radar indicator displaying two space coordinates, range and azimuth.
Baseline—See Time Base.
Beam width—The width in azimuth of the pulsed r.f. energy beam.
Bearing—See Azimuth.
Blocking oscillator—Tuned-grid, tuned plate r.f. oscillator in which the grid circuit controls the pulse duration.
C-type Scope—Radar indicator displaying two space coordinates, azimuth and relative height.
Carrier frequency—The ultra-high frequency at which a radar transmitter operates.
Cathode follower—Distortionless, impedance-matching, isolating stage.
Charged line—A pulse-shaping network which reflects a steep-sided rectangular pulse of a duration determined by the electrical constants of the line.
Clamping circuit—A circuit which holds either the positive or negative amplitude extreme of a wave form to a given reference level of voltage.
Crystal mixer—Mixing two frequencies by using the non-linear characteristics of a crystal.
Cut-off limiting—Limiting action of an amplifier when operated beyond the point of plate current cut-off.
D.C. restorer—See clamping circuit.
Delay circuit—Network or circuit which introduces a time or phase delay of a wave form.
Differentiator circuit—A short time constant (RC) circuit and amplifier which produces an output voltage with an amplitude proportional to the rate of change of the input voltage. A circuit used to sharpen a wave form Sometimes called a peaking circuit
Dipole—A half-wave, center-fed radiating element.
Display—See Indicator.
Duty cycle—The fraction of a complete radar cycle during which energy is transmitted.
Echo—That part of the r.f. pulse reflected back to the radar set by a target.
Electronic timer—The component of a radar set that originates the pulse recurrence frequency, and synchronizes the operation of other components with the radiation of r.f. pulses by the transmitter.
Elevation angle—The angle of the target with respect to the radar set and the horizontal plane of the earth.
Envelope—The general outline of a wave form.
Gate—A rectangular wave used to switch a circuit on or off electronically during certain portions of the radar operating cycle.
Grass—Static or noise appearing as intermittent, minute interruptions of the oscilloscope time base.
Ground return—That part of the r.f. pulse reflected by the ground surrounding the radar set.

(Continued on page 127)

A calibrated scale is attached to the oscilloscope screen, and the display of information along the time base is a miniature record of the transmission and reflection of the set's r.f. pulses. Allowing for twice the travel time due to the out-and-back journey of the r.f. pulse, the range of the echo target can be determined on the scope screen by measuring the distance along the time base between the main pulse and the echo corresponding to the target.

The visible portion of the time base is always calibrated and the maximum range reading corresponds to the maximum range of the set. This range will vary considerably with different types of radar sets, depending on the tactical use of the equipment. It's not a technical impossibility to calibrate any radar set at almost any desired maximum range. But sets are usually designed and calibrated for particular maximum ranges, indicated by the highest digit marker on the scale.

Short-range sets may be calibrated to function up to only a few thousand yards, while long-range sets may measure targets up to 150 miles.

For checking the accuracy of range calibration, locally generated precisely timed pulses—known as *calibrator pips*—can be superimposed on the screen of the scope. Then the various positioning and control voltages can be adjusted, when necessary, to align the set properly.

An electromagnetic cathode-ray tube could be used to produce the same 'scope picture (Fig. 4), but a sawtooth *current* wave would be applied to one pair of coils. Echo signals could be applied to the second pair of magnetic coils, or by means of *intensity modulation*—the modulation of the electron beam by the echo signal voltages.

There are other differences between the two types of tubes, but essentially the electrostatic type requires a sawtooth *voltage* wave to form the time base, whereas the magnetic tube requires a sawtooth *current* wave.

Linear Time Bases

Sawtooth voltage and current waves are generated by charging a condenser through a resistance at a known and controllable rate, and then allowing the condenser to discharge at regular intervals.

An external source — the control pulse from the electronic timer—is used to trigger the sawtooth generator.

A typical *voltage generator* is shown in Fig. 5A—with its output waveform. The condenser *C* remains charged until a control pulse premits the tube to conduct. This conduction effectively short-circuits the condenser, and the condenser dissipates its charge. When the control pulse is removed from the circuit, the tube becomes non-conducting and the condenser *C* charges through the resistance *R*. With the selection of proper circuit constants, this rate of charge can be controlled so that it is practically linear. The charge continues until interrupted by another control pulse from the electronic timer, and the cycle is then repeated. A graph of the output voltage across condenser *C* resembles a sawtooth wave (Fig. 5A).

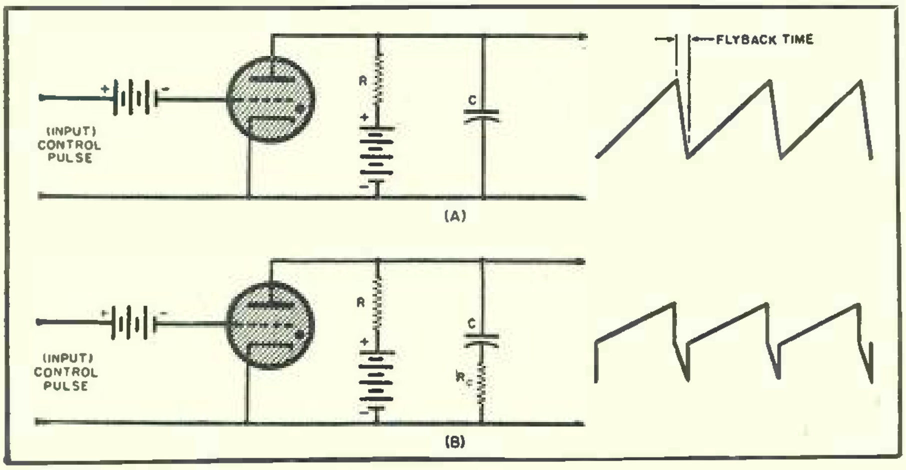
The triggering pulse (from the electronic timer) must have a steep leading edge to avoid time variations in triggering and the pulse must be very short in duration to prevent double-triggering.

Since the charge and discharge cycle of the condenser is repeated after each application of the control pulse, the *frequency* of the sawtooth wave will equal the frequency of the control pulse. In this way, the time base of the radar indicator is properly synchronized with the pulse recurrence frequency of the radar set—the electron beam of the 'scope makes one linear crossing of the screen every time an r.f. pulse is radiated by the antenna system. All other components of a radar set are synchronized with the established pulse recurrence frequency. This results in a relatively stationary pattern on the screen of the indicator.

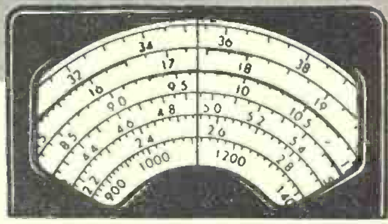
By varying the resistance *R* (Fig.

(Continued on page 85)

Fig. 5. (A) Sawtooth voltage wave generator. (B) Sawtooth current wave generator.



International SHORT-WAVE



***Compiled by* KENNETH R. BOORD**

CONDITIONS with regard to schedules and expanding facilities of short-wave stations are expected to remain fluid for several months, particularly in European and Far Eastern countries most directly affected by the war. Stations now in operation and prospective ones in many countries, however, have equipment *on order* and expansion of short-wave services is expected gradually as such material becomes available. Countries expected to increase short-wave operations in the near future include New Zealand, India, the Levant, and some of the African nations.

Commenting on the future of short-wave broadcasting, William R. Reid, BBC's Acting North American Director, recently said:

"If the radio organizations of the world will take advantage of the technical advances in short-wave broadcasting and news reporting brought on by the war, we should embark on a postwar era in which radio will play as vital a role for the maintenance of peace as it has in the war against fascism. After six years of frontline broadcasting, the BBC is happy to take off its battle dress. Proud of our war-time accomplishments, we look forward to fulfilling our equally important responsibilities in the postwar world. The BBC hopes that the war-time cooperation and collaboration between the great broadcasting organizations of the world will be maintained and expanded so that the powers of radio may be utilized to the fullest for lasting peace."

Expanding on his statement for collaboration between the radio organizations of the world, Reid declared that we will have gone a long way toward making radio a servant of the peoples' desire for peace when radio in all countries devotes some of its air time to programs about other nations.

The BBC executive, who before he came to the United States was Chief Executive Officer of the Malaya Broadcasting Corporation, reminded that at the United Nations Conference in San Francisco the BBC asked the delegates of the various nations to state their positions on what radio can do in the postwar world. "Their statements," continued Reid, "are a clear mandate to world radio leaders to make the fullest possible use of radio if the charter for peace is to be effective. The shooting has stopped. It is now for world radio leaders to harness radio in the service of mankind.

"The genius of those in radio who were able to devise the methods by which to help defeat fascism, will find the methods to help guarantee lasting peace," Reid concluded.

* * *

RADIO-LEVANT

Radio-Levant, the broadcasting system for Syria, is truly good DX in the United States. Through the courtesy of Captain Badin, Signals Officer, of Radio-Levant, we have details of this service. He writes:

"Radio-Beirut has two transmitters. (1) Medium-wave, 5kw., crystal-controlled, operating on 730 kc. or 411 meters; and (2) FXE, short-wave, 3 kw., crystal-controlled, operating on a theoretical frequency of 8.036 mc. or 37.34 meters, but due to interference, we have shifted down the frequency to be in the clear at 8.025 or 8.030 mc. We are expecting to increase our aerial power to 10 kw. as soon as we receive certain valves from the U.S.A.

"This station has directional antenna pointing North-East. It is well heard in the Balkans and the Middle East. We have also had many reports from listeners in France, England, Australia, etc.

"We are broadcasting in not less than 10 languages and for the past 3 years we have contributed to allied propaganda for the occupied territories of Eastern Europe and the Middle East.

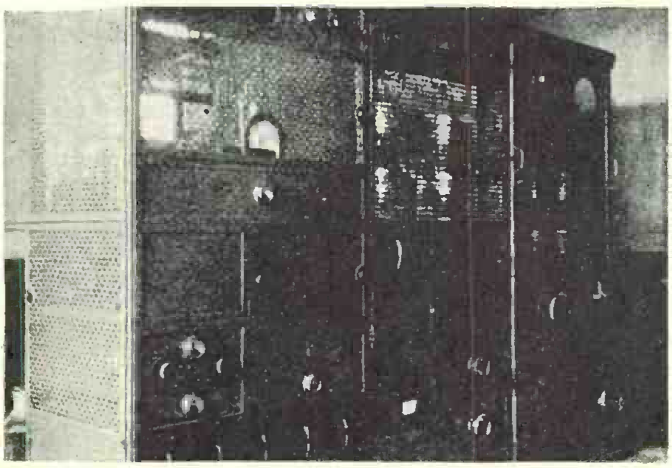
"Perhaps you will be interested to learn that during the Syrian Campaign of June-July, 1941, the original stations were entirely destroyed and then sabotaged. This station has been entirely rebuilt locally, with the help of a few *grand amateurs*, or radio fans, including the writer, ex-VU2AM, of India.

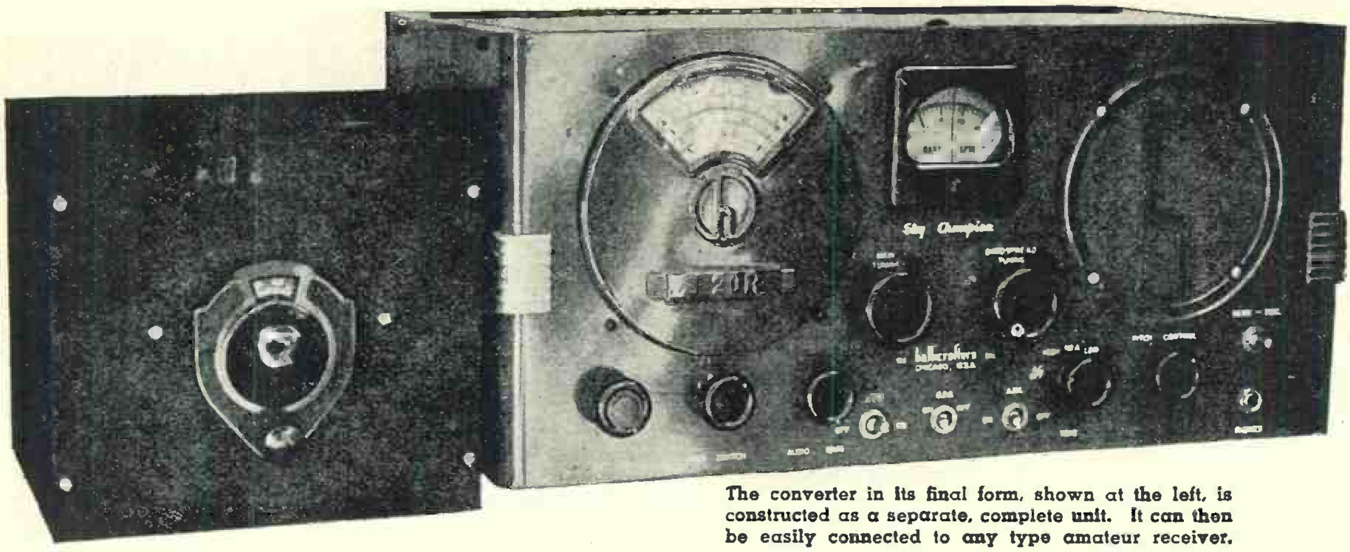
"We also have a small broadcasting station at Damascus called Radio-Damascus, operating on 2 wavelengths: (1) Medium-wave on 1,040 kc. or 288.5 meters, with an aerial power of 1 kw., to be shortly increased to 3 kw., and (2) on short-wave, 7.090 mc. or 37.60 meters, with aerial power of 500 watts, shortly to be increased to 3 kw.

"We have an elaborate listening section. monitoring daily the American

(*Continued on page* 106)

This is Radio-Beirut, Lebanon, FXE, 8.025, reported heard in the U.S.A. with English news at 4 p.m. EST. The transmitter is crystal-controlled, uses 3 kw. power, but expects to increase this to 10 kw. soon.





The converter in its final form, shown at the left, is constructed as a separate, complete unit. It can then be easily connected to any type amateur receiver.

112 MC. CONVERTER

By RAY FRANK, W9JU

Amateurs who have prewar receivers can adapt them to 112 mc. operation by employing this easily home-constructed converter. By slight coil changes, 144 mc. operation can be obtained. This band will be opened to amateur operation in the near future.

THE recent resumption of amateur operation on the 112 mc. band has resulted in local QRM that is strikingly like that encountered on the 3900kc. phone band in pre-Pearl Harbor days. Apparently, everyone who had any sort of equipment that could be made to operate, promptly placed it on the air with the result that operation is a rather difficult problem in most urban areas.

Although some of the trouble is caused by the old type of modulated oscillator, a good deal of the interference can be traced to the use of superregenerative receivers with their attendant broad tuning and radiation. With the relatively few stations on the air for WERS work during wartime such equipment was not too great a problem. However, interference is bound to become rapidly worse until such time as additional bands are opened to amateurs, so that some means of combating present conditions is necessary.

In the near future the manufacturers of communications receivers will probably have available receivers with all the necessary controls to cope with the new conditions, but until this time arrives some temporary expedient must be used.

Most amateurs still have their prewar communications receivers available or the family broadcast receiver may be pressed into service if it has short wave bands. However, some sort of converter will be necessary to permit tuning to the 112 mc. band.

Trial of several converter circuits indicated that the simple one described would perform satisfactorily and require a minimum of parts and labor. Essentially, it consists of a 7N7 twin triode, using one section as the mixer, with the other section doing duty as the high-frequency oscillator. Tuning of the oscillator and mixer are ganged by means of a midget dual condenser.

As the power requirements are only 6.3 volts at 0.6 A. for the heater and 250 volts at 12 ma. for the plate supply, the power is taken from the receiver by means of a plug adapter unit which plugs into the output stage of the receiver. Leads from the output of the converter replace the regular antenna of the receiver, using the receiver as an i.f. system operating on 20 mc. By using such a high *i.f.* frequency, any trouble from images is eliminated and the possibility of unwanted stations appearing on the i.f. frequency is rather remote.

Almost any small cabinet or metal box may be used for the construction of this unit or, if desired, it may be built using only the front panel and chassis. A 7" by 8" by 7" cabinet was used for this particular unit. In place of a regular chassis, a metal shelf 4¼" by 5½" with a ½" lip bent along the front edge was used. As only a few parts are used and they are light in weight, a piece of 16 gauge metal is sufficiently strong.

The only control on the front panel is the tuning dial, a small friction drive type. A direct drive dial was first tried but due to the selectivity of the receiver, tuning was rather critical and, accordingly, the vernier dial was used in its stead.

The parts layout may be clearly seen from the photographs. The shelf holding the various components is mounted 4" above the lower edge of the panel to permit the tuning condenser to be mounted below it in order to afford very short leads to the tube terminals. The tube should be oriented to place the grid terminals toward the tuning condenser. The condenser shown in the photographs is a dual 25-μμfd type of unknown make, but may just as well be two individual units ganged by means of a flexible coupling. Coils in both cases are soldered directly to the terminals of the tuning condenser.

In order to permit minimum loading on the mixer tuner circuit, the grid of the mixer is tapped down on the coil. This results in the retention of a high Q in this circuit and aids in the overall selectivity of the converter. The optimum point for the tap appeared to be the center of the coil in this particular unit.

The mixer grid coil L_2 consists of 6 turns of No. 18 enameled wire, wound around a ⅜" diameter rod and then removed. The antenna coil L_1 is a single turn of pushback wire placed between the two lower turns of L_2. In this case, the antenna used was fed by means of co-axial cable of 70 ohms impedance, but if a different type of feed is used it may be necessary to experiment with the number of turns in L_1. A drop of Duco cement should be placed on L_1 to hold it in place after the coils have been adjusted. The length of L_2 may vary somewhat in individual cases but the turns should be spaced about the diameter of the wire. Final adjustment can be made after the converter is completed and working. The coil used here had an over-all length of 9/16" when the receiver was completed.

The oscillator circuit used is the conventional grounded plate Hartley, using a cathode tap. By using such a circuit, the coil construction is much simpler than would be the case if a tickler winding were used. This coil consists of 3 turns of No. 18 enameled wire, ⅜" inside diameter, with the cathode tap at one turn from the ground end. The turns are spaced so the coil has an over-all length of ½".

The tuning condenser used was originally a dual midget of 25-μμfd per section. However, to keep the frequency range of the converter down, in order to spread the band out, one rotor plate was removed from the oscillator section, letting that section consist of one rotor and two stator plates. The mixer section was pared down to one rotor and one stator.

To give greater stability in the oscillator, a 15-μμfd ceramic condenser is connected across the oscillator section of the condenser. If it is not possible to obtain a condenser of this type, every effort should be made to obtain a silver mica condenser for this position.

While a certain amount of coupling exists between the oscillator and mixer sections by virtue of capacity through the tube and circuit components, it is not sufficient to give proper mixing and, accordingly, the condenser C_3 is constructed by means of two pieces of No. 18 wire soldered to the stator terminals of both the oscillator and mixer sections of the tuning condenser.

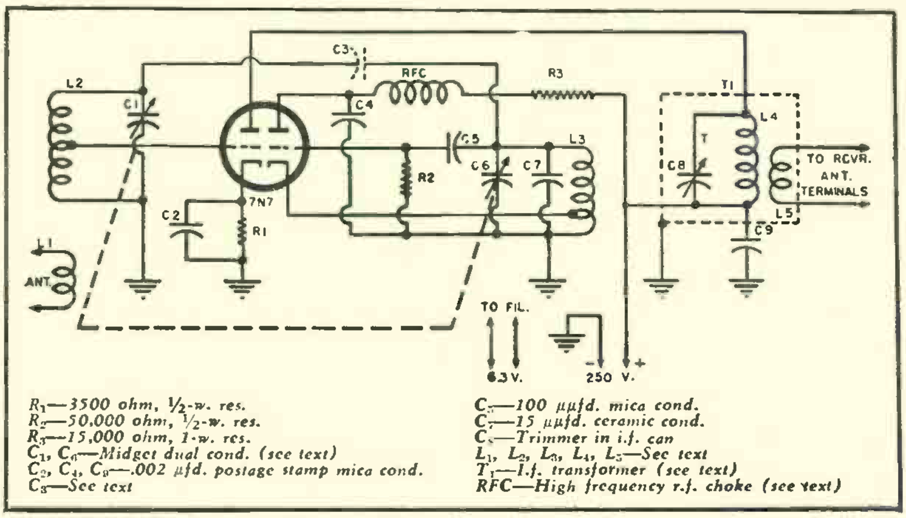


Diagram of single tube converter. All coils are built from obsolete junk-box parts.

These wires are allowed to overlap ¾" and are separated about 1/16". These wires may be seen in the photograph of the underside of the chassis, on the right hand side of the tuning condenser.

The r.f. choke *RFC* consists of 50 turns of No. 30 enameled wire, close wound on the body of a ½ watt resistor. This resistor should be at least 100,000 ohms, in order not to short out the choke. Alternately, a piece of 3/16" diameter bakelite rod may be used instead.

The i.f. transformer T_1 was made from a defunct 455 kc. unit of the replacement type. The regular i.f. coils were removed and a winding consisting of 10 turns of No. 32 d.s.c. wire wound on for L_4. The coupling winding L_5 consists of 3 turns of No. 32 d.s.c. wire wound at the *cold* end of L_4. Both windings are close wound. The i.f. used in this case had a dowel of ⅜" diameter. Many of the standard i.f. transformers have a dowel of approximately ½" diameter and, if one of these is encountered, the number of turns in L_4 should be reduced to 8.

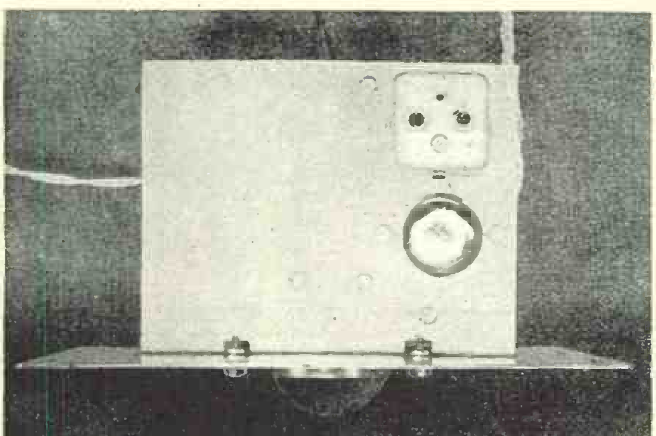
When construction has been completed, the first step is to check the frequency of the oscillator section, using either an absorption type wavemeter, or calibrated receiver. As the oscillator in this case operates 20 mc. above the signal frequency, the range should be approximately 128 to 148 mc. The range can be adjusted by squeezing the turns of the oscillator coil together to lower the frequency, or spreading them slightly to raise it. When the high-frequency end has been set, the lower end can be adjusted by slightly bending the plates of the tuning condenser.

When adjustment of the oscillator has been completed, the next step is to align the i.f. transformer. The receiver should be set to 20 mc. and the trimmer condenser C_8 adjusted for maximum receiver noise. If a signal generator is available, it may be used to align the i.f. transformer by disconnecting the mixer grid from L_2 and applying the signal from the signal generator between the grid and ground.

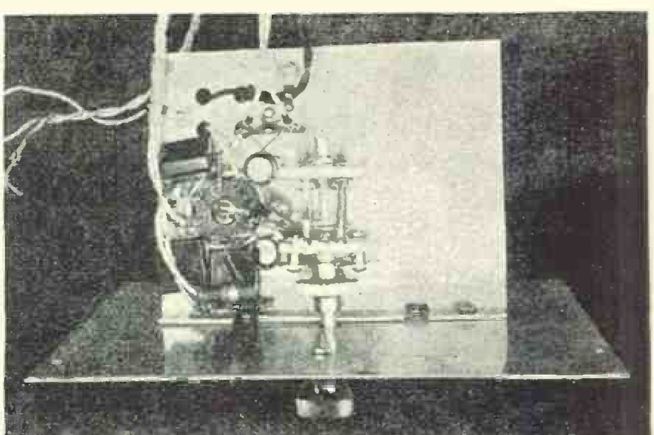
The next step is to adjust the mixer grid coil L_2. It is probable that the only adjustment that this coil will need is the stretching or squeezing of

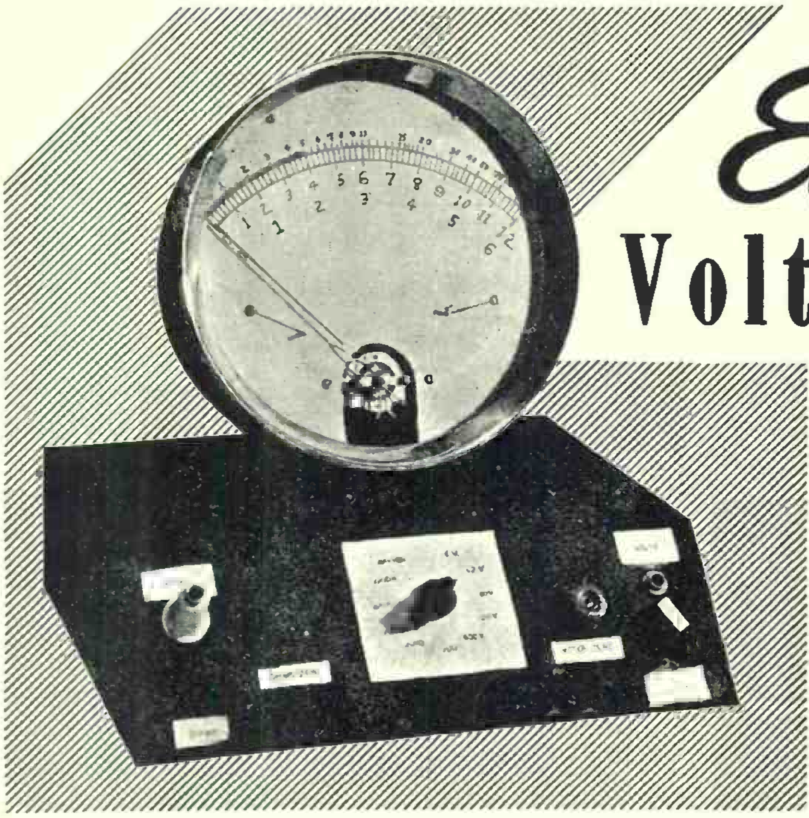
(*Continued on page 77*)

Top view shows simplicity of construction. The 7N7 and coil T_1 are the only components mounted on top of chassis.



Bottom view of completed instrument. Over-all size can be reduced considerably and still obtain efficient operation.





Electronic Volt-Ohmmeter

By
HOWARD H. ARNOLD

The design and construction of a sensitive, high-input electronic test instrument, employing low-cost, easily obtainable meter.

The completed instrument. A smaller meter may be used, sacrificing sensitivity.

THE design and construction of an electronic voltmeter using a large meter involves factors not ordinarily encountered in electronic design. The large meter movement requires either a unit of delicate construction, in order to obtain high sensitivity, or an alternative of rugged construction and low cost, coupled with low sensitivity. The purpose of this article is to discuss the construction of a large universal volt-ohmmeter, using the latter type meter, and to point out some of the theory behind the component selection made.

The voltmeter circuit selected is the familiar bridge circuit. Fig. 1A illustrates this circuit in diagramatic form. It has been shown that if arms *A*, *B*, *C*, and *D* are so proportioned that:

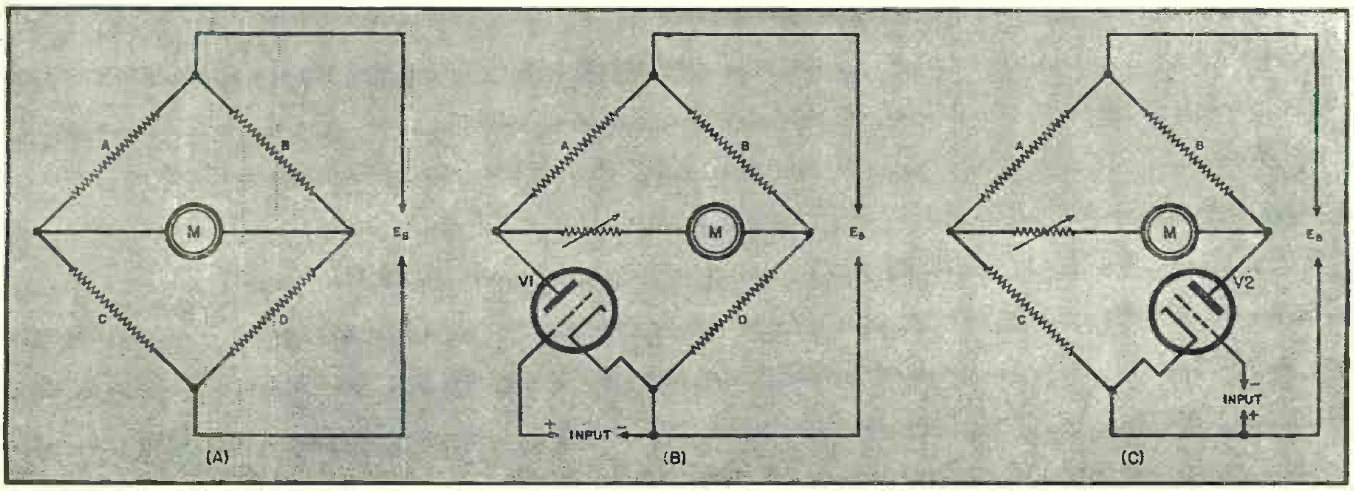
$$A/C = B/D$$

the current through the meter, *M*, will be zero. Further, if resistance *C* is decreased, or if resistance *D* is increased, current flow will occur through meter *M*, and this current flow will be dependent for its magnitude on the applied voltage (E_b), on the resistance change, and upon the resistance of the meter itself.

If we substitute a vacuum tube V_1, for resistor *C*, as shown in Fig. 1B, we now have the plate resistance of V_1, substituted in place of resistor *C*. The plate resistance of a vacuum tube becomes lower when a positive voltage is applied to its grid, so it can easily be seen that by applying a potential of positive polarity to the grid of V_1, the same effect can be had as by lowering the value of resistance C, mentioned above. This, then, will cause a current to flow through the meter and if we were to adjust the series resistance of the meter, for a particular meter reading for a given input voltage, we would then have a simple means of determining this *particular* voltage level whenever it again occurred at the input terminals of our *electronic voltmeter*.

We have now developed a means of measuring one particular voltage level. However, if we had a voltage one half this level, it would be desirable for the meter to read one half as high as it did before. An inspection of a few

Fig. 1. (A) The familiar Wheatstone bridge around which this instrument was designed. (B) Vacuum tube is used in place of the resistance, arm C. (C) Vacuum tube replaces arm D. This instrument could have been designed with solely one tube in either one of the arms shown. However, the scale calibration would not be linear. The final design employs both of these tubes and, as a result, a linear scale is obtained.



VOLTAGE MEASUREMENT
(up to 600 v.)

1. Plug test lead into "volt" jack.
2. Set control SW-1 to proper range.
3. Set polarity switch to polarity desired.
4. Turn "ohms zero" (R21) full counter-clockwise.
5. Short test leads together and adjust "meter zero."
6. Proceed to take reading.

VOLTAGE MEASUREMENT
(above 600 v.)

1. Perform steps above.
2. Set range switch, SW-1 to 600 v. position.
3. Plug special high voltage lead into 6000 v. terminal.
4. Proceed to take reading.

OHMS MEASUREMENT

1. Turn polarity switch to positive.
2. Set range switch to 600 v. position.
3. Adjust meter zero.
4. Set range switch to proper ohms range.
5. Turn ohms zero control clockwise until meter reads just full scale.
6. Plug test leads into "ohms" jack and take reading.

VOLTAGE RANGES

0 to 6 volts
0 to 12 volts
0 to 60 volts
0 to 120 volts
0 to 600 volts
0 to 6000 volts

INPUT IMPEDANCE

30 megohms on first five ranges.
300 megohms on 6000 volt range.

RESISTANCE RANGES

Lowest measurable value .1 ohm (a reasonably accurate estimate can be made to .02 ohm).
Highest measurable value, 500 megohms.

Outline of the operation and various characteristics of the instrument.

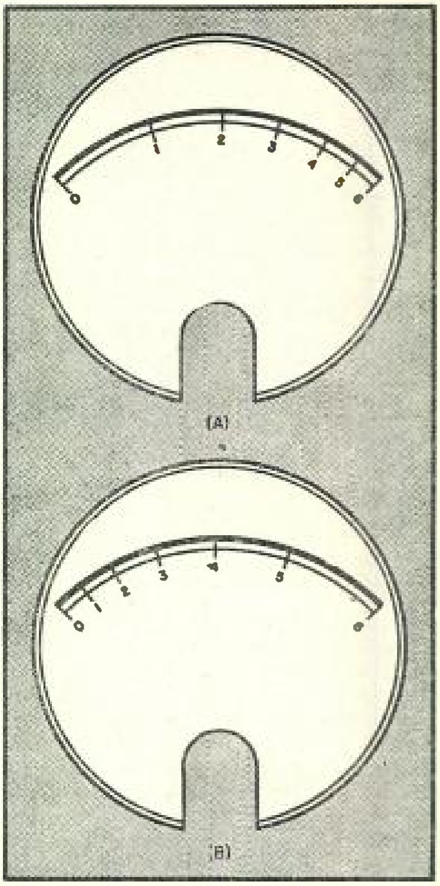


Fig. 2. Non-linear scale calibration that would have been obtained if a single-tube were used. (A) Calibration obtained with circuit, shown in Fig. 1C. (B) Calibration obtained with circuit, shown in Fig. 1B.

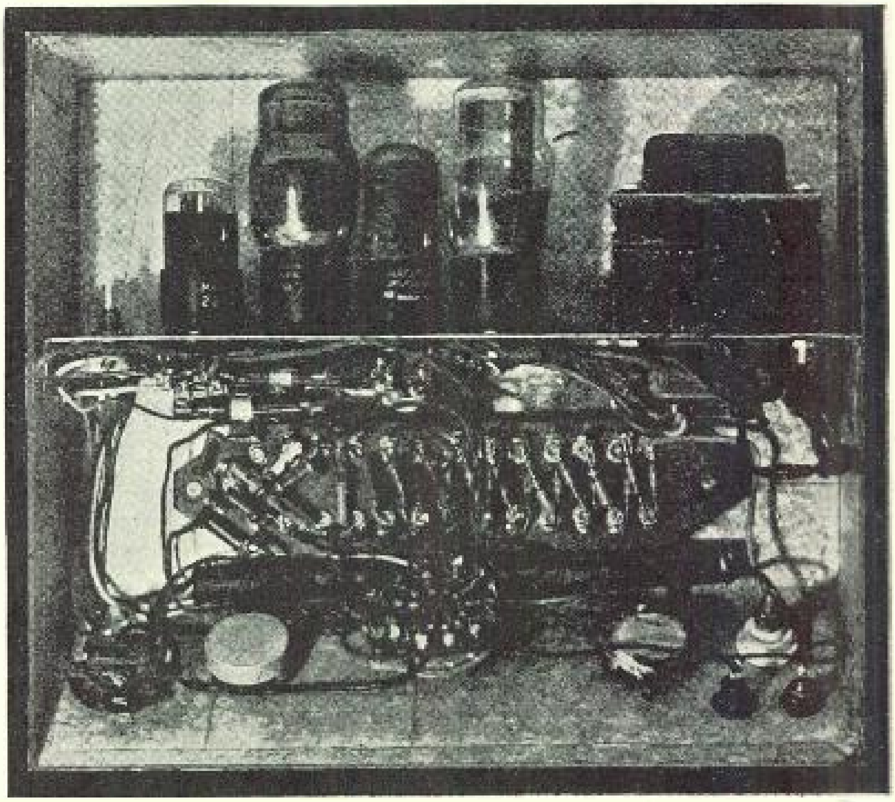
tube characteristic curves indicates that the choice of a tube whose plate resistance varies linearly with a linear change in grid voltage is not an easy problem. We could, of course, make up a special non-linear scale for our meter, so that it would fit the particular tube at hand, but we would be likely to find that as our tube aged, and as we changed tubes, the calibration of the meter would change and our calibration job would have been in vain.

In an effort to make our scale more nearly linear, and also more independent of tube characteristics, let us, for a moment, consider what would happen if we substituted a vacuum tube, V_2, for resistor *D* in Fig. 1A instead of substituting V_1 for resistor *C*. This is shown in Fig. 1C. We now find that in order to have current flow through our meter in the same direction as previously, it will be necessary to *increase* the plate resistance of V_2. This, of course, is easily done by applying a negative voltage to its grid. We find now, that the curvature of our scale is as bad as before, but in an opposite direction. That is, for an increased input voltage, our scale becomes progressively more crowded; whereas, with the circuit of Fig. 1B, an increased input voltage caused our meter scale to become further expanded. These results are shown pictorially in Fig. 2.

If we now combine the circuits of Fig. 1B and Fig. 1C, as in Fig. 3A, we get much the same results that we have when we combine two single tubes in a push-pull amplifier. The *distortion* is eliminated, and a practically linear indication of voltage input is accomplished. It will be noted, however, that the addition of this other tube requires that an additional voltage of negative polarity be applied to the grid of V_2 at the same time the voltage to be measured is applied to the grid of V_1. This is best accomplished by a d.c. *phase inverter*, a simple form of which is shown in Fig. 3B. Here the grid of V_2 is grounded. The cathodes of V_1 and V_2 are connected together. A positive voltage on the grid of V_1 causes an increased plate current through V_1 and a consequent

★

Under chassis view of the completed instrument showing position of component parts.



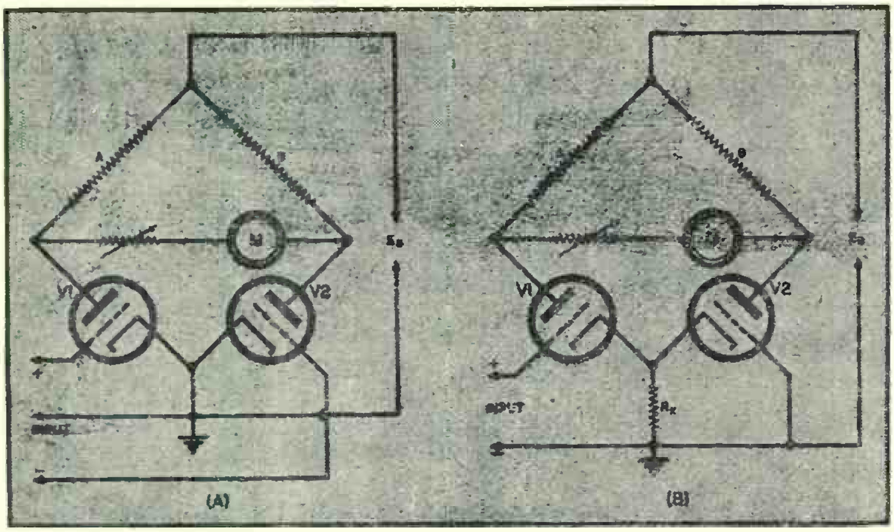
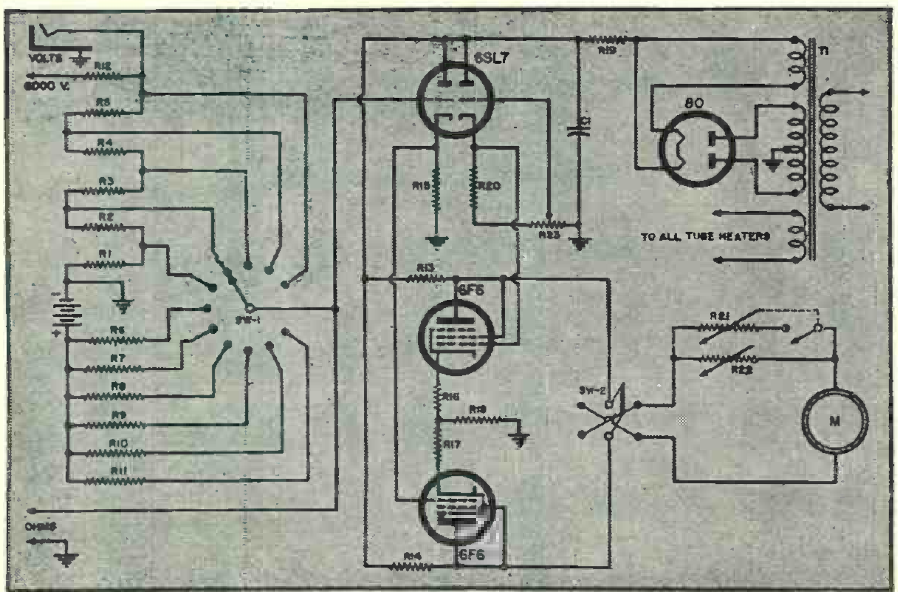


Fig. 3. (A) The circuit as it appears after combining both tubes, as shown in Figs. 1B and 1C. (B) Rearrangement of Fig. 3A makes possible single input operation.

increase in the voltage developed across the cathode resistor, R_k. This positive voltage is tied directly to the cathode of V_2, which, of course, is the equivalent of applying a negative voltage to the grid of V_2, and the approximately linear indication previously attained still occurs. Thus, with these connections, we have a voltmeter which will give us a linear indication of the voltage applied to the grid of V_1, using a vacuum tube circuit.

The usefulness of any voltmeter used for servicing is limited by how much current it draws from the circuit under test. An ordinary meter of the *1000 ohms-per-volt* variety, a quite common type, requires one milliampere for full scale deflection. This meter is hardly usable for use in a.v.c., a.f.c., cathode-ray, and similar circuits, where the circuit resistance is quite high. A better meter, and one quite popular for a time, was the 20,000 ohms-per-volt meter, which took only 50 microamperes from the circuit under test. The ultimate point in view, whenever a vacuum tube voltmeter is required, is to raise the input impedance of the instrument to such a high value that practically no current is drawn from the unit undergoing voltage measurement.

Fig. 4. Complete schematic diagram involves the total of four tubes and provides high input impedance with linear scale calibration as added features.



R_1—.3 megohm, 1 w. precision res
R_2—1.2 megohm, 1 w. precision res.
R_3—1.5 megohm, 1 w. precision res.
R_4—12 megohm, 1 w. selected carbon res.
R_5—15 megohm, 1 w. selected carbon res.
R_6—10 ohm, 1 w. res.
R_7—100 ohm, 1 w. res.
R_8—1000 ohm, 1 w. res.
R_9—10,000 ohm, 1 w. res.
R_{10}—100,000 ohm, 1 w. res.
R_{11}—10 megohm, 1 w. precision carbon res.
R_{12}—270 megohm res. (18 15 megohm, 1 w. res. in series)
R_{13}, R_{14}—10,000 ohm, 10 w. res.
R_{15}—68,000 ohm, ½ w. res.
R_{16}, R_{17}—200 ohm, ½ w. res.
R_{18}—350 ohm, 1 w. res.
R_{19}—1000 ohm, 10 w. res.
R_{20}—47,000 ohm, ½ w. res.
R_{21}—50,000 ohm linear taper pot.
R_{22}—5000 ohm pot.
R_{23}—25,000 ohm linear taper pot.
SW_1—11 pos. single pole rotary sw.
SW_2—D.p.d.t. rotary sw.
C_1—10 μfd. 450 v. cond.

T_1—Power trans., 300-0-300 v. @ 70 ma. 6.3 v. @ 3 amps, 5 v. @ 2 amps.
M—9" 5 ma. meter, hand calibrated scale
Tubes—1-80, 2-6F6, 1-6SL7

As previously pointed out, the only factor which controls the meter deflection in our circuit is the *voltage* applied to the grid of V_1. If we could make the grid resistor of V_1 infinite, we could apply a voltage to it and no current would flow. Therefore, we would have exactly what we set out to find—a meter which does not load the circuit we are attempting to locate trouble in.

Unfortunately, there is a secondary peculiarity of a vacuum tube, which normally does not cause us much concern, but which immediately spoils this perfect conception. The electrons on their flight from the cathode to the plate of the tube, occasionally impinge on the grid. This, in most circuits, causes no trouble, as there is always a path for these stray electrons to return to ground through the grid resistor, without producing a noticeable effect. However, in our circuit, we would like to make the path, from grid to ground, of a very high resistance—infinite, if possible, as we just mentioned. We cannot make this path infinite because of these prodigal electrons, but we can make it a very high value by taking special precautions. We find that the higher the plate voltage and the higher the filament temperature, the higher is the number of electrons which strike the grid of the tube, and, consequently, the lower the grid resistor must be made to allow for their passage to ground. If we lower the plate voltage (and the heater current) to a fairly low value, only a very few electrons strike the grid of the tube, and it is possible to make the resistor between grid and ground of a very high value (20 megohms) so as to allow for the passage of only these few electrons back to ground. However, in so lowering the plate voltage and cathode temperature, we have limited the maximum current we can draw through the tube, and since the only current available to operate our meter is that which flows through the tubes in the circuit, it becomes necessary to use a meter of extremely high sensitivity to obtain full scale deflection with ordinary tubes in the bridge circuit. If we use such a meter, this arrangement is perfectly practical, and has been used with excellent results.

It will be recalled, however, that our initial purpose was to design an electronic voltmeter using a large, high-current meter. This then eliminates the possibility of using reduced plate voltage on our bridge tubes in order to reduce the effects of grid current to tolerable levels. We must, then, pursue the other course, and use a low value of grid resistor, so that the rather high grid current, necessitated by the high plate voltage and heater current, can be passed harmlessly to ground. We can at the same time, however, maintain a high input resistance to our meter by the use of an iso-

(*Continued on page* 130)

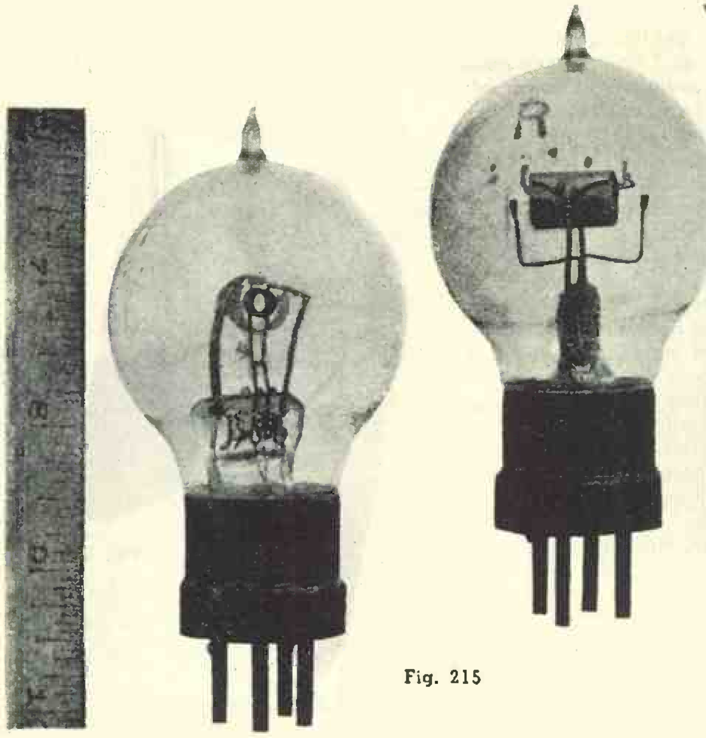


Fig. 215

Saga of the VACUUM TUBE

Part 20. Continuing the study of the evolution of the vacuum tube and the many mechanical problems that were confronted in their manufacture during World War I.

By
GERALD F. J. TYNE
Research Engineer, N. Y.

THE manifold difficulties in the manufacture and in the utilization of soft tubes, because of the non-uniformity of the manufactured product and the erratic behavior of individual tubes, eventually compelled the adoption by the British armed services of hard tubes even though their comparative insensitivity necessitated the use of multistage amplifiers. The exact time when this decision was reached is unknown but Gossling states that[297] a study was made of some "oscillions" imported from America in 1915 by the Admiralty and that the most illuminating data was obtained in 1916 by H. M. Signal School at Portsmouth on re-exhausted audions of the flat plate and zigzag wire grid type. Later in 1916 further study was made of a "pliotron" made by the American General Electric Company.[298]

Meantime, the British Thomson-Houston Company had been studying the so-called "French" valve, developed by the French Military Telegraphic Service. From all this work came a receiving tube designated as the *R* valve. This tube was widely used in its various embodiments. Fig. 215 shows two views of an *R* valve made by Osram. Tubes of this pattern were made by all of the British manufacturers.

The *R* tube had an anode of sheet nickel, bent in the form of a cylinder about 5/8 inch long and .41 inch in diameter. The grid was an 11 turn helix about .2 inch in diameter, the wire being .005 inch in diameter. The filament was of tungsten and operated with .7 ampere at about 4 volts. The anode voltage was 30 to 100 volts, anode resistance 35,000 to 40,000 ohms, and amplification factor about 9.

The earliest models of this tube had a simple helix form of grid patterned after the French tube. This proved to be very microphonic and later tubes had the grid stiffened by means of a catenary suspension. Such was the construction of the B.T.H. Type *A* tube.

The base usually applied to the *R* tube was of the type originally developed for the French tube. It has been called by various names such as "Burndept," "Continental," and "European." The dimensions and pin spacings are given in Fig. 216. The outer metallic shell was of copper or (later)

Fig 216

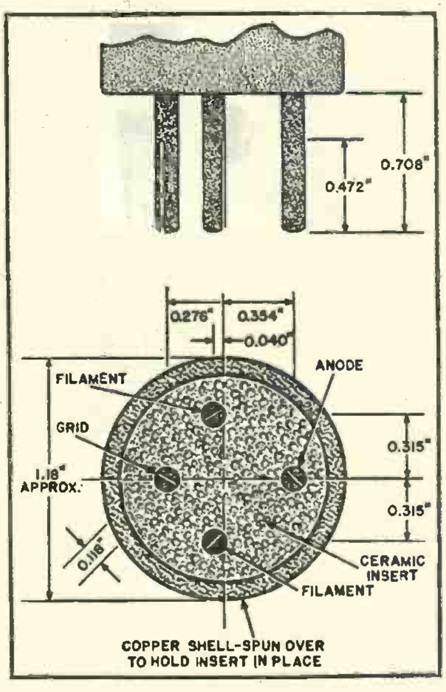
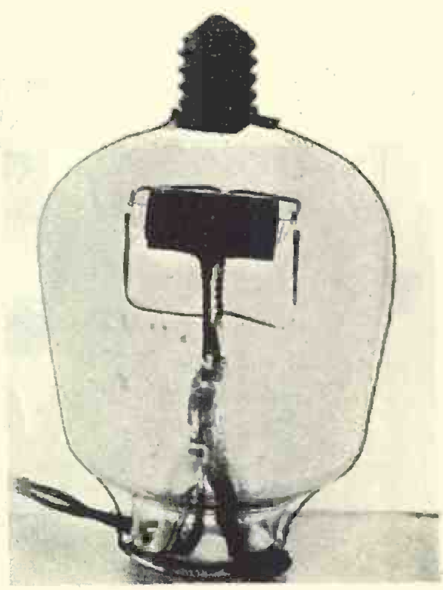


Fig. 217



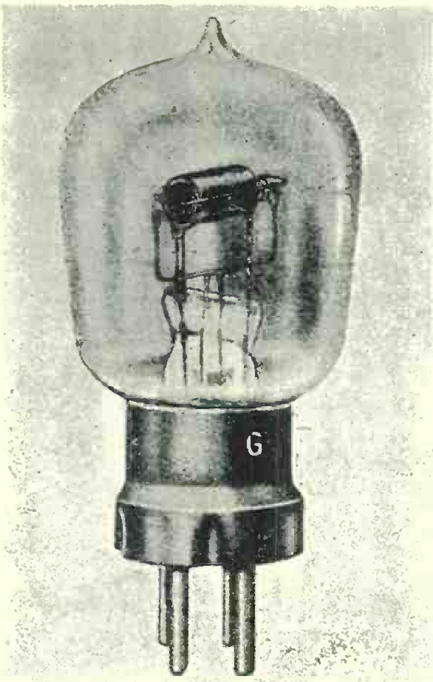


Fig. 218

brass, and the pins were set in a ceramic insert.

The *R2* tube, second in the *R* series, has been discussed in a previous instalment. The author has been unable to obtain any information concerning the *R3* and does not know whether or not it was ever manufactured commercially.

Now it must be remembered that this tube development was going on in the midst of a world war. Engineers and scientists were working under pressure to satisfy the incessant demand for more and better communications equipment. The chief naval communications problem in the early part of World War I was to get good c.w. reception. Audions and other soft tubes were used in naval installations as local oscillators in heterodyne c.w. reception. The audion first came into prominence in naval work for this application. The extent of its use is indicated by the fact that there were 800 audions of de Forest manufacture in service for the Admiralty in 1917. Small arc generators had previously been used as local oscillators but were troublesome, and even the smallest which could be conveniently operated gave a much higher output than was desirable. The Audion and the Round tube operated satisfactorily over the entire range of frequencies required, but were short-lived and difficult to handle.

Up to this time, the British Thomson-Houston Company had been successful in the manufacture of *R* type tubes, but the standard *R* tube would not oscillate over the complete frequency range used in this work. They now proposed to develop a high-vacuum tube to replace the Audion and other soft tubes in use. The *R4* was born of observations made by Mr. Edmundsen of the B.T.H. Co. in the course of this work. A number of modifications of the *R* tube were made up for trial, and by accident one of these experimental tubes had a distorted filament. The distortion was such as to bring the filament and grid very close together. Mr. Edmundsen observed that this tube was very satisfactory in operation, being capable of meeting all the requirements for this application. But it was not reproducible. The *R4* was an attempt to duplicate, in a commercially manufacturable tube, the characteristics of this "freak."

Fig. 219

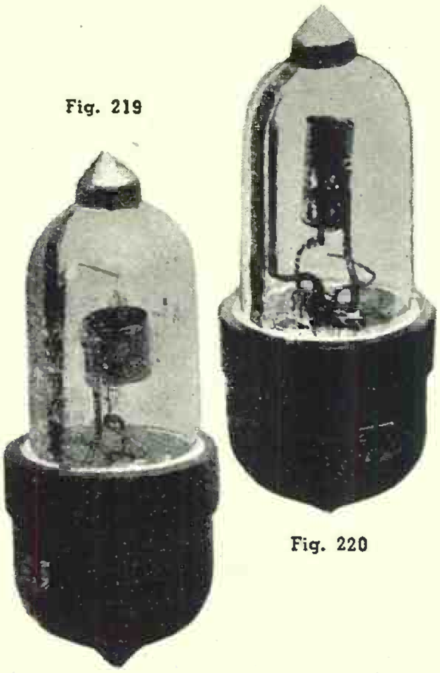


Fig. 220

The grid diameter was made as small as possible, the diameter and pitch being chosen to accomplish the desired effect. The anode was of nickel sheet about .006 inch thick, bent in the form of a cylinder .36 inch in diameter and .68 inch long. The helical grid was of molybdenum wire, .006 inch in diameter, wound with a pitch of 25 turns per inch, had an internal diameter of .14 inch and a length of .79 inch. The filament was of tungsten wire containing 1% of thorium, about 3.5 miles in diameter and 1 inch long, and crimped to eliminate tensile strains. The filament operated with about 1.1 amperes at 3.5 to 4 volts. The anode voltage ranged from 45 to 55. This low anode voltage greatly eased the requirements on the hardness of the vacuum to be obtained.

The characteristics of this tube compared very favorably with those of the soft *R2*. The working temperature of the filament was sufficiently low so that the crackling noises, usually experienced when thorium was used, were not present.

The first of these tubes, made by the B.T.H. Company, had a life of about 1500 hours and attempts were made by other manufacturers to improve the tube and attain longer life. This was finally achieved by the Osram-Robertson Works, by the development of an extremely hard exhaust which could be obtained with a minimum of bombardment. The commercial product of these tubes was long-lived, some lasting for 8000 hours, while the general run had a life of several thousand hours. The *R4* was also made by Ediswan, and Stearn Lamp Company.

The *R4* was redesigned about a year later to reduce the filament power required. The diameter and length of the anode were reduced, the pitch of the grid increased slightly and the fila-

Fig. 221

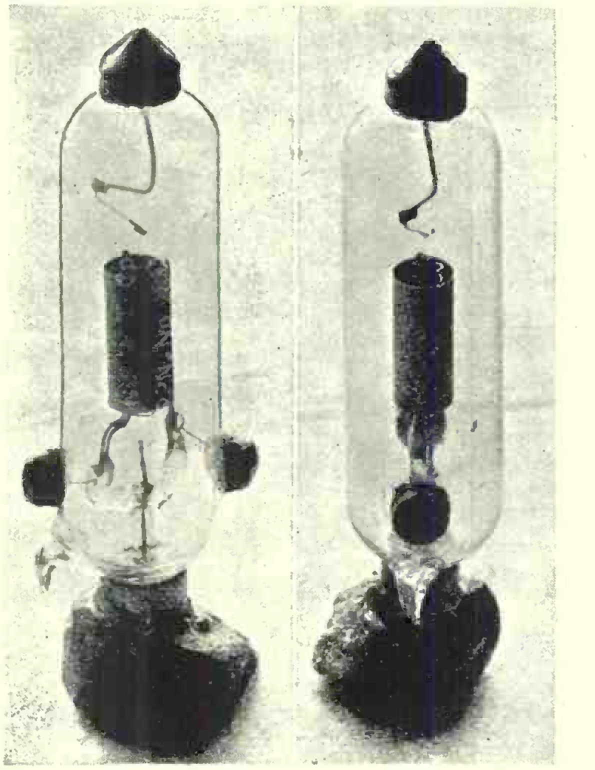
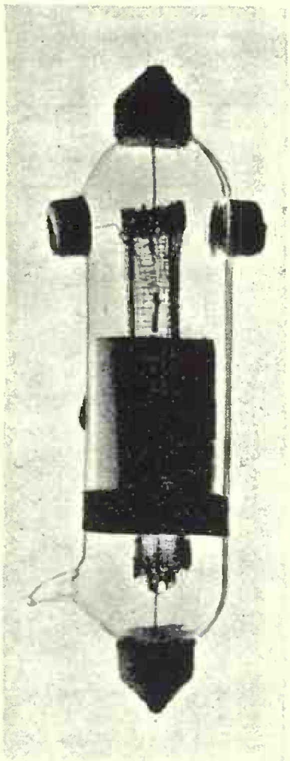


Fig. 222



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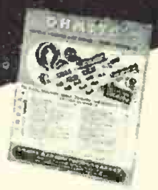

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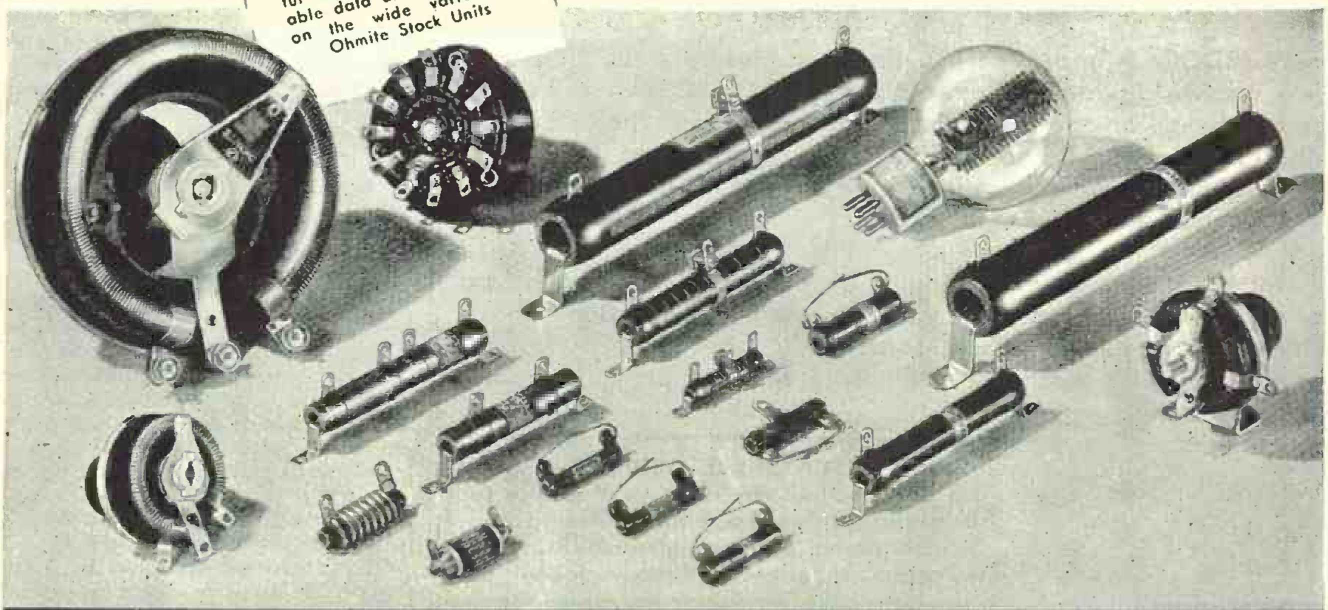

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ment wire changed to 2.4 mil diameter thoriated tungsten. The redesigned tube was designated R_{14} and is shown in Fig. 217. It operated with a filament current of about .65 ampere at 2.5 to 4 volts. The life of the R_{14} was was about 1500 hours. The filament operated at a somewhat higher temperature than that of the R_1 and, hence, the tube was somewhat noiser.

The R_{1B}, shown in Fig. 218, was designed for use in amplifiers where the noise introduced by the R_{14} was objectionable. The element structure was practically the same as that of the R_{14} except that the filament was of unalloyed tungsten. It operated at the same filament current as the R_{14} but at a somewhat higher filament voltage, the range of voltage being 3.4 to 3.9 volts.

The final development of high vacuum receiving tubes for British Naval Service, during World War I, was the R_3, manufactured by the "Z" Electric Lamp Company (among others) and shown in Fig. 219. This tube was evolved experimentally from the *R* series and followed in its general design one of the high vacuum receiving tubes developed by Captain Round, which will be discussed later. The first quantity production did not come up to expectations and the tube was redesigned to increase the ratio of saturation current to working current. With this change it was satisfactory. The anode was of nickel sheet, .006 inch thick, in the form of a cylinder .36 inch long and .36 inch in diameter. The helical grid was composed of 14 turns of .004 inch diameter molybdenum wire, with a pitch of about 22 turns per inch and an internal diameter of .115 inch. The filament was of pure tungsten, approximately 2.5 mils in diameter and .87 inch long. It operated with a current of about .65 ampere at about 3.6 volts. The anode potential used was 30 to 60 volts.

It will be noted from the photograph that this tube differed from the rest of the *R* series in its method of mounting. The bulb and cap used on this tube were developed by Captain Mullard for the use of the R.F.C. The ratio of diameter to length of the anode is also different from other tubes of the *R* series, being greater. This change was made to reduce grid-anode capacitance. This capacitance was about 2 μμfd. when the tube was cold and somewhat less when the filament was in operation. One drawback was found. Leakage developed between the electrode leads outside the glass, due to the cement used to attach the caps being hygroscopic.[299]

The design of this tube was inadequate in some other respects. The thin spring wire after heating lost its elasticity and the lack of suitable spring action caused considerable filament breakage while tubes were still on the exhaust pump. The adjustment of spring tension was quite critical. If the tension was too great the filament would break, if too little it would sag and touch the grid.

There were two other tubes made

for use in Air Force equipment, which were similar mechanically to the *R5*. These were known as the "Air Force *C* Valve" and "Air Force *D* Valve." An Air Force *C* Valve made by Osram is shown in Fig. 220. This tube was first introduced about September, 1918. It was a high-vacuum triode for receiving purposes and had a pure tungsten filament which operated at 5 volts and .75 ampere. It had an amplification factor of about 6 and anode impedance of 16,000 to 30,000 ohms. The anode voltages used were between 50 and 70.

The Air Force *D*, which was a soft tube for use as a detector, was first employed about January, 1919. It resembled the *C* in external appearance and mounting but the anode was of larger diameter and the grid was of gauze rather than the helical wire type.

The design of the *R5* was based on a high-vacuum tube which had first been produced for the British Marconi Company in 1916 by Captain Round, and designated by them as *V24*. It is shown in Fig. 221. The *V24* was intended specifically for use as a high frequency amplifier, since it had been found that it was impracticable to build a satisfactory multi-stage amplifier using *R* type and similar tubes of the single-ended construction with the conventional base. The common type of multi-stage amplifier at that time was resistance-capacitance coupled, and the interelectrode capacitances of the *R* tube were a considerable shunt on the resistance. Accordingly, in the design of the *V24*, Captain Round strove to reduce these capacitances as much as possible by separating the leads as far as possible. This was accomplished by using a cylindrical bulb and bringing out leads to the axial filament at opposite ends, while the anode and grid connections were brought out on caps on the sides of the bulb. This tube, which had a spring tensioned filament, operated with a filament current of .75 ampere at about 5 volts. The anode voltage used varied between 20 and 60 volts. The amplification factor was about 6 and the internal impedance 15,000 to 20,00 ohms. Six of these tubes were used in the famous Marconi D-55 Amplifier as high frequency amplifiers. This amplifier was widely used in marine work. In fact this tube was still being made, by hand, for replacement purposes in these amplifiers, up to about 1937.

A companion tube to the *V24* was the Marconi type *Q*, which was used in the D-55 Amplifier as a detector, following the six stages of high-frequency amplification. This tube was similar in appearance and mounting to the *V24*, as may be seen from Fig. 222. It differed chiefly in the construction of the grid, which was of fine mesh gauze, and which was carried on two glass beads through which the filament leads passed. This tube had a higher amplification factor and internal impedance than the *V24*, the values being 50 and 150,000 ohms respectively. It also re-

(*Continued on page* 129)


AMPHENOL
ANTENNAS
Promise . . . New Improvements
In Postwar F-M
and Television Reception
AMPHENOL F-M DIPOLE
ANTENNAS WILL PROVIDE
• High gain that means better pick-up and reception.
• Directional array that will eliminate interference from the reflector side.
• Trouble-free reception in the F-M bands.
• Swivel feature will reduce or eliminate undesirable reflections that cause multipath distortion in television.
• New idea in parallel lo-loss transmission line.
For every improvement the antenna array can bring to future F-M and television reception—look to Amphenol. With a background of wartime experience in special research and engineering for the Armed Forces on dipole broad band reception, Amphenol has amplified its long production experience that began in the early days of radio.
When Amphenol is free to convert its output to peacetime products, Amphenol's F-M Dipole Antennas in kit form will offer a new top efficiency that is in advance of all present developments in the field.
Features will include all-steel construction for supporting parts and hi-strength aluminum dipole and reflector rods.
Your commitments should be made now to secure early deliveries.
Depend upon
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Quality
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U. H. F. Cables and Connectors · Conduit · Fittings · Connectors (A-N, U. H. F., British) · Cable Assemblies · Radio Parts · Plastics for Industry

A Simple Co-Axial Switch

By **EDWARD BURGESS**

A simple method to overcome the problem of cost in the use of co-axial feeders for amateur antennas.

ONE of the greatest deterrents to the use of co-axial line as an antenna feeder is the realization that large amounts are needed to feed the two or more antennas in use at most stations. If some method were evolved to switch a common feeder at will, more amateurs would practice this method of feed.

Trial of conventional methods of switching (using relays or ordinary switches results in failure) as the characteristics of the co-ax are materially altered when the live lead is brought into the open, as is necessary in this type of switching.

What is needed is some means of preserving the characteristic impedance of the line at the switching point. Reason dictates some form of enclosed switch, for this purpose, that will continue the line in a form that will appear for all practical purposes to be unbroken.

The switch shown in Figs. 1 and 2 was constructed to satisfy this requirment. While the model shown was turned out in a machine shop, the same results may be obtained by one constructed from fabricated parts. For example, the case for the unit may be made from a piece of brass or copper tubing with the bottom either screwed or soldered in place. The rotating section may be sawed from a piece of brass sheet. These are the only parts that were made on a lathe.

Details of the rotating section may be seen in Fig. 1. A brass plate about four inches in diameter and one eighth inch thick is used for the base. Short lengths of concentric line, constructed of copper tubing with an inside diameter of five sixteenths inch, have concentric centers made from No. 12 wire which is supported on the conventional ceramic spacers. The ends of the No. 12 wire are allowed to project slightly from the ends of the tube, and are flattened in order to pass between the switch contacts. The lengths of concentric tubing are fastened in place by means of small straps which in turn are screwed to the base by means of 4-36 screws.

A length of one quarter inch shaft is fastened rigidly to the base by means of a flange or swedging to permit the plate to be rotated from outside. As laid out in the drawing, the switch has three positions, but this may be varied to suit the constructor.

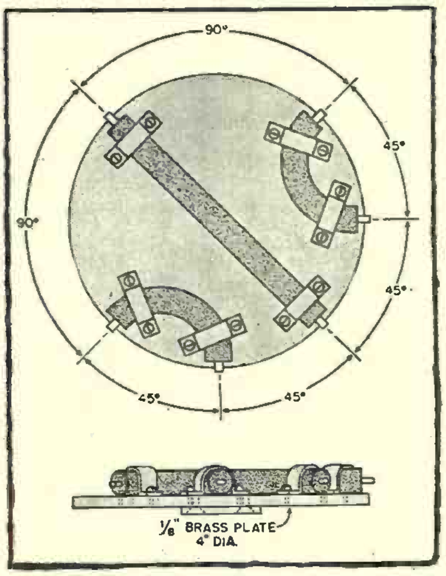
The antenna feeder from the transmitter connects to the center right hand connector, while the antenna leads from the three antennas connect to the other three connectors. As the switch is rotated to the left, the various sections of concentric line within the switch line up between the main connector and the three antenna connectors in turn. Examination of Figs. 1 and 2 will show how this is accomplished.

The case for the unit was turned from a piece of solid brass. However, it could just as well be made from tubing, or possibly a heavy, metal can of the proper size may be obtained. The one described has walls about three sixteenths inch thick and one inch in height. *Amphenol* type SO-239 co-axial sockets are fastened around the periphery of the case in the proper positions to contact the rotating lengths of concentric line within the case. A clearance hole five eighths inch in diameter should be drilled in the case at the exact center of each connector. In addition, the case should be filed down slightly in order that the connectors may fit well on the case.

Each connector is modified before being mounted, by soldering the contact from a conventional band switch to the center connector of the fitting. Care must be exercised in this soldering to assure the contact lining up with the rotating stubs inside the case.

It is essential that there be as little clearance as possible between the rotating stubs and the case, to keep the impedance of the lines low and assure a good match. It is suggested that the

Fig. 1. Detailed view of the rotating disk, within the switch, which carries the three lengths of co-axial tubing.



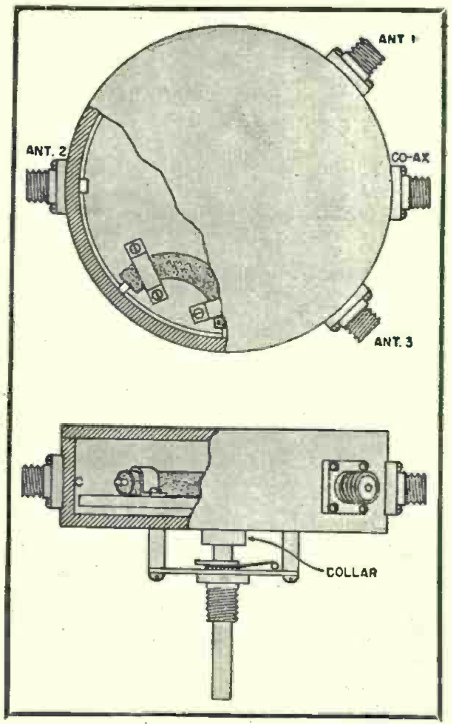


Fig. 2. Cutaway view of the completed switch, showing method of assembly.

stubs be made slightly long and then fitted into the case by filing. The outer conductor of the stubs should come very close to the walls of the case as the unit is rotated.

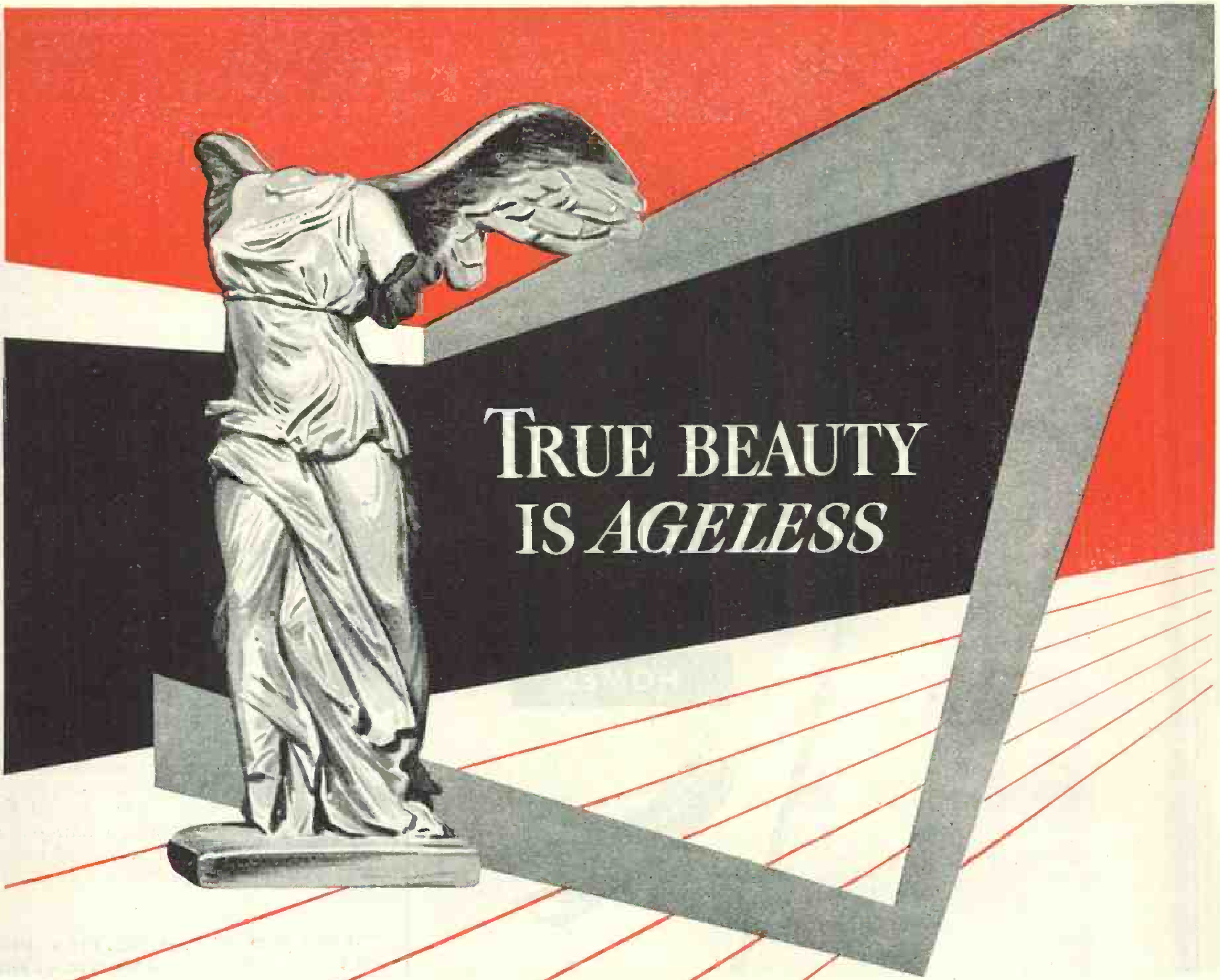
A detent from an old band switch was used to afford proper positioning of the rotating disk. The detent in this case had the detents spaced 90 degrees apart, and additional holes were drilled midway between these to furnish positions spaced 45 degrees. The detent is fastened to the case by means of spacing studs and 6-32 machine screws tapped into the case. By using a detent of this nature, single hole mounting of the entire unit may be obtained.

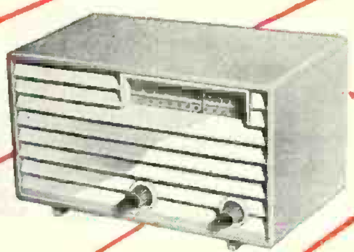
In most cases, two of these units will be needed. One may be mounted near the operating position to enable various transmitters to be switched to the line, while the other is mounted at some remote point, possibly in the attic. In any case the second one should be located at a point that will allow fairly short leads to the antennas.

If the second switch is mounted in an inaccessible position, some means of remotely controlling it will be necessary. Probably the simplest is to obtain a tuning motor of the type used on motor-tuned broadcast receivers. This motor may then be geared to the shaft of the switch and remotely rotated into position. Any of the conventional methods of stopping the motor at a predetermined position may be used.

In the event that a motor driven switch is used, it will be advisable to remove the detent spring from the switch as it will not be needed and will only serve to make the motor load heavier.

—30—





Symbolizing Winged Victory, Nike from Samothrace is a masterpiece of sculpture of 280 B.C., treasured throughout the ages by all peoples for sheer, simple, lasting beauty.

Pride of craftsmanship is represented by idealism in conception and execution of Detrola radio receivers, automatic record changers and other electronic instruments . . . all of unsurpassed beauty and value . . . developed especially for the world's outstanding merchants and their customers.

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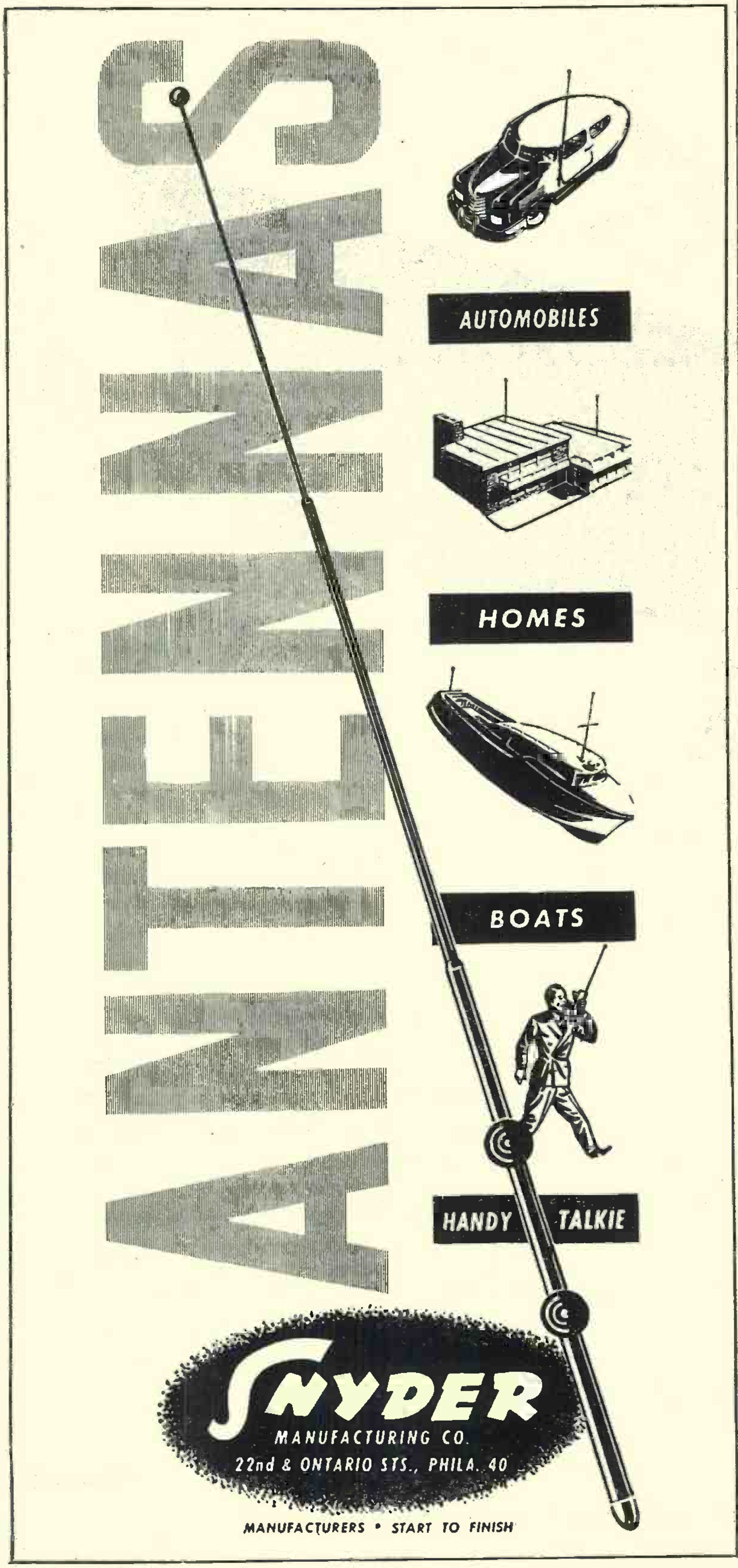
Detrola Radio



TECHNICAL BOOK & BULLETIN REVIEW

"THE ELECTROLYTIC CAPACITOR," by Alexander M. Georgiev. Published by the Technical Division of *Murray Hill Books, Inc.,* New York. 191 pages including index. Price $3.00.

This member of the American Institute of Electrical Engineers presents practical material of a very definite use to engineers in the electrical, radio, and electronic fields, and to technicians who maintain and service this equipment, as well as to experimenters and students in the technical and electrochemical fields. This book is a comprehensive study on the design, construction, manufacture, function, and testing of dry and wet electrolytic capacitors. Operating characteristics, and the advantages and limitations of the electrolytic capacitors are thoroughly discussed, in addition to the detailed description presented on their design and function. Causes of possible defects and methods of prevention are explained, and a chapter is devoted to present developments and probable future applications.

Supplementing the text are helpful illustrations covering construction details, manufacturing processes, etc. A 7-page bibliography and a list of important U. S. and foreign patents, as well as a glossary of technical terms, add to the interest and value of the book.

"APPLIED MATHEMATICS FOR RADIO AND COMMUNICATION ENGINEERS," by Carl E. Smith. Published by *McGraw-Hill Book Company,* New York. 336 pages, including appendix. Price $3.50.

This first commercial edition of "Applied Mathematics" has been preceded by four private editions used in a practical home-study course of the Smith Practical Radio Institute. In this new book, the principles of mathematics used in radio and communication engineering, from arithmetic through calculus, are presented in a clear and simple manner. Each theory is developed by building from the simple basic fundamentals to the more elaborate detailed concepts; thus, the material is so arranged that the fundamentals may be mastered easily by self-study.

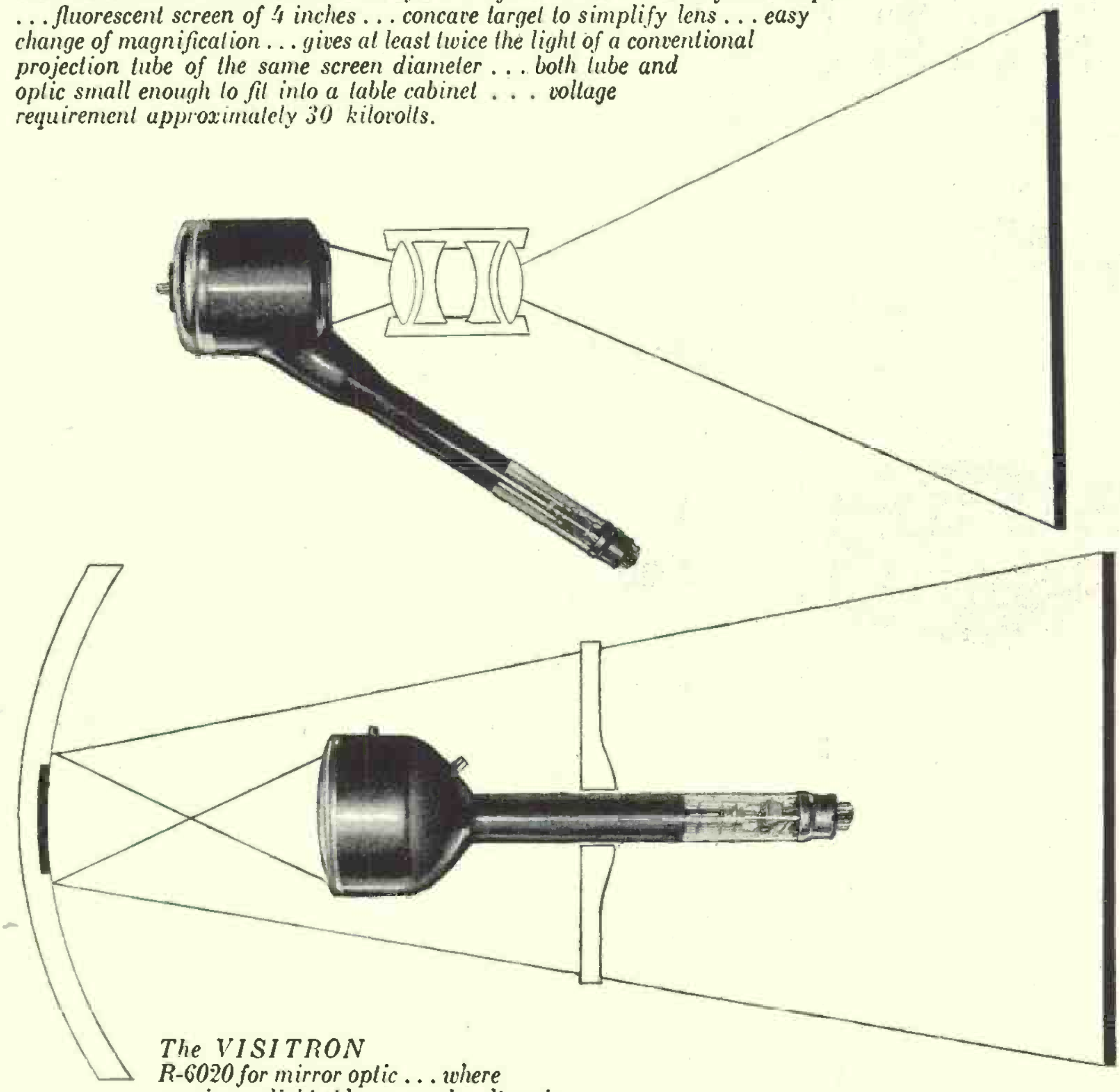
So that the reader may master practical application of the principles learned, the theory is then applied to the development of useful design equations followed by practice examples. A simple treatment of calculus is included and a chapter on Series and Wave Forms provides information to meet the modern trends to frequency modulation, television, and radar development. This book is suitable as a refresher course for persons already familiar with the subject.

-30-

Projection Tubes for Home Television

Pioneering experience in the development of large screen television projection has given *Rauland* physicists and engineers the "know-how" necessary to produce projection tubes for home television receivers.

The VISITRON R-6016 Front Surface Projection Tube with refractive optic . . . fluorescent screen of 4 inches . . . concave target to simplify lens . . . easy change of magnification . . . gives at least twice the light of a conventional projection tube of the same screen diameter . . . both tube and optic small enough to fit into a table cabinet . . . voltage requirement approximately 30 kilovolts.



The VISITRON R-6020 for mirror optic . . . where maximum light at lower anode voltage is desired . . . 5 inch diameter fluorescent screen.

Consult with *Rauland* about your television tube problems. We have the facilities to build projection tubes to special requirements.

RADIO · RADAR · SOUND — **Rauland** — **COMMUNICATIONS · TELEVISION**

Electroneering is our business

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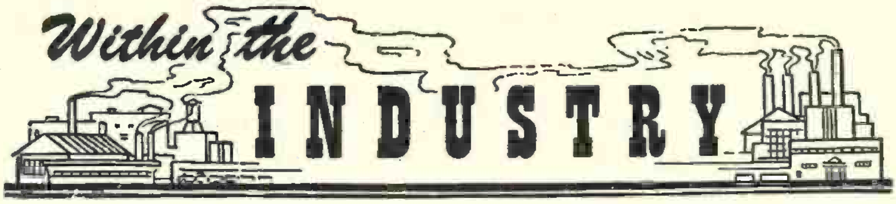


JOHN MECK INDUSTRIES SALES CORPORATION has appointed the following as district managers for the *John Meck Industries:* R. M. Brotherson, Chicago, Illinois; W. A. Hendrickson, Scituate Center, Massachusetts; J. W. Marsh, Los Angeles, California; L. D. Marsh, Seattle, Washington; L. W. Maynard, Clayton, Missouri; L. R. Schenck, Livingston, New Jersey; W. G. Steward, Philadelphia, Pennsylvania; M. F. Taylor, Silver Springs, Maryland; R. H. Van Dusen, Winter Haven, Florida; P. A. Boyd, Pittsburgh, Pennsylvania; J. M. Maynard, Dallas, Texas; and Gail Halliday, Denver, Colorado.

* * *

LAWRENCE M. BRAUN has been appointed vice-president in charge of *Electronic Corporation of America's* newly formed export division to be known as *E.C.A. International Corporation.*

Mr. Braun has been with the E.C.A. organization for thirteen years. At the present time and for the past four years he has been in charge of the procurement of all materials and components used in the manufacture of critical radar and communications equipment for E.C.A.

Mr. Braun was formerly associated with the *American Steel Export Company* and the export division of *Philco Radio and Television Corporation* as a department manager. In 1932 Mr. Braun became export manager for *Lafayette Radio Corporation.*

* * *

WESTINGHOUSE ELECTRIC CORPORATION has acquired the *B. F. Sturtevant Company,* of Boston, Mass., which will hereafter be known as the *B. F. Sturtevant Company,* a Division of *Westinghouse Electric.*

The *Sturtevant Company* is one of the largest in the air-handling business in the United States.

* * *

FRANCIS X. RETTENMEYER has been appointed chief components engineer of the *Federal Telephone and Radio Corporation,* affiliate of *International Telephone and Telegraph Corporation.*

Mr. Rettenmeyer joined *Federal Telephone and Radio Corporation* after ten years as chief receiver engineer and staff engineer for the *RCA Victor Division* of the *Radio Corporation of America,* at Camden. Prior to that time he spent ten years with *Bell Telephone Laboratories.*

An authority on radio receivers and wired radio systems for power and telephone lines, Mr. Rettenmeyer's work will involve the engineering of selenium rectifiers, quartz crystals, transformers and coils, special purpose and transmitting tubes, Intelin cables, and other components.

* * *

TEMPLETONE RADIO MANUFACTURING CORP., of New London, Conn., recently appointed the following distributors: Alfred Distributing Company, Albany, N. Y.; K & F Distributing Company, Cleveland, Ohio; Hi Major Division, Minsky Bros. & Co., Pittsburgh, Pa.; Hartford Stove Company, Hartford, Conn.; The A. G. Rhodes Company, Atlanta, Georgia; Harry Lasky & Co., Philadelphia, Pa.; Goyer Supply Co., Greenville, Mississippi; Associated Distributing Co. of South Carolina, Columbia, S. C.; Eastern Wholesalers, Inc., Washington, D. C.; Bird's & Company, Greeneville, Tennessee; and Penn Appliance Distributors, Inc., Harrisburg, Pa.

* * *

W. BERT KNIGHT has been appointed sales representative for *Operadio Manufacturing Company* of St. Charles, Ill.

According to an announcement by J. McWilliams Stone, president, Mr. Knight will represent *Operadio* loudspeakers in southern California and Arizona. Mr. Knight is president of the *W. Bert Knight Company* of Los Angeles.

* * *

THE PYROFERRIC COMPANY of New York has appointed B. J. Funk as Mid-Western representative in a sales and service capacity for their line of iron cores and powdered metal products.

Mr. Funk will make his headquarters at 565 W. Washington Street, Chicago.

* * *

IRVING B. BABCOCK, president of *The Aviation Corporation,* has been elected president of *The Crosley Corporation,* in which a controlling interest has been acquired by *Avco.* Mr. Babcock is also chairman of the boards of *Consolidated Vultee Aircraft* and *American Central Manufacturing* corporations, two other associated *Avco* companies.

Raymond C. Cosgrove, vice-president and general manager of the Manufacturing Division and James D. Shouse,

LOWER COST OF TUBES: Simple bulb design in soft glass lends itself to low-cost quantity production.

LOW-COST POWER SUPPLY: New electrostatic-focus electron gun avoids cost of a magnetic-focus coil and, at the same time, permits use of a low-cost power supply having moderate regulation.

HIGH CONTRAST AND HIGH LIGHT OUTPUT: New method of applying fluorescent particles to the glass face results in high contrast and high light output.

HIGH RESOLUTION: Improved gun design provides high resolution.

TAILORED TO PROJECTION OPTICS: Spherical face of RCA projection kinescopes matches RCA reflection-type optical system.

Already, RCA has demonstrated to hundreds of engineers and radio experts television of tomorrow as made possible by these new tubes. Screens as large as a newspaper page, with clear, bright images, enable dozens of persons to see the program . . . and this is but one example of RCA electron-tube development, engineering and leadership.

Make sure you have the advantage of this leadership in building your radio and television service business. Carry the tubes with the best-known name . . . RCA.

BUY VICTORY BONDS

RCA

RADIO CORPORATION OF AMERICA

TUBE DIVISION, HARRISON, N. J.

LEADS THE WAY . . . In Radio . . . Television . . . Tubes . . . Phonographs . . . Records . . . Electronics

The Fountainhead of Modern Tube Development Is RCA vice-president in charge of the Broadcasting Division will continue in their respective positions and also remain as directors.

Lewis M. Clement is vice-president in charge of research and engineering of the Manufacturing Division and Frank A. Schotters is vice-president in charge of production of the same division. In the Broadcasting Division, Robert E. Dunville is vice-president and general manager of Station WLW. Other Crosley officers are Lewis M. Crosley, vice-president; Raymond S. Pruit of Chicago, secretary and general counsel; Walter Mogensen of Detroit, treasurer; and Edwin J. Ellig, assistant secretary-treasurer.

* * *

ROBERT CORENTHAL, after three years as pilot in the Army Air Forces, has returned to the *Terminal Radio Corporation* of New York City, to resume his position as advertising and sales manager.

Mr. Corenthal, who served as a 1st Lieutenant, joined the Air Forces in 1942 and was sent overseas in February, 1944, as pilot of a Flying Fortress. He served in Africa and Italy in this capacity and was later shot down over Austria where he was captured and imprisoned in Germany until his liberation on April 29, 1945.

* * *

ALLIED RADIO CORPORATION of Chicago, a distributor for *The Hallicrafters Company*, now has a limited number of Hallicrafters high-frequency radio receivers for civilian use.

The recent lifting of government controls has made these receivers available for civilian use and they have been shipped in limited numbers to the company's distributors in Chicago and elsewhere in the United States. These high-frequency radio receivers that get both standard broadcasts and short-wave reception had been produced throughout the war for the armed forces and high priority orders.

* * *

E. E. CHAPMAN has been appointed Assistant to the President of the *Wilcox-Gay Corporation*, Charlotte, Michigan.

Mr. Chapman recently resigned as plant manager of the *Lonergan Manufacturing Company* of Albion, Michigan. Previously, he was service production manager of the Product Division of the *Bendix Aviation Corporation* at South Bend, Indiana.

* * *

THE ROBINSON HOUCHIN OPTICAL COMPANY of Columbus, Ohio, manufacturers of electronic equipment, has announced that their product formerly

A real communications receiver at a sensationally low price

MODEL EC-1A

ECHOPHONE COMMERCIAL

The 1946 Echophone, Model EC-1A, is a 6-tube AC/DC communications receiver of outstanding value. With electrical bandspread throughout its frequency range of .55 to 30 megacycles, BFO for CW reception, and a new automatic noise limiter to suppress interference from automobile ignition, etc., the EC-1A provides genuine communications receiver performance in the lowest price range. Standard 115-volt AC or DC operation; also available for 220 to 250-volt operation.

SPECIFICATIONS

TUBE LINEUP: 1—12SA7 Mixer; 1—12SK7 I.F. Amplifier; 1—12SQ7 Second Detector, First Audio Amplifier and AVC; 1—35L6GT Second Audio Amplifier; 1—12SQ7 Beat Frequency Oscillator and Automatic Noise Limiter; 1—35Z5GT Rectifier.

CONTROLS: TUNING, BAND SPREAD, VOLUME, BAND SELECTOR, CW/AM, NOISE LIMITER, PHONES/SPEAKER, STAND BY. (BFO pitch adjustment conveniently located on rear of chassis.)

EXTERNAL CONNECTIONS: (On rear of chassis.) Power line cord, phone tip jacks, antenna (doublet or single wire and ground).

PHYSICAL CHARACTERISTICS: The EC-1A is housed in a metal cabinet attractively finished in machine tool gray wrinkle lacquer. The cadmium plated steel chassis is substantially constructed. The PM dynamic speaker is mounted in the top of the cabinet and is protected by special sound projecting louvers instead of the ordinary grill.

DIMENSIONS: 8″ high, 11¾″ wide, 8⅛″ deep; overall. Act. wt., 11 lbs. Ship. wt., 22 lbs. Model EC-1A—Suggested Amateur Net Price . . . $29.50.

FEATURES

1. Frequency coverage, .55 to 30 mc, complete in three bands.
2. Electrical bandspread on all bands with dial indicator.
3. Dial calibrated in megacycles with all important service bands identified.
4. Beat frequency oscillator for CW reception.
5. Automatic noise limiter.
6. Self-contained PM dynamic speaker.
7. Headphones or speaker selected by panel switch, headphones completely isolated by means of phone circuit transformer.
8. AC/DC operation 115 volts or 220 to 250 volts available with external line cord.
9. Good selectivity combined with exceptional sensitivity.
10. Modern 6-tube superheterodyne circuit.

ECHOPHONE

ECHOPHONE DIVISION • THE HALLICRAFTERS CO.
2611 INDIANA AVENUE, CHICAGO 16, U.S.A.

known as Radiotone is now called Rad-O-Recorder.

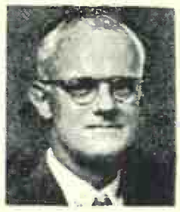
Lloyd Manzer is the production manager of the Sound Division and Dr. Christian A. Volf is director of research.

* * *

RUFUS P. TURNER of New Bedford, Mass., one of our most prominent writers, has completed meritorious work in the Graduate Course of Letters of *McKinley-Roosevelt Incorporated* and has been awarded the degree of Doctor of Letters.

* * *

WILLIAM E. SNODGRASS has joined the *Western Electric Company* as general manager of the company's hearing aid division, according to an announcement by F. R. Lack, vice-president.



Mr. Snodgrass was formerly executive vice-president of the *Dictograph Products Company.* He also held the post of vice-president and general manager of the *Lectro-Lite Corporation.* In 1935, as sales consultant, he joined the *American Telephone and Telegraph Company* and for five years was engaged in marketing and sales promotion work.

Mr. Snodgrass is a member of the New York Sales Manager's Club, the Advertising Club of New York, and the American Management Association.

* * *

HARCO TOWER INCORPORATED is the new name of *Harco Steel Construction Co., Inc.*, of Elizabeth, New Jersey. The company will remain at 1180 East Broad Street and will continue the manufacture of radio masts and towers.

* * *

W. G. H. FINCH, Captain, USNR, has returned to inactive duty and will assume the presidency of *Finch Telecommunications, Inc.* In addition to his work with this company, he also expects to resume construction of FM Station WGHF, New York, within the next few months.

Mr. Finch reported for active duty as a Lieutenant Commander on December 1, 1941, and was assigned as head of the Countermeasures Section in the Bureau of Ships. He was a member of both the Joint and Combined Countermeasures Committees of the Joint and Combined Chiefs of Staff from the beginning of their organization.

* * *

LAWRENCE C. F. HORLE has been appointed chief engineer of the *Radio Manufacturers Association*, Engineering Department. In this capacity, Mr. Horle will be responsible for the management of the Department, including

NEW!

...the MOST COMPLETE REPLACEMENT VIBRATOR GUIDE ever published

Ready for you NOW...

Long hailed as one of the most helpful publications in the radio service field, the Mallory Replacement Vibrator Guide has run through 17 editions since 1934. Now comes the largest, most comprehensive edition of all — easier to read, easier to use, more valuable than ever before!

If you're an old timer in radio service, you'll recognize that a great deal of new material has been added. There's a whole new section on buffer capacitor circuits. Another section shows you how to service old radio sets that need obsolete or discontinued types of vibrators. Still another contains a complete cross-index of all vibrators.

Mallory is the first manufacturer in this post-war period to offer this up-to-date Guide. It's yours, as usual, without cost. Get a free copy of the Mallory Replacement Vibrator Guide at your nearest Mallory distributor.

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APPROVED PRECISION PRODUCTS

VIBRATORS • VIBRAPACKS* • CONDENSERS
VOLUME CONTROLS • SWITCHES • RESISTORS
FILTERS • RECTIFIERS • POWER SUPPLIES

ALSO MALLORY "TROPICAL"* DRY BATTERIES, ORIGINALLY DEVELOPED BY MALLORY FOR THE U. S. ARMY SIGNAL CORPS. NOT PRESENTLY AVAILABLE FOR CIVILIAN USE.

*Reg. U. S. Pat. Off.

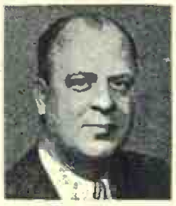
RMA Data Bureau and related activities.

Mr. Horle has been associated with the radio industry for many years and has held such important positions as expert radio aid with the Navy Department's yard at Washington; chief engineer of the De Forest Radio Telephone and Telegraph Company at New York; consultant, Department of Commerce Radio Laboratory, Bureau of Standards, Washington; chief engineer of Federal Telephone and Telegraph Company, New York; and vice-president of Federal Telephone Manufacturing Corporation, Buffalo.

From 1929 to 1940, Mr. Horle was president of the Radio Club of America and in 1940 was president of the Institute of Radio Engineers.

* * *

LESTER L. KELSEY has joined the *Hallicrafters Company* of Chicago as vice-president of the firm and general manager of the Echophone division.



Mr. Kelsey comes to Hallicrafters from *Belmont Radio Corporation* where he held the post of assistant to the president. Lester Kelsey has been associated with the radio industry for more than twenty-four years and for ten years of that time was general manager of the radio division of the *Stewart-Warner Corporation.* From 1942 to 1944 he was a director of the Radio Manufacturers Association.

* * *

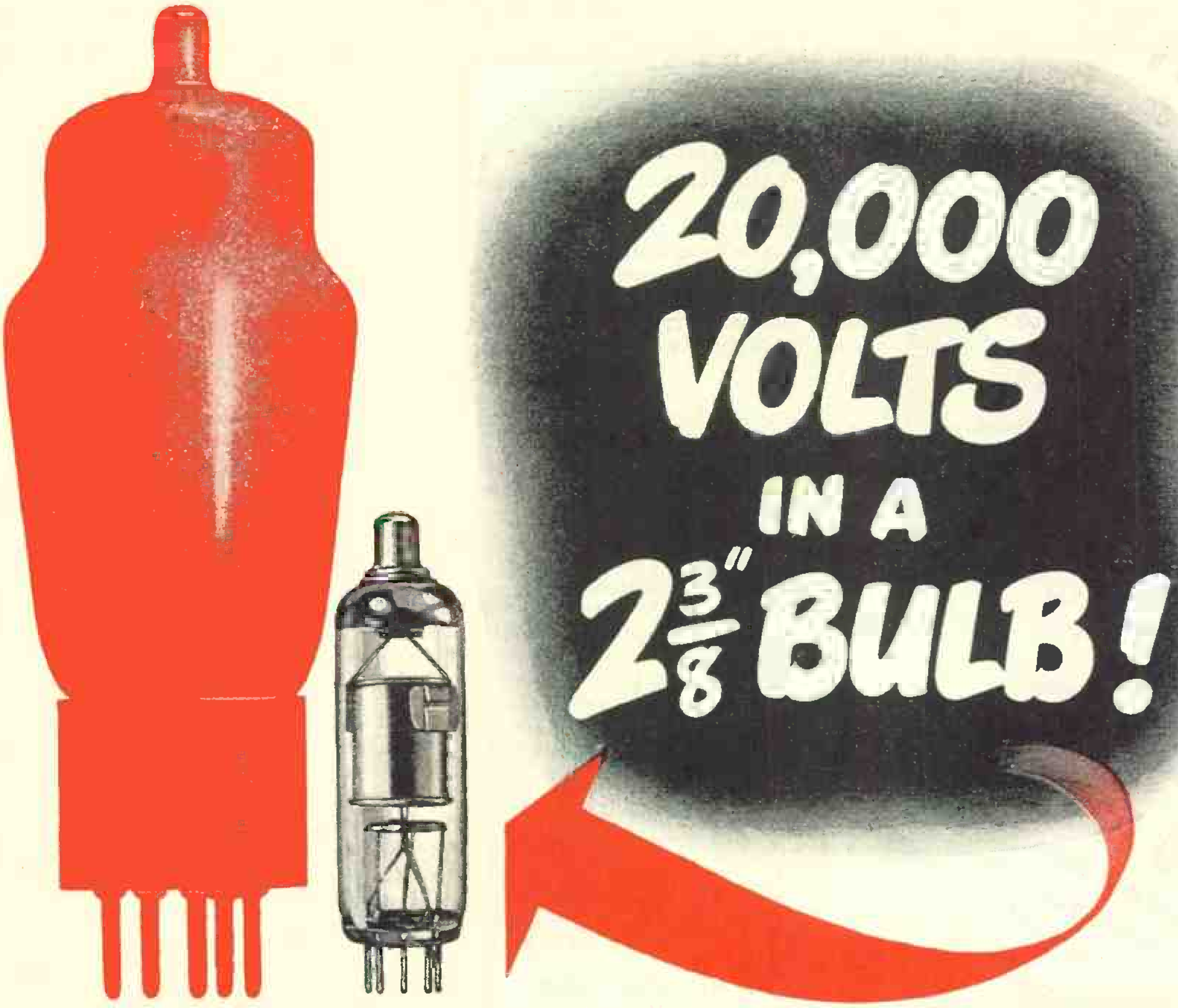
WALTER VAUGHN has been re-elected secretary of the Quad-Cities Control of the Controllers Institute of America. Mr Vaughn is assistant secretary of the *Central Broadcasting Company* of Davenport, Iowa.

John D. Grayson, treasurer of the *Hazeltine Electronics Corporation,* was renamed a director at the annual meeting of the Institute's New York City Control. William W. Hetzel of the *Stromberg-Carlson Telephone Manufacturing Company* was reelected a director of the Rochester Control and Alexander MacGillivray, comptroller of the *Radio Corporation of America,* was renamed a director of the Institute's Philadelphia Control.

* * *

E. I. DU PONT DE NEMOURS AND COMPANY is now exercising options to purchase a site of about 400 acres at Washington, near Parkersburg, W. Va., to provide plant space on which to expand the company's activities in the plastics field.

The company now operates two other plastics plants, one at Arlington, N. J., and another at Leominster, Mass. Among the first units to be built at the new location will be greatly expanded facilities for manufacturing nylon as a plastic in various forms. Facilities will also be provided for manufacturing nylon polymers, bristling filament, sheets, rods, tubes. —30—



ANOTHER "FIRST" BY NATIONAL UNION RESEARCH LABORATORIES

An example of how war-time research by National Union engineers is helping to lay the foundation for vastly improved post-war Television, FM and radio reception, is this new half wave high vacuum rectifier—the NU 1Z2.

Here is a miniature with the voltage handling capabilities heretofore possible only in full size tubes. For a high voltage rectified supply in the operation of radar and television equipment, the NU 1Z2 saves space—operates with increased efficiency—is exceptionally rugged. Its low filament power consumption suggests many new fields in circuit design and application, especially to the "ham" and experimenter.

For the distributor and service dealer, such original N. U. electron tube developments are creating new opportunities for profitable N. U. Tube replacement sales—today and in the future.

National Union 1Z2

High Voltage Rectifier

Inverse peak anode voltage-max.	20,000 volts
Peak anode Current	10 ma.
DC Output Current	2 ma.
Filament Voltage	1.5 volts
Filament Current	300 ma.

The NU 1Z2 is designed to withstand shocks in excess of 500 G's.

Maximum overall length	2.70"
Maximum seated height	2.37"
Maximum diameter	.75"
Bulb	T5½
Base Miniature Button	7 pin
Mounting position	Any

NATIONAL UNION

RADIO AND ELECTRON TUBES

NATIONAL UNION RADIO CORPORATION · NEWARK 2, N. J.

..... LETTERS .....

FROM OUR READERS

PEGLER'S EDITORIAL

"JUST received my first issue (August) of my RADIO NEWS subscription.

"Very pleased that the very first article took issue with a 'misinformed crab artist,' an 'ersatz informant,' a 'Mr. Knowitall' who knows even less about almost everything he writes of than the subjects of television, radio, etc."

M. Snitzer
Boston Harbor, Mass.

* * *

AN ORCHID FROM OVERSEAS

"I HAVE been a reader of RADIO NEWS for some years now and consider it one of the best radio journals published and far ahead of any similar English magazine.

"The layout of American technical books appeals to a great number of English radio fans.

"I find there is a great demand for a good American book on radio servicing, *i.e.*, a book that is not too technical but which really shows a service engineer how and where to look for faults . . ."

A. G. Browne
Heston, Middlesex, England.

Mr. Browne, our own Rufus P. Turner's book is now on the press and will be available shortly. It really rings the bell for the service technician.

* * *

TO MANUFACTURERS

"I BELIEVE that you are the one to make our desire known to the radio manufacturers.

"Many of the boys here, including myself, have expressed their desire for a very small radio with a metal or some other durable type of case, so they could have a little of home wherever they go.

"I don't believe this is too much to ask of the radio industry considering that American boys have fought as men for America."

Malcolm E. Hess, S 2/c
Newport, R. I.

* * *

SUGGESTION

"THE September issue of RADIO NEWS was just received by this reader.

"In the last year of constructive reading, your magazine has become my favorite journal, and it improves with age.

"It covers the field of radio and electronics much more thoroughly than any other radio magazine I know.

"Mr. Taylor's article, 'V.H.F. For Federal Airways' is especially interesting because that is the field I expect to enter upon my release from the Service and upon my graduation from trade school.

"There is one addition that you might make that I'm sure would interest your readers. That is a column in which your readers, especially servicemen, would exchange ideas they have adopted for shortcuts, that might help other servicemen. A suggested title could be 'Trade Hints and Short Cuts.'

"A suggestion I would like to pass on: An excellent non-inductive aligning screwdriver can be made from a hard rubber comb by cutting off the teeth and filing the end down. A little more filing will renew the tip when it wears down or breaks. Such a tool will last indefinitely or until it can be replaced by the commercial product.

"Be sure it is hard rubber, as plastic is too soft and bends too easily for this work."

Pfc. Harold V. Phillips
Douglas, Arizona.

Private Phillips' suggestion is most welcome. How about it, fellows? Shoot in your hints and short cuts and we'll run them in a new and specially prepared column. Here's a chance to make a buck for each accepted hint or short cut.

* * *

ON BEHALF OF THE AMATEUR

"THIS letter is in behalf of all amateur radio licensees in Naval radio work. Through the medium of ham radio the stepping stone to commercial work is formed.

Now in Coast Guard and Navy radio, a new picture comes to view. Namely, that the ham filled the gap until service schools could fill quotas.

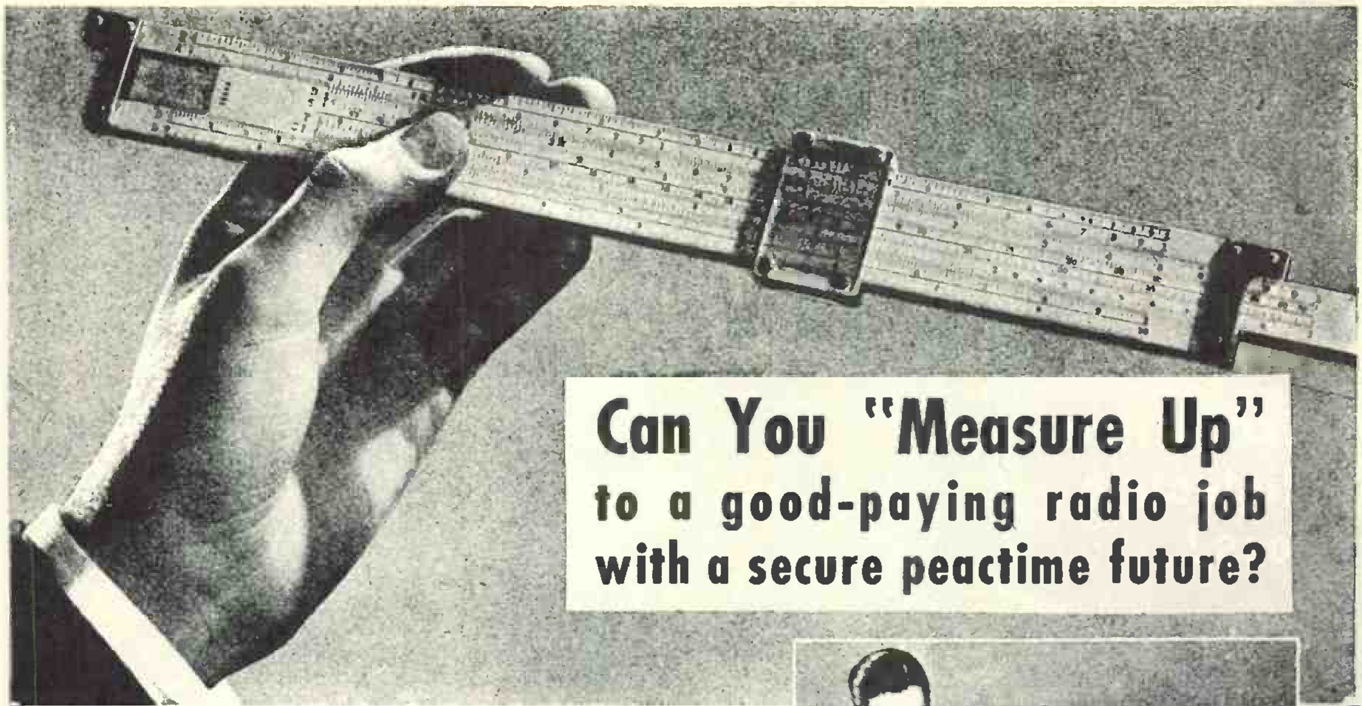
"These hams have conclusively demonstrated their ability to operate anything from a walkie talkie up to 5 kw. procedure; both naval and commercial must be thoroughly known, as well as, materiel, FCC law, distress work and effective maintenance of the various plants encountered. Shipboard and shore station operating make the operator still more versatile.

"If you could operate in the area of Greenland, you'd soon learn that it takes a very good operator to do the job. Especially, when submarines were thicker than hair on a dog's back.

"Why, then, are all of these Government operators treated like beginners in this field by FCC and other organizations? Also, these operators have used equipment which the average commercial operator has never seen due to war security measures.

"Many men, approximately two out of one-hundred, want to go commercial. Also, all naval radiomen have been far too busy fighting the war, so they couldn't be studying FCC, study guides, etc. Many of these guides are badly in need of revision, because an operator seldom uses much more than batteries tuning transmitters, using frequency meters, etc.

"Certainly service radiomen deserve a probationary amount of time so they can shift from Navy operating to civilian operating



Can You "Measure Up" to a good-paying radio job with a secure peacetime future?

"POST-WAR" IS NOW!

Don't be caught unprepared! Add CREI home study training to your present experience and step ahead of competition

What's ahead for you in the field of Radio Electronics? One thing is certain. Now that peace is here, Radio-Electronics will surge forth as one of America's foremost industries, offering promising careers for radiomen with modern technical training.

NOW is the time to take the time to prepare yourself for these important, career jobs in radio-electronics engineering. You will find the knowledge gained from your CREI course useful almost from the beginning. Student C. Whitehead writes: *"Your course has been of great value to me in that the knowledge I have gained has enabled me to meet technical situations satisfactorily and has given me the confidence to accept greater responsibility."*

In our proved home-study course, you learn not only *how* . . . but *why!* Easy-to-read-and-understand lessons are provided you well in advance, and each student has his personal instructor who corrects, criticizes and offers suggestions on each lesson examination. This is the successful CREI method of training for which more than 10,000 professional radiomen have enrolled since 1927.

Your ability to solve tough problems on paper and then follow up with the necessary mechanical operation, is a true indication that you have the *confidence* born of *knowledge* . . . confidence in your ability to get and *hold* an important job with a secure, promising future. Investigate now the CREI home-study course best suited to your needs, and prepare for security and happiness in the New World of Electronics! *Write for all the facts today.*

Servicemen— Discharged Veterans

CREI RESIDENCE TRAINING AVAILABLE UNDER PROVISIONS OF "G.I." BILL

CREI offers Residence School courses in Radio-Electronics Engineering, Broadcast & Television Engineering and Broadcast & Television Servicing under the Serviceman's Readjustment Act of 1944 ("G.I." Bill). Classes now in session. Enter at any time. Write for details.

Those interested in CREI residence school after discharge should write for information about the CREI Priority Plan.

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"Your Opportunity in the New World of Electronics"

TELL US ALL ABOUT YOURSELF, so that we can intelligently plan a course best suited to your needs. If you have had professional or amateur radio experience—let us prove to you that we have something you need to qualify for a better radio job. To help us intelligently answer your inquiry—PLEASE STATE BRIEFLY YOUR BACKGROUND OF EXPERIENCE, EDUCATION AND PRESENT POSITION

CAPITOL RADIO Engineering Institute

HOME STUDY COURSES IN PRACTICAL RADIO-ELECTRONICS ENGINEERING FOR PROFESSIONAL SELF-IMPROVEMENT

Dept. RN-11, 3224 — 16th Street, N. W., Washington 10, D. C.

Contractors to U. S. Navy—U. S. Coast Guard—Canadian Broadcasting Corp.
Producers of Well-trained Technical Radiomen for Industry.

"Not so long ago the Japs capitulated. Behind this was effective communications well done. But, how does Uncle Sam expect an operator to live on 'well done' after he gets out of uniform? It is high time FCC, the Coast Guard, and Navy got together on this.

"I considered a class B ham license, aeronautical license, and four years of diversified radiotelegraph and phone worth something more than just 'well done.'

"The state of the art should remain high, but I'd like to hear from others on this viewpoint."

Franklin A. Munro
Marshfield, Mass.

* * *

MORE SUGGESTIONS

"TAKING up your invitation for practical suggestions, I should like to submit some, which have probably been made many times, but have not been recognized, though the importance is evident. Before giving you details, I should like to thank Mr. Thomas H. Bell of Bell Radio Service, N. Attleboro, Mass., for his really very practical suggestions, to which I not only fully agree, but also support them by inducing many of my Palestinian colleagues and business friends to express their approval to the importance and effectiveness of these proposals, if carried out. I am getting my copy of your monthly journal regularly here, and therefore I think I can also say a word or two when suggestions are invited.

"I think, that in addition to the improvements proposed by Mr. Bell, another feature very important for the serviceman should be included in tomorrow's products of the radio industry. To cut the introduction short, I propose that in every receiver leaving the factory a complete wiring diagram as well as data on the location of trimming condensers should be contained for easy reference. This sheet should include listings of parts, their ratings, tubes, coil diagrams and their actual connection, i.f. rating (as requested by Mr. Bell), and mainly voltages at various points of the receiver should be stated against the various points. These lists should then be glued to the inner side of the cabinet. One cannot emphasize enough, how many minutes are saved by this method, which has before the outbreak of the war been used by a few continental manufacturers. Moreover, it occurs very often, that even, if one loses one's time with searching for reference in various manuals and collections of diagrams, the very diagram is not found, valuable time is lost and no improvement is obtained.

"Moreover, I suggest, that apart from the numbers on the glass or metal cylinders of the tubes a color code be introduced for tube types, since sometimes the numbers imprinted go off by the influence of heat and humidity. This could be improved by an additional marking by a color code, which to provide I am ready on request.

"Furthermore, a word to the sales

managers. They should issue to servicemen and dealers all available data and charts, diagrams and manuals not only by request, but make it their special aim to render these most primitive services to the servicemen automatically."

Josef T. Plaschkes
Tel-Aviv, Palestine.

* * *

"THE letters from your readers concerning radio receiver improvements are rather interesting.

"Apparently, radio servicemen and amateurs fail to grasp two simple facts. One is that such suggestions are in most cases perfectly obvious to design men and the other is that the cost and profit factors are the governing points in the design of equipment —not 'ideas' or performance factors.

"The suggestions some readers have made would lift a $25 radio into the $100 price class. It should be borne in mind that a mere change of a 6-32 to an 8-32 screw size in an existing component in a piece of equipment would cost a large manufacturer some $10,000 in drafting, blueprint, and recording man-hours alone.

"Connections are rivetted, terminal blocks and tube sockets not marked, etc., for the simple reason that if such improvements were to be made and the price class maintained, the manufacturer would go bankrupt inside of a couple of months.

"One writer stated that he would make 'the changes in all but the lowest-priced receivers.' The answer to this suggestion is that if all his suggestions were to be made part of all receivers, there would be no low-priced sets.

T. Powell
Maspeth, L. I., N. Y. —30—

For the Record
(*Continued from page 8*)

the basic equipment needed for the beginner to first get on the air. There are many local ham clubs throughout the country. They can do much to publicize amateur radio in their own communities by sending one of their younger members to talk on ham radio at Scout meetings.

Leading manufacturers of amateur equipment are cognizant of the problem and are doing much to foster a general interest in ham radio. One of them, Bill Halligan of Hallicrafters, has provided complete radio facilities at the Vaughan General Hospital in Chicago so that returning servicemen undergoing treatment may find in radio a hobby which can give them many hours of personal pleasure.

Even if we only instill interest in one per-cent of Scouts, returning GIs, etc., we will have taken a step in the right direction.

SPEAKING of amateurs, George Sterling, RID Chief, calls the following to our attention in a recent letter. The Brazilian government has authorized amateurs in that country to operate in the 160 and 80 meter bands. In spite of this authorization, many Brazilian amateurs have been heard by the RID operating on 40 meters.

United States amateur stations have been heard on 40 meters in this country. The following were heard on September 10 by the RID: W5EAV, W2NIH, and W5GGK from the Orient.

SEVERAL of our ham readers have voiced their objections to our loss of the 160 meter band. Others believe that it is a good thing. Consensus of opinion seems to be that we have gained more than we have lost for the following reason. The 160 meter band has often been referred to as the "Saturday night jamboree" where in the case of phone stations, the microphone gain has been turned wide open and the ether was filled with quite a hodgepodge of voices, laughter, music, etc. These over-modulated transmitters caused undue interference to broadcast listeners as well as to essential police communications. Surely this did not do the amateur fraternity any good in the eyes of the public.

Actually, the main reason we lost the 160 meter band is because the Navy has found it ideally suited to very essential communications already developed. In addition, demands of the police radio systems are such that more space must be allocated to them.

The argument that the loss of the 160 meter band takes away a dx band doesn't hold much water. Except on rare occasions, such communications can be carried out on the ultra-high frequencies and with less qrm. Time will tell. ........................O.R.

112 Mc. Converter

(*Continued from page* 47)

the coil as this circuit tunes rather broadly. Some source of signal, either from stations on the air, or a low powered transmitter, should be used for this operation.

The final step is the adjustment of the coupling condenser C_3. This adjustment is not critical as long as there is sufficient oscillator voltage appearing at the grid of the mixer. Results can be compared by bending the two wires either closer together or farther apart. However, to prevent "pulling" between the oscillator and mixer, the coupling should be as loose as possible.

When adjustments have been completed, the converter is ready for operation, and may be tried by connecting it to the receiver and connecting an antenna to the antenna leads of the converter.

Tuning will be rather sharp and if the receiver used has a "broad" selectivity position it should be used. Tuning should be smooth throughout the range of the converter. For fine tuning, the converter may be set at approximately the center of the band and the regular bandspread dial of the receiver used for tuning. It will be almost impossible to understand the average modulated oscillator on this converter due to its selectivity. This is no hardship as this form of transmitter will soon be obsolete due to the crowded conditions.

The new amateur band from 144 to 148 m.c. may be covered by this converter by spreading the oscillator coil to about ¾" in length and reducing the mixer coil to 4 turns.

A good antenna is the greatest asset on the high-frequency bands and every effort possible should be made to erect one as high as possible. If a good antenna is used on both the transmitter and receiver, the range will be much greater and signals correspondingly stronger.

A worthwhile improvement that could be added to this converter would be the use of a VR 105 voltage regulator to keep the oscillator voltage constant.

-30-

Vacuum Tube Analyzer

(*Continued from page* 40)

liammeter. To provide protection for this meter from accidental short circuits, a microswitch was provided as a short circuiting device. It is necessary to press the pushbutton of the microswitch to read this meter. The microswitch located under the volt meter is used as a gas test.

The voltmeter multipliers and meter shunt resistors are wired into their respective circuits, while the meter is switched across the proper shunt resistors. The milliammeter shunt resistors are also wired into their respective circuits and the meter is switched across the desired shunts. For measuring plate current, two ranges are available. By means of a toggle switch, either a one hundred milliampere or a ten milliampere range is selected.

Any standard metal cabinet could be used. However, a special sloping panel cabinet was fabricated from a .030 inch galvanized iron and the front panel was fabricated from a .050 inch galvanized iron. The exterior finish is black crackle. The accompanying photographs and drawings indicate the chassis layout used. The heater transformer is located under the chassis.

The operation of the instrument is simple. After becoming familiar with the controls, the operator can test vacuum tubes at any desired voltages within the limits of the instrument. As an example, let us assume we wish to check a type 6V6GT/G tube. Place the tube in the octal socket. Banana plug and jack connections should be made as follows: plug 1 to ground, 2 to heater, 3 to plate, 4 to screen, 5 to grid, 6 no connection, 7 to heater, and 8 to cathode.

Set the heater voltage selector switch to 6.3 volts and the grid bias control to the extreme right to avoid

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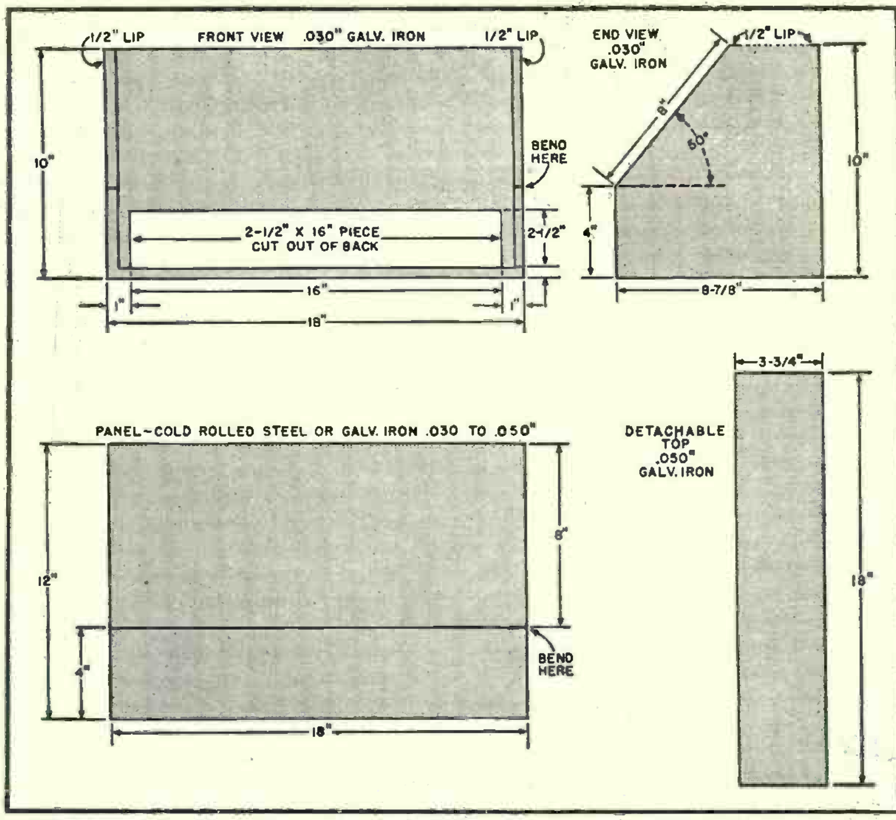


Mechanical drawing of the metal cabinet showing sizes and method of construction.

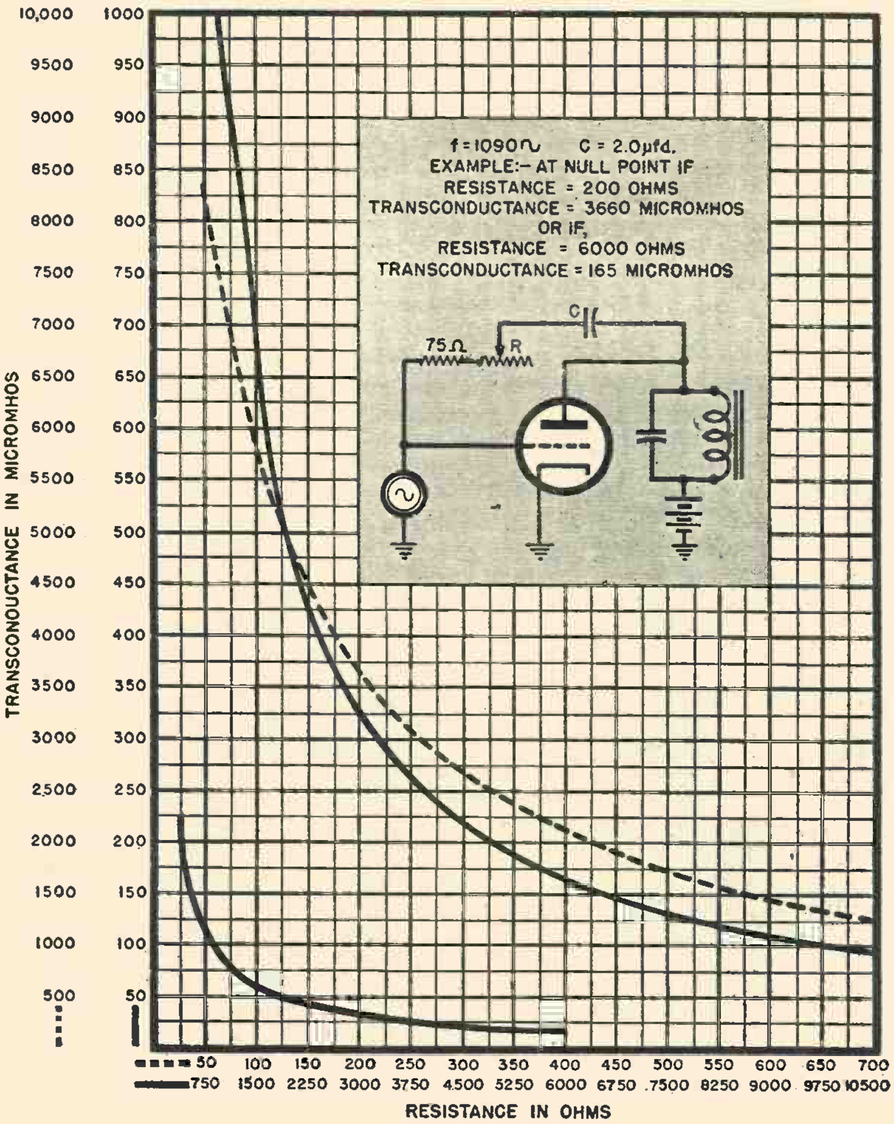
damaging the tube by excessive plate or screen current flow. Turn the power switch to position No. 1 and note the tube's heater. If it does not light, check the banana plug and jack connections. If it lights, turn the power switch to position No. 2 and allow a minute for the instrument to warm up. If desired, the heater voltage can be checked at the binding posts with an external a.c. voltmeter. If the voltage is less than 6.3 volts, set power switch on position No. 3 or No. 4 until desired voltage is read. This procedure is not necessary unless a study of the tube under various heater voltages is desired.

Set the voltmeter selector switch to measure plate voltage. Adjust the plate voltage control potentiometer until the voltmeter reads two hundred fifty volts. If the meter is a zero to one hundred microammeter and the original scale is used, two hundred fifty volts will be applied when the meter reads fifty on the scale. Now set the voltmeter selector switch to measure screen voltage, and adjust the screen voltage control potentiometer until two hundred fifty volts is applied.

With the voltmeter selector switch set to measure control grid voltage, turn the grid bias control potentiometer to the left until approximately

Parts list of vacuum tube analyzer corresponding to diagram shown on page 39.

R_1, R_2—330,000 ohm, ½ w. res.
R_3—120,000 ohm, ½ w. res.
R_4—1 megohm, ½ w. res.
R_5—910 ohm, 1 w. res.
R_6—68,000 ohm, 1 w. res.
R_7, R_{40}, R_{41}—150,000 ohm, 1 w. res.
R_8, R_{47}, R_{54}—250,000 ohm pot.
R_9, R_{16}, R_{18}—100,000 ohm, ½ w. res.
R_{10}—1800 ohm, 1 w. res.
R_{11}, R_{12}, R_{13}, R_{17}, R_{22}, R_{25}, R_{26}—1000 ohm, 1 w. res.
R_{14}, R_{15}—1.8 megohm, ½ w. res.
R_{19}—470 ± 5% ohm, 1 w. res.
R_{20}—10,000 ohm w. w. pot., General Radio No, 314
R_{21}, R_{24}, R_{27}, R_{28}—180,000 ohm, ½ w. res.
R_{23}—6 megohm, ½ w. res.
R_{29}, R_{30}, R_{31}, R_{35}—9.6 ohm, 1 w. res.
R_{32}, R_{33}—1200 ohm, 1 w. res.
R_{34}—5000 ohm pot.
R_{36}—910 ohm, 1 w. res.
R_{37}—220 ohm, 1 w. res.
R_{38}—80,000 ohm, 2 w. res.
R_{39}—15,000 ohm pot.
R_{42}—82,000 ohm, 2 w. res.
R_{43}—30,000 ohm pot.
R_{44}—30,000 ohm, 1 w. res.
R_{45}—5000 ohm, 10 w. res.
R_{46}, R_{55}—5600 ohm, 1 w. res.
R_{48}, R_{58}—200,000 ohm, ½ w. res.
R_{49}—6000 ohm, 10 w. res.
R_{50}, R_{56}, R_{57}—47 ohm, 1 w. res.
R_{52}—20,000 ohm, 1 w. res.
R_{53}—10,000 ohm pot.
C_1—.001 μfd., 400 v. cond.
C_2, C_3—.0005 μfd., 400 v. cond.
C_4, C_5—.01 μfd., 400 v. cond.
C_6, C_{21}, C_{22}—20 μfd., 25 v. cond.
C_7, C_9, C_{10}, C_{12}, C_{13}, C_{16}, C_{23}, C_{24}, C_{26}, C_{27}—.1 μfd., 400 v. cond.
C_8—.2 μfd., 400 v. cond.
C_{11}—2 μfd., 400 v. cond.
C_{14}—See L_3
C_{15}—.0001 μfd., 400 v. cond.
C_{17}—.25 μfd., 400 v. cond.
C_{18}, C_{19}—20 μfd., 450 v. elec.
C_{20}, C_{25}—8 μfd., 450 v. elec.
L_1, L_2—10 henry, 100 ma. fil. choke
L_3—Choose value of L_3 and C_{14} to produce anti-resonance at frequency of RC oscillator
T_1—Power trans., Stancor P-6013
T_2—Fil. trans., Stancor P-6134
T_3—Fil. trans., Stancor P-1834-3
S_1—Normally closed push button sw.
S_2—D.p. 11 pos. sw., Centralab No. 1413
S_3, S_5—D.p. 5 pos. sw., Centralab No. 1405
S_4—S.p.s.t. sw., I.C.A. No. 1296
S_6—S.p. 11 pos. sw., Centralab No. 1403
S_7—S.p.d.t. push button sw.
J_1—Jack
J_2, J_3 J_4, J_5, J_6, J_7, J_8, J_9, J_{10}, J_{11}, J_{12}—Binding posts
M_1—0-100 d.c. microammeter
M_2—0-1 d.c. milliammeter
I_1, I_2—6.3 v. pilot light
P_1, P_2, P_3, P_4, P_5, P_6, P_7, P_8—Banana plugs
Tubes—1-6SN7GT, 1-6SJ7GT, 1-6V6G, 1-6X5GT, 1-5V4G, 2-6L6, 1-0D3/VR150



Transconductance vs. resistance graph. The short heavy line curve in the lower left hand corner may be used as an innerconnecting link between the other two curves. To utilize. refer to resistance in ohms (figures indicated by solid line) and then read the transconductance (numerals indicated by broken line).

thirteen volts is read on the meter, which, in the case of the zero to one hundred d.c. microammeter, is twenty-six. The cathode control should be in the extreme left position to eliminate any self bias. Grid bias can be supplied by the fixed or self bias methods or by both, as desired.

Recheck the plate and screen voltages and make any slight readjustments as required. Set the milliammeter selector switch to read plate current and set the milliammeter range switch to the one hundred milliampere position. Press the milliammeter microswitch pushbutton and read the plate current, multiplying the scale of the zero to one d.c. milliammeter by one hundred. With the switch set to read screen current multiply the meter reading by ten to obtain actual current in milliamperes. It might be noted here that the milliammeter has a range of zero to ten milliamperes on screen, diode, and suppressor current positions, regardless of the setting of the milliammeter range toggle switch. The toggle switch changes the range of the meter only in the plate current position.

After having noted the plate and screen current readings, the voltages to screen, plate, or grid may be varied and corresponding plate and screen currents noted, if desired.

To check the transconductance of the tube under test, plug in a headset into the jack provided for that purpose. With the element voltages set at their desired positions, advance the oscillator signal level control until the signal is heard in the headset. Adjust the transconductance measuring potentiometer until no signal or minimum signal is heard. Note the potentiometer scale reading and transcribe into microhms as explained earlier in this article.

The voltmeter may be set in the output meter position and used as the "null" indicator in the above test if desired. More accurate results are obtained with the headset. Care must be taken not to over drive the tube under test by setting the oscillator signal level no higher then necessary to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• Lever Action Switches
Old Man Centralab urges you today, as he has for the past two decades, to "always specify CENTRALAB" Replacements.
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afford a comfortable listening level. This level can be read on an arbitary scale by setting the voltmeter switch to read signal input.

The gas test is a simple circuit consisting of a resistor in series with the grid, normally short circuited by a microswitch pushbutton. With no signal applied, a gassy tube is often indicated by a change in plate current when the gas test button is pressed. This is not true with all types of vacuum tubes.

To check a dual purpose tube such as a 6B8, the diode is checked in addition to the other elements. To check the diode, set the milliammeter selector switch to measure diode current and the voltmeter selector switch to read diode voltage. With the milliammeter pushbutton pressed, vary the diode voltage and note the current readings. This current will be quite small with most tube types.

Tubes having a suppressor grid terminal may be studied for the effect of changing the suppressor voltage. A static check of the action of the tube with suppressor modulation can be made. There are many other interesting vacuum tube studies that are within the scope of this instrument. An oscilloscope may be connected to the head set jack and used as a "null" indicator, as well as visually observing distortion and noise.

-30-

Practical Radar
(*Continued from page* 44)

5A), the time of the condenser charge may be varied—resulting in control of the *steepness* of the sawtooth wave. Ordinarily both values of *R* and *C* are fixed in radar sets, although a switching arrangement may be used to select any one of several values of resistance when a radar set is designed to operate with several maximum ranges.

A similar circuit for generating a sawtooth *current* wave is shown in Fig. 5B—with its output waveform. The operation of the condenser *C* is much the same as before. But in this instance the output waveform is more complex than the simple (voltage) sawtooth form. The output wave actually combines a pure sawtooth wave (taken from across condenser *C*) with a pulsed wave (taken from across resistor *Rc*), resulting in the complex sawtooth-type output wave shown in Fig. 5B. This is necessary because deflecting coils have both inductance and resistance. which must be taken into consideration in the generation of a time base waveform.

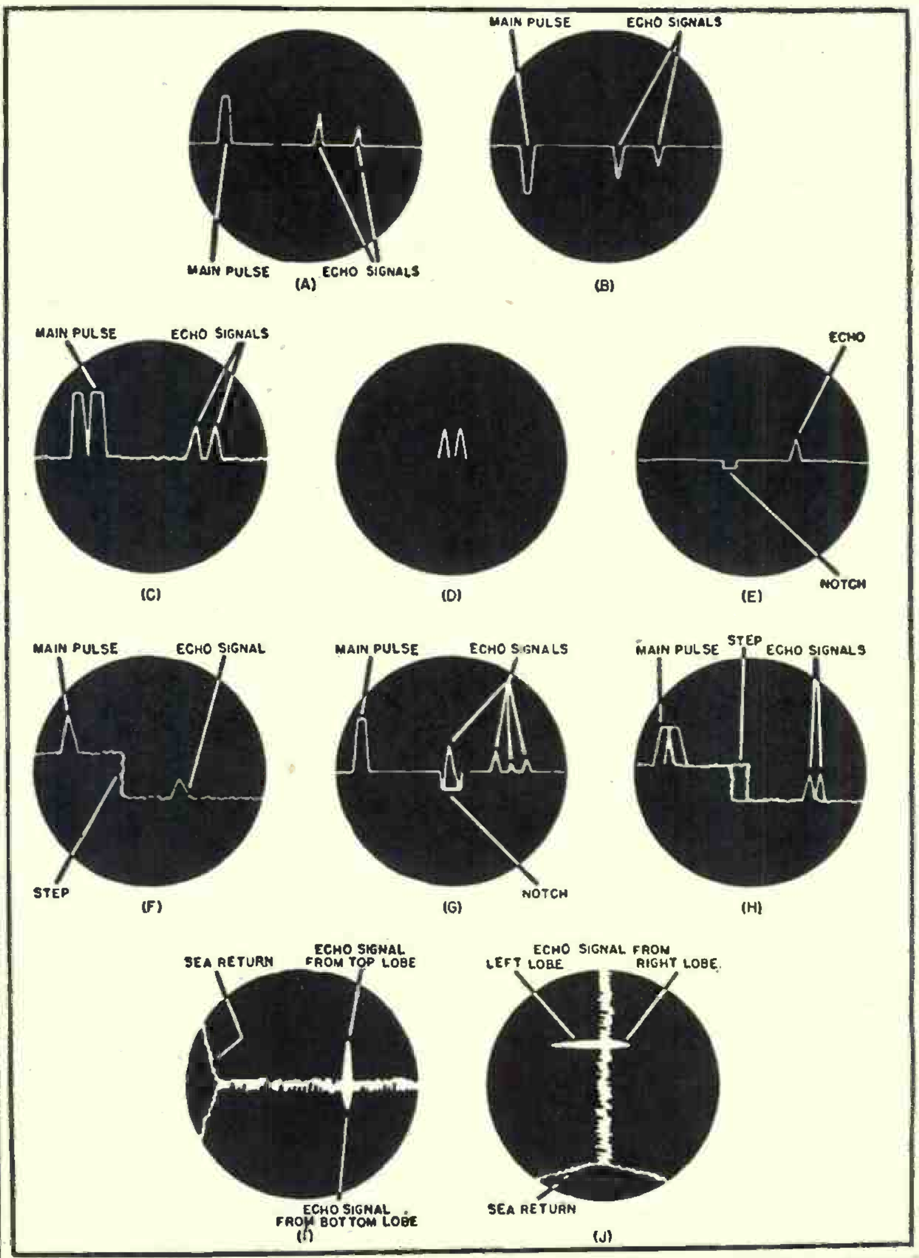
Since the pulse recurrence frequency of radar sets is rarely higher than several thousand cycles-per-second, *thyratrons* are generally used as the control tubes in time base generators.

A thyratron is a gas-filled tube in which emission current from the cathode produces ionization of the gas vapor. This permits an excessive current flow, limited only by the resistance of the external circuit, because the internal resistance of the thyratron is negligible during ionization. Use of the grid permits control of the tube's ionization. Thus the control pulse from the electronic timer is connected directly to this electrode of the thyratron. After the gas becomes ionized, the grid has little effect on the flow of plate current. Ionization ceases when the condenser has discharged sufficiently.

The limit of frequency operation in a thyratron is determined only by the de-ionization time of the gas inside.

By combining the linear sawtooth time base with the incoming echo signals, the electron beam of the c.r.t. is made to follow a definite pattern by controlled differences of potential (in the electrostatic tube) or controlled differences in current (in the magnetic tube). This—the "A" type display—is the simplest type of radar data pre-

Fig. 6. A few of the many types of 'scope displays used by radar indicators. (A) Range is measured horizontally. Main pulse and echo signals are upward vertical deflections of horizontal time trace. (B) Same as (A), except that in some equipment signal deflections are downward from baseline. (C) Range measured horizontally. Difference in pip heights, by double-lobe system, indicates error in azimuth or elevation. (D) Same as (C), except that the main pulse and timebase have been blanked out. (E) Notch is moved along timebase until it coincides with echo pip indicating range. (F) Range measured by moving "step" gate along baseline until it coincides with echo pip. (G) Variable width notch fixed at midpoint of sweep. Range determined by moving echo pip into notch. (H) Range measured horizontally by moving step. Azimuth or elevation error indicated by unequal heights of echo pips due to double lobe. (I) Range measured horizontally. Double lobe system indicates elevation error by unequal lengths of echo pips. (J) Range measured vertically. Double lobe system indicates azimuth error by unequal lengths of echo pips.



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sentation, although there are many minor variations widely used in radar indicators.

Other Time Bases

By a suitable arrangement of voltages on the plates of the electrostatic tube, or of current through the coils of the magnetic tube, other types of oscilloscope measuring patterns may be devised.

The range scale of the "A" type 'scope just described is physically limited by the diameter of the oscilloscope screen. By using a polar-coordinate scale, the effective scale length of the time base can be increased more than three times (Fig.12).

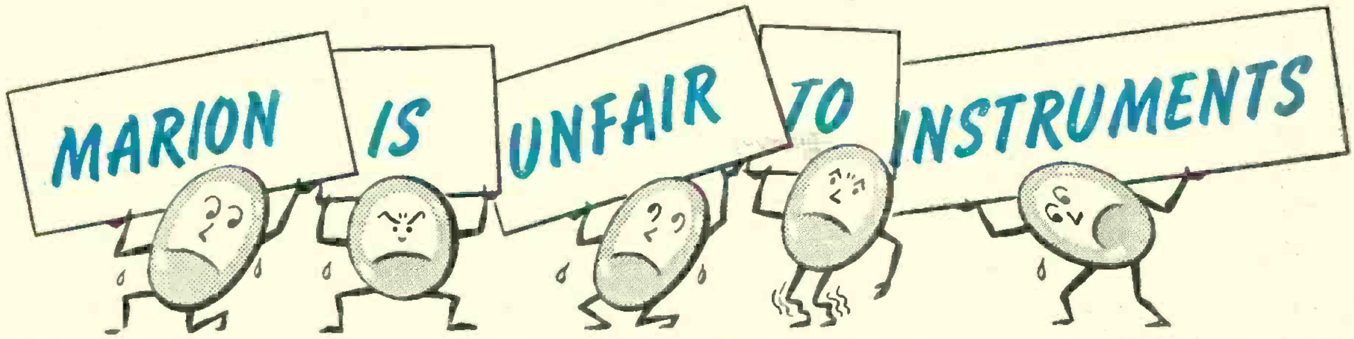
This is done by using a circular time base—or circular sweep—created by combining two sine waves of equal amplitude and frequency but displaced from each other by 90 degrees. If the circuit constants are accurate, the resultant trace on the 'scope screen will be a perfect circle. The time base can then be triggered—or controlled—so that it commences at any point (Fig. 12) continuing around the circle for 360 degrees. Targets can be indicated much in the usual fashion—as echoes displacing the circular time base. The straight-line range scale of the "A" type is replaced by a radial range scale.

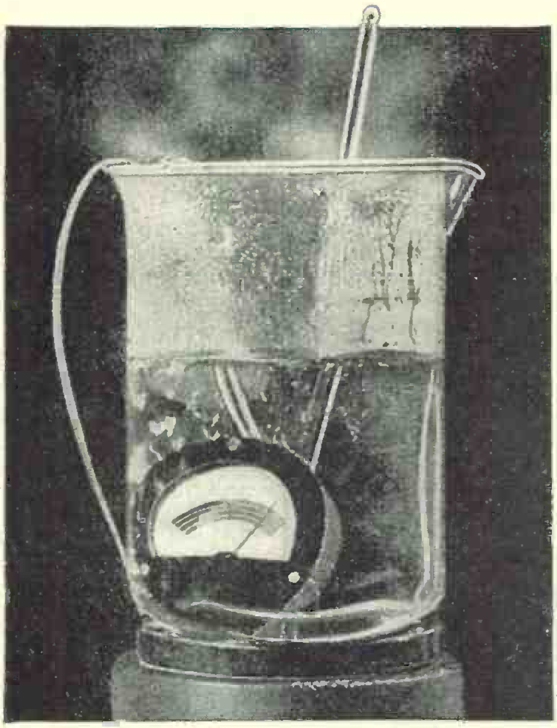
If a linear sawtooth voltage is used to control the amplitude of the circular time base just described, a spiral time base can be generated on the 'scope screen. The period frequency of the sawtooth voltage should be a multiple of the circular trace frequency, in order to produce a stationary image. The spiral time base affords an extreme in measurement accuracy. But since it is difficult to read and interpret by radar operators, such a time base is rarely used in practical radar applications.

If the two equal sine waves used to produce the circular sweep are slightly out of phase with each other, the electron beam will describe an ellipse. The dimensions and *slant* of the ellipse will depend upon the actual phase angle between the two deflecting potentials and upon their relative values. Expanded and contracted elliptical time bases are shown by the dotted lines in Fig. 7. The signal to be examined can be superimposed on either pair of plates of the tube; the solid lines of Fig. 7 show the appearance of a pure sine wave when applied to expanded and contracted elliptical time bases. This type of indicator display is worth remembering, since radar of the future may employ variations and refinements of the elliptical trace to provide three-dimensional radar presentation.

Other of the more unusual forms of time bases—such as re-entrant circular loops, the zig-zag trace, and single sweep time bases—are of no practical use in radar circuits.

However, there is another general type of oscilloscope display which differs radically from systems and ar-





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Raster Type Scanning

More highly developed types of radar indicators use intensity—or grid-modulated electromagnetic tubes with a system of *raster scanning* somewhat similar to that used in television.

Controlling electrodes — generally magnetic coils—are utilized to produce the raster scanning pattern. And echo signals modulate the electron beam by application to the grid of the electron gun.

This permits the measurement of *two* space coordinates on the same 'scope screen. For example, the 'scope shown in Fig. 8 could portray *range* (to the target) horizontally and *azimuth* (of the target with respect to the radar set) vertically. If the antenna system was synchronized perfectly with such a raster type scanning arrangement, target positions (with respect to the radar set) could be shown in terms of range and azimuth coordinates (Fig. 8).

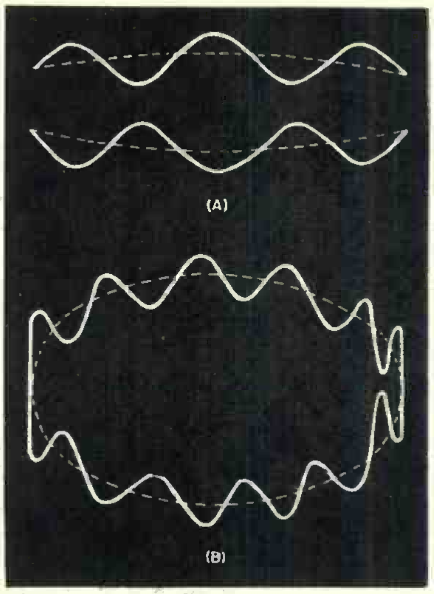
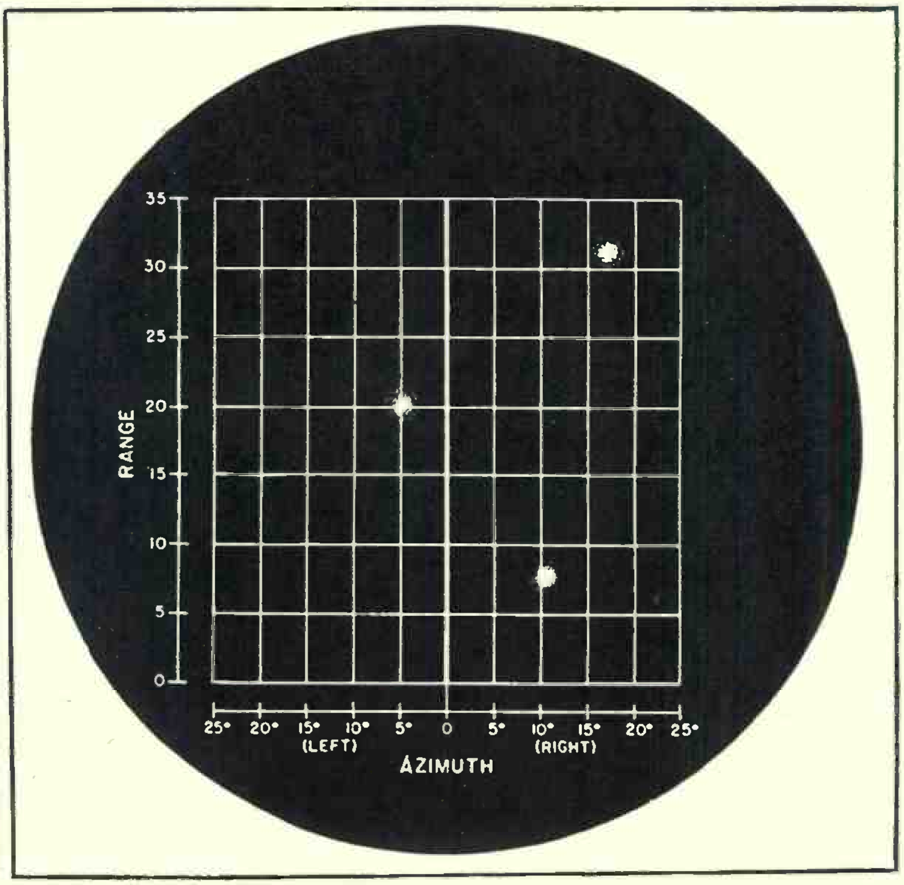


Fig. 7. Expanded and contracted elliptical time bases, measuring the same recurrent sine waves.

The position of the electron beam is controlled by the magnetic fields produced by currents flowing through deflecting coils mounted around the neck of the tube. The pattern is retraced — as in television — several thousand times-per-second — at the pulse recurrence frequency of the radar equipment.

Received target echoes modulate the grid of the cathode-ray tube, producing brilliant spots of lights on the c.r.t.

Fig. 8. Raster type scanning is much like television. Light spots indicate targets.

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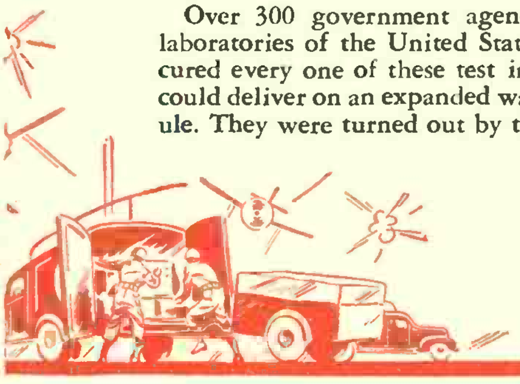

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10	10	10 V.	100		0-100,000	(1200 ohms center)
50	50	50 V.	500		0-10 Megohms	(120,000 ohms center)
250	250	250 V.				
1000	1000	1000 V.				
5000	5000	5000 V.				

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screen—indicating the exact positions of the target or targets in space.

This type of radar indicator is known as a type "B" 'scope.

If the radar set is designed to locate targets in terms of elevation and azimuth, a similar raster type scanning system could be used. Such indicators are known as type "C" 'scopes.

This process of display requires the consideration of a number of important factors.

Since the raster type of scanning—like television—is somewhat devious and complex, echo signals are received only during the comparatively brief periods when the rapid-swinging beam strikes the target. Thus the duty cycle for any target is extremely small, and the illumination of the target spot on the 'scope screen is many thousands of times less than the illumination on a type "A" scope.

This requires an intense burst of electrons every time the antenna beam strikes a target. The intensity-modulated tube should also have a high degree of phosphorescence, or afterglow, to enable the radar operator to observe and plot the target echo during the relatively long time intervals between the reception of target echoes.

An additional *gating* voltage is sometimes used with these types of indicators to black-out extraneous signals—particularly noise, or *grass*. The 'scope screen is normally blank unless target echoes are being received by the radar system.

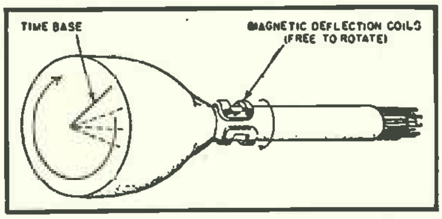


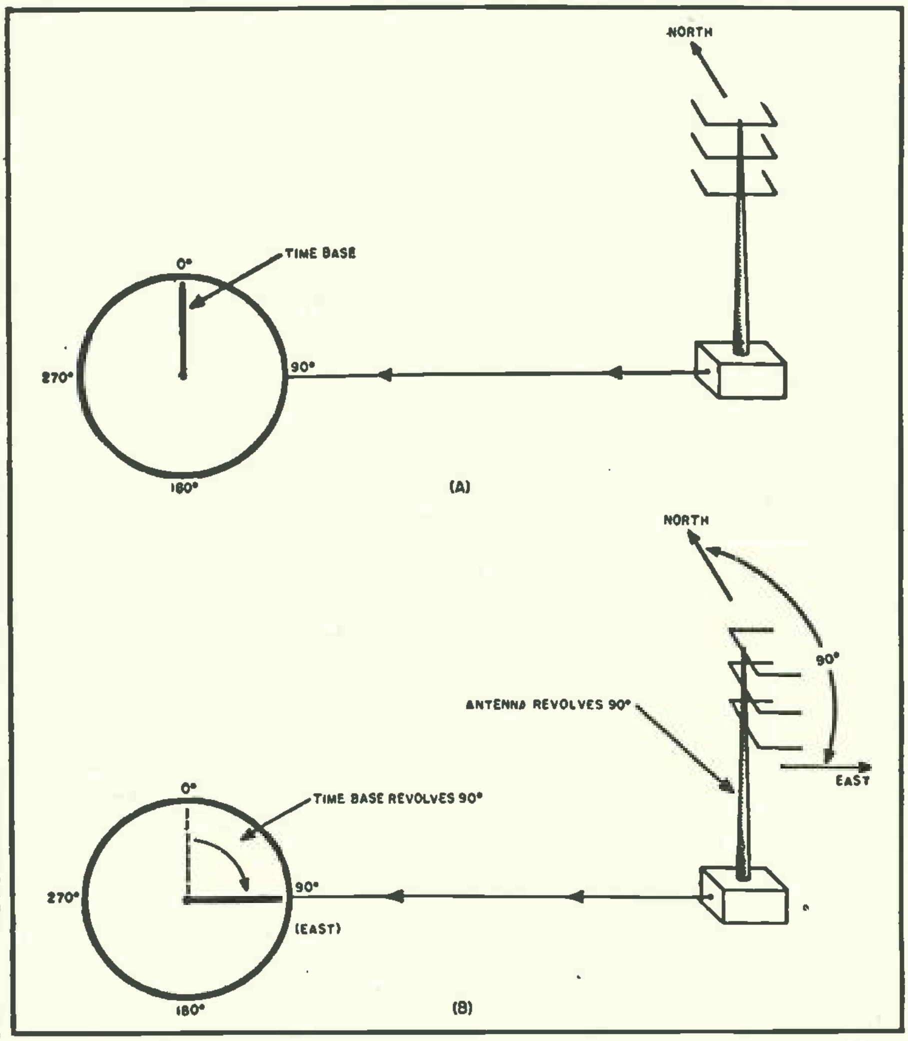
Fig. 9. Physical appearance of a PPI tube. The time base starts at center of tube and revolves around the 'scope screen.

A Further Development

The effectiveness of intensity-modulated tubes in presenting more than one space coordinate, led to the development of an electromagnetic tube with a special map display—known as the PPI (Plan Position Indicator)—which presents an effective plan view of all space surrounding the radar set.

The display is circular in shape. A large blob of light in the center represents the radar set. Echoes from air and sea targets appear as dots or

Fig. 10. (A) With antenna pointing north, PPI time base is vertical. (B) After antenna has rotated 90° clockwise, time base on PPI has rotated the same amount.



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FOR SALE—Wind power plant, 3½ KW generator, 80' tower, 60—615 AH lead cells; 3 used dc-ac converters; 4—⅛ h.p. motors; 85 assorted Edison cells and a 24/1500 dynamotor. Grote Reber, 212 S. Seminary Ave., Wheaton, Ill.

WANTED—12A8GT and 12Q7 tubes. William H. Owen, 618 Spring St., Seattle 4, Wash.

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WANTED—Tube tester a-c operated for all type tubes. Give full details. Frank Teicher, 717 E. 175th St., New York 57, N. Y.

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WANTED—R.C.P. #414V-9 or #414V-7 multitester. Cash. D. C. Hill, 104 S. 3rd St., Yakima, Wash.

FOR SALE—Weston type 674 3-tube tester, $15; tube tester transformer 1.5v to 110v, $2. G. W. Winter, 13416 Sherry Ave., Cleveland 11, Ohio.

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WANTED—#76 or #37 tubes. Panzen Service, 922 Hoe Ave., New York 59, N. Y.

FOR SALE—Philco V-O-M; Hickok portable tube checker with adapters and Weston counter model tube checker, $65 for lot. Chas. J. McMahon, 208 W. 93rd St., Los Angeles 3, Calif.

WANTED—Riders 6 to 13 and modern tube checker. Roy W. Court, 15005 Aspinwall Ave., Cleveland 10, Ohio.

FOR SALE—9002, 9003, 9004, 832, 793 and 955 tubes 15% off ceiling, also Philco a-c audio oscillator. W. G. Eslick, 431 Stephen St., Wichita, Kans.

WANTED — Chevrolet auto radio, 1941. Louis DeMarco, Jr., 2 Cloy St., New Haven 13, Conn.

WILL TRADE—G-E and Tung-Sol 117L/M7 and 50L6 tubes for new 32L7 tubes, even exchange. George S. Koester, 1427 South Hope St., Los Angeles 6, Calif.

FOR SALE—Rider's 1 & 2; also Gernsback's radio-service manuals 3 to 7 incl., $15 F.O.B. M. Youngman, 515 South Blvd., Oak Park, Ill.

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FOR SALE—100mf high-voltage variable cond.; 10v filament transformer type 203A; xmitting tube and socket; 0-200 milliampmeter, R.F. meter and misc. parts. C. Holstein, 246 E. 148th St., Bronx, N. Y.

WANTED — Superior Instrument Co. tester #1220. Ray S. Hanson, Fertile, Minn.

FOR SALE—Two Philco auto radios A-1 condition, $25 ea.; ¼ h.p. 110v a-c motor, $14; Solar C.E. condenser analyzer, $60; Arvin 8-tube auto radio, $25. Paul Capito, 637 W. 21st St., Erie, Pa.

FOR SALE—77 New 2v series tubes, 1A4, 1C6, 1C7, 1B5, 31, 32, 34, etc. Write for list. $105.90 value, $50. One lot only. Taylor Radio Co., Sandky Creek Road, Pittsburgh 21, Pa.

WANTED—#4-1 tube for 2v battery radio, J. R. Whitaker, Box 6, Farmerville, La.

FOR SALE — Radio City tube and set tester; also Triplett sig. gen., good condition, sold together, $75. Tommie Beacham, 158 E. Lacy St., Chester, S. C.

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spots of lights on a simulated map of the area being scanned by the antenna beam. Target range and azimuth—with respect to the radar set—are thus provided simultaneously.

Targets appear on the 'scope screen much as they would if actually observed from a height of seven or eight miles above the earth. Reflections from land formations also appear on the screen.

A single oscilloscope thus provides all the information necessary to locate surface vessels and aircraft within range of the radar equipment.

The tube performing this remarkable function is shown in Fig. 9. Essentially it is an electromagnetic cathode-ray tube with a radial time base. That is, the sweep baseline begins in the center of the screen and extends to the edge. The magnetic deflection coils which produce this time base are free to rotate around the neck of the tube and, in this manner, the baseline can be made to *rotate* radially from the center of the 'scope screen.

This rotation is synchronized with the rotation of the set's antenna system (Fig. 10). When the antenna system is pointing toward the north, the time base sweeps radially in that direction. All targets within the beam of the antenna will reflect echoes which will appear along this baseline.

By means of *Selsyn* motors (previously described in this Series) the rotating magnetic coils around the neck of the tube are made to follow every movement of the radar antenna system. Thus, when the antenna turns 90 degrees from north—or due east—the time base on the 'scope also revolves 90 degrees.

In a sense, the baseline indicates the exact azimuthal direction of the radar antenna beam. Targets anywhere along that beam will reflect signals which will register as echoes along the time base.

In operation, the antenna system of such a radar set revolves continually—making several revolutions-per-minute—searching the entire area surrounding the set *in all directions.* The screen of this type of electromagnetic tube has a very high degree of phosphorescence, so that when a target echo registers on the fast-moving radial baseline it remains to glow long after the baseline has continued on around the screen. Therefore, it isn't necessary for the radar operator to follow the time base as it revolves.

A typical PPI picture—recently released by the Army—shows the appearance of the invasion of France, as seen from a plane's radar set. The time is a few hours before H-hour on D-day (Fig. 11). The outline of the north coast of France can be easily identified. Each of the tiny white dots represents one or more invasion craft or low-flying aircraft. The bright center spot represents the main or transmitter pulse of the plane's radar set. From this photograph it can be seen that the PPI type of radar indicator is truly a plan position indicator—an

expert drawer of maps, which functions in light or darkness, and regardless of the weather.

Other Indicator Displays

Since the resultant combination of two or more signals can be made to achieve any desired geometric pattern on an oscilloscope, the number of different ways of displaying radar information are countless.

However, radar information must be displayed so that it is practicable.

Some sets are designed to measure only range, others measure range and azimuth, others measure aircraft height. But whatever the type of information obtained by the radar equipment, it must be displayed in such a way that a radar operator can interpret the 'scope pattern simply, quickly, and accurately.

A few of the vast number of different types of indicator 'scope patterns are shown in Fig. 6

When a single but extremely wide or "bouncing" target echo is reflected on the 'scope screen, experienced operators can often determine the number of planes flying in close formation which cause such an echo. As the number of such planes—all flying in close formation—is increased, the echo pip gradually becomes wider and brighter. During the height of the Battle of Britain, when the German Air Force sent thousands of planes across the Channel to bomb and strafe the English countryside, the echo signal on British radar sets became so wide that it often covered the entire baseline of the oscilloscope. Yet it *was* possible to read through the complex echo pattern and determine not only the approximate number of planes in formation, but their height and direction of flight.

Many types of radar sets have more than one oscilloscope. Some have as many as four or five. Certain radar sets on battleships may require a half dozen 'scopes to obtain extreme accuracy. But regardless of the number of actual scopes, every radar indicator

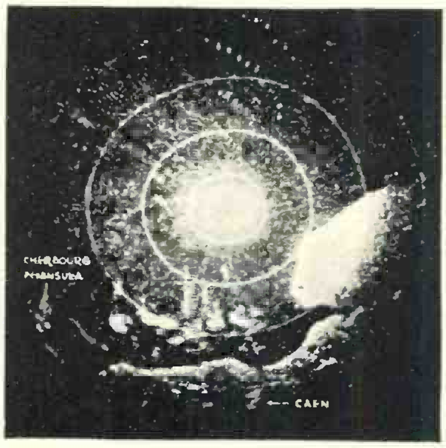
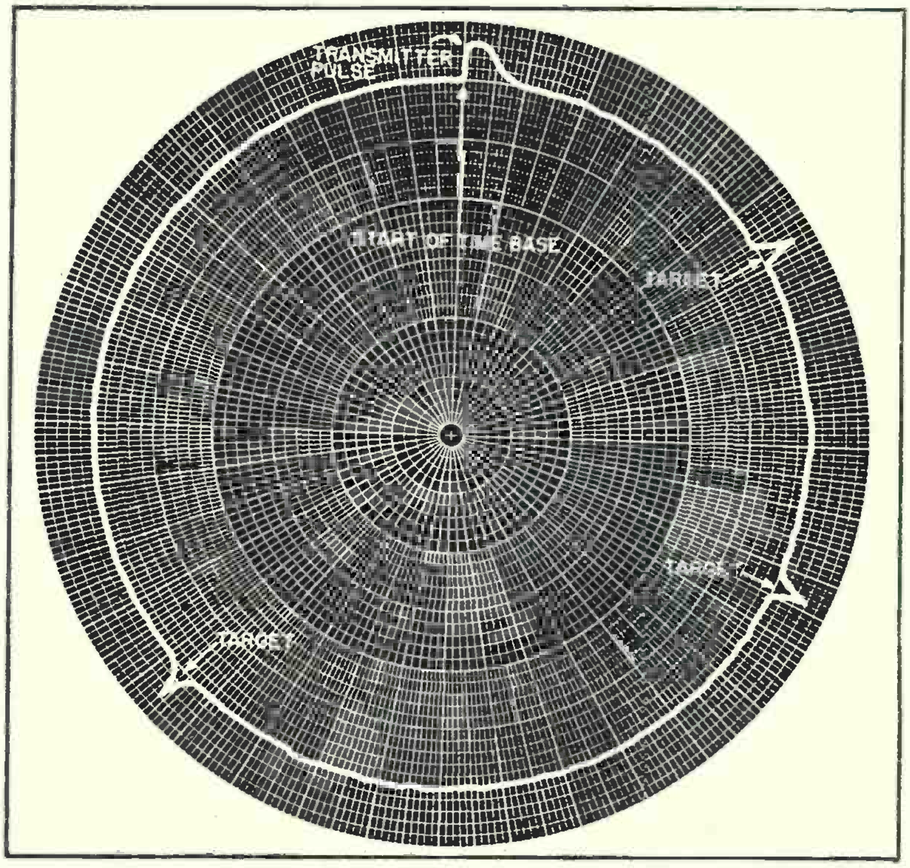
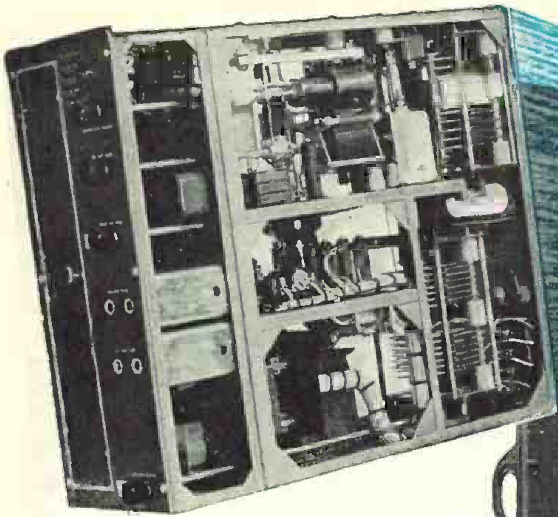


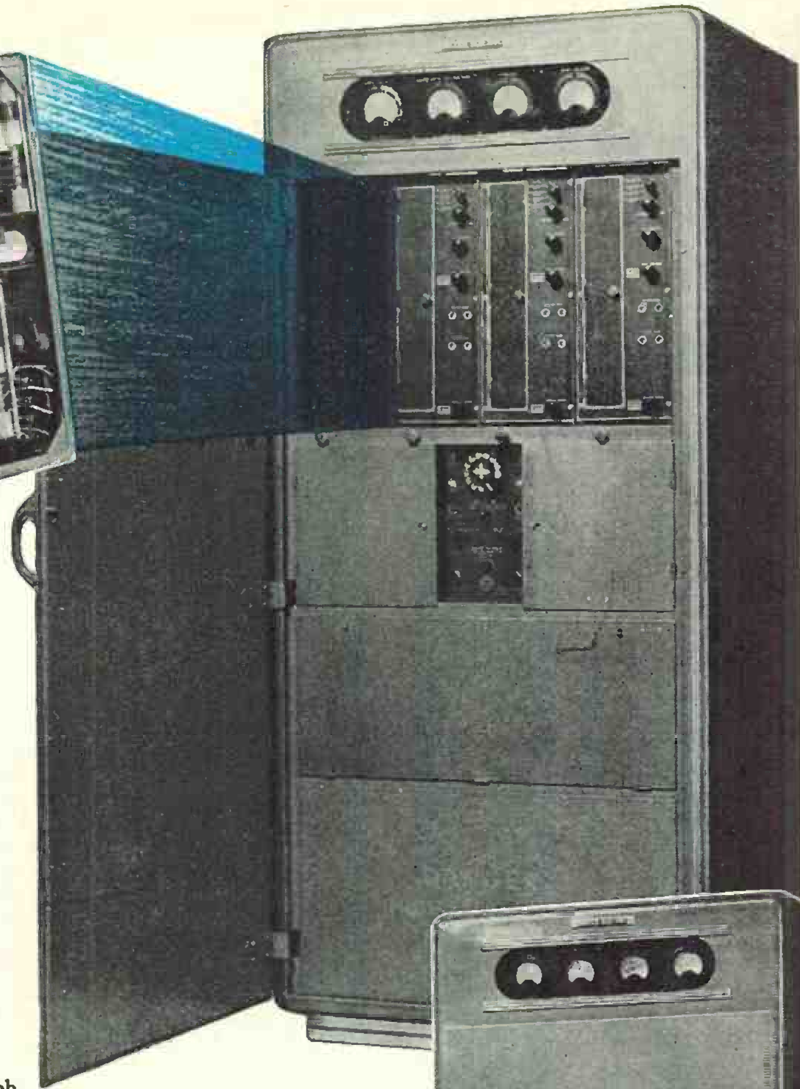
Fig. 11. PPI 'scope photographed a few hours before invasion of France. Plane has moved to within thirty-five miles of the coast, its position indicated by bright spot in center of 'scope. Invasion fleet (smaller blobs and grains) is clearly visible massed just off shore.

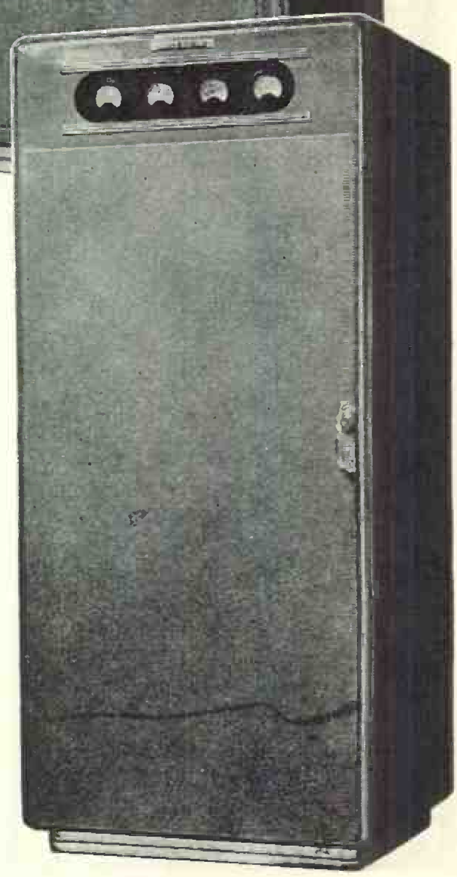
Fig. 12. Greater accuracy can be obtained by using a circular time base since the scale is lengthened considerably. In this 'scope, the target range is determined by polar coordinates.



Wilcox TYPE 99A Transmitter







A medium power transmitter, designed particularly for aeronautical service. Equally adaptable to other fixed services. Check these features for their application to your communication problems:

- ★ Four transmitting channels, in the following frequency ranges:

  125—525 Kc. Low Frequency.
  2— 20 Mc. High Frequency.
  100—160 Mc. Very High Frequency.

  Other frequencies by special order.
- ★ Simultaneous channel operation, in the following maximum combinations:

  3 Channels telegraph.
  2 Channels telephone.
  1 Channel telephone, 2 Channels telegraph.
- ★ Complete remote control by a single telephone pair per operator.
- ★ 400 Watt plus carrier power.
- ★ Low first cost. Removable radio frequency heads are your protection against frequency obsolesence.
- ★ Reliability backed by two years of engineering research, one year of actual field operation.
- ★ Available with all-steel, or wood pre-fabricated transmitter house complete with primary power, antenna, and ventilation fittings.
- ★ Not a "post-war plan," but a field-tested transmitter now in production.

An inquiry on your letterhead outlining your requirements will bring you complete data.

REMOVABLE R. F. HEADS

All radio frequency circuits are included in the 2—20 Mc. R.F. head shown above. All connections to the transmitter cabinet are by means of plugs and receptacles.

WILCOX ELECTRIC COMPANY, INC.

Manufacturers of Radio Equipment

Fourteenth and Chestnut   Kansas City, Missouri functions in the same basic manner —presenting *visually* all of the technical information gathered by the rest of the radar set. —30—

Recording Equipment
(*Continued from page* 34)

tomatically done while recording with magnetic records) plus the handling costs of routing the records back to the dictator, investment in records, etc. The fact that a dictator can have an almost indefinite supply of blank discs in a desk drawer, eliminates costly routing and handling systems. These are important advantages of the disc which has the further advantage that it can be filed or discarded.

In making and reproducing discs at these groove speeds and groove spacings, many refinements of the mechanical components used in the machines have been necessary. A good analogy might be to consider ordinary phonograph record making as compared to a magnifying glass and that this long playing recording involves the comparative precision of the microscope throughout.

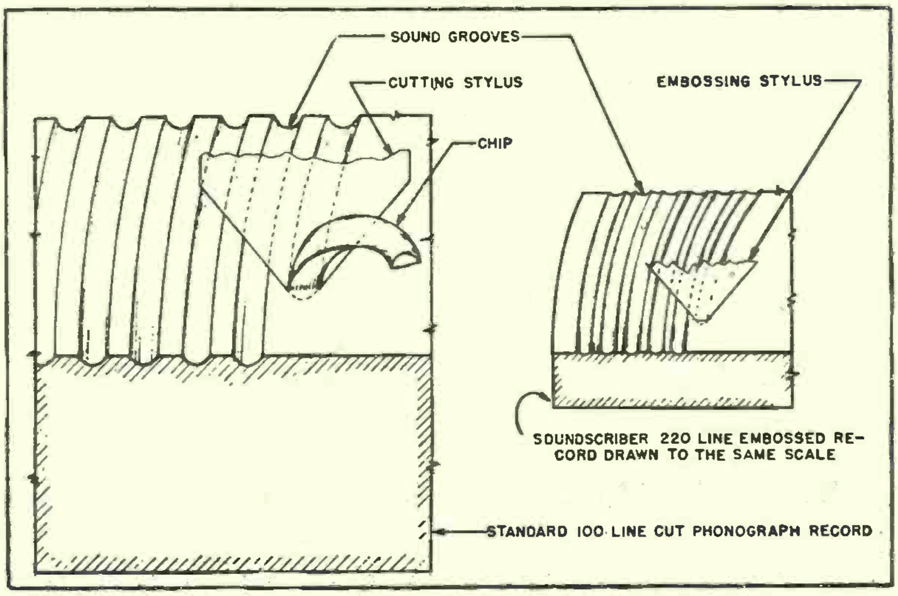
In order to achieve satisfactory signal-to-surface noise ratio at these slow sound groove speeds, with close spacing between grooves, it is necessary to make the maximum use of the groove at all frequencies within the range to be recorded. It is also imperative that grooves be spaced with perfect accuracy. Use is made of the well known fact that most of the energy content of speech is found in the frequency range under 800 cycles and that a decreasing amount of energy is to be found as the frequency increases (the frequencies from 3500-4000 cycles in average speech may be 30 decibels lower in level than those at 400 cycles.) Additionally, a modulated sound groove of a 4000 cycle note will have only one-tenth the amplitude of an equal intensity 400 cycle note. These two factors make it obvious that a more favorable signal-to-noise ratio at the higher frequencies will result on playback if corresponding pre-emphasis of these small amplitude higher frequencies is used in the recording process with corresponding attenuation of these frequencies in the reproducing process. This pre-emphasis in recording is accomplished by using a microphone and a recording amplifier combination with rising frequency response curves, and the playback system uses an amplifier with dropping frequency response. These changes in response are made as the *Talk-Listen* selector is shifted.

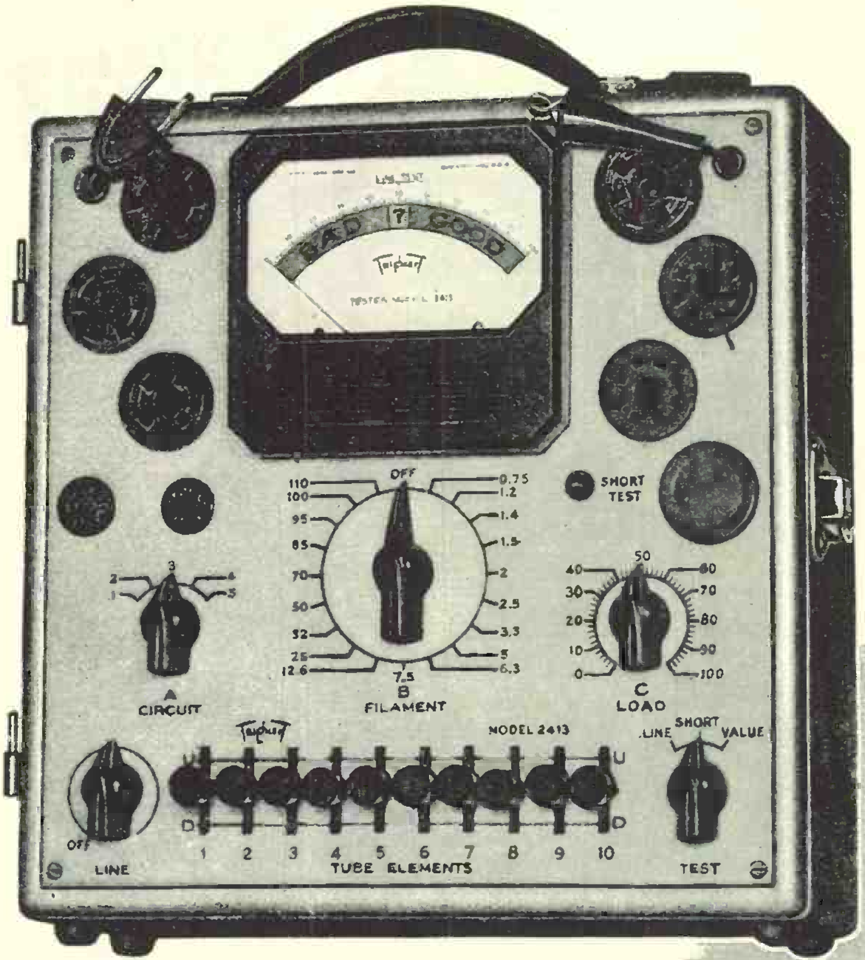
Furthermore, since the amplitude of the lateral undulations of the recording stylus is much less than in conventional phonograph records, it is obvious that vibration and *rumble* effects from the driving motor must be eliminated from the turntable to a much greater degree than in the conventional phonograph. Motor vibration is prevented from reaching the turntable surface by means of a mechanical filter system composed of special "U" shaped thin spring steel springs for mounting the motor and a flexible coupling for driving the turntable consisting of two canvas diaphragms which are fairly stiff rotationally but very flexible vertically.

Rumble effects are further minimized by a unique two-section turntable construction wherein the heavy flywheel section of the turntable has a sponge neoprene supporting ring which drives a light bakelite turntable shell which furnishes a smooth hard recording surface. This narrow ring of sponge neoprene between the two sections further effectively reduces *rumble*.

The diamond recording stylus is vibrated laterally by the voice signals and, thereby, produces lateral undula-

Comparison of sound grooves of a standard phonograph record and those of the embossed disc utilized with the SoundScriber recorder.





MODEL
2413

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The New Speed-Chek Tube Tester

MORE FLEXIBLE • FAR FASTER • MORE ACCURATE

Three-position lever switching makes this sensational new model one of the most flexible and speediest of all tube testers. Its multi-purpose test circuit provides for standardized VALUE test; SHORT AND OPEN element test and TRANSCONDUCTANCE comparison test. Large 4" square RED • DOT life-time guaranteed meter.

Simplicity of operation provides for the fastest settings ever developed for practical tube testing. Gives individual control of each tube element.

New SQUARE LINE series metal case 10" x 10" x 5½", striking two-tone hammered baked-on enamel finish. Detachable cover. Tube chart 8" x 9" with the simple settings marked in large easy to read type. Attractively priced. Write for details.

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- Authoritative tests for tube value; shorts, open elements, and transconductance (mutual conductance) comparison for matching tubes.
- Flexible lever-switching gives individual control for each tube element; provides for roaming elements, dual cathode structures, multi-purpose tubes, etc.
- Line voltage adjustment control.
- Filament Voltages, 0.75 to 110 volts, through 19 steps.
- Sockets: One only each kind required socket plus one spare.
- Distinctive appearance with 4" meter makes impressive counter tester — also suitable for portable use.

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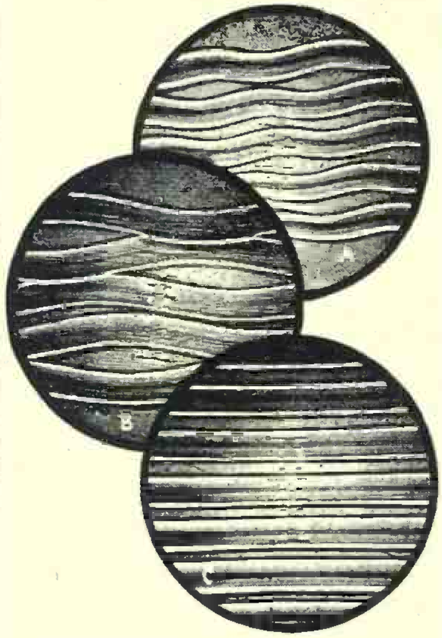


Microphotograph of embossed grooves showing: (A) Normal modulation. (B) Over modulation resulting in groove crosstalk. (C) Unmodulated grooves.

tions of the groove. The normal width of the groove is .003" and since the center to center distance between grooves is .0045", it is apparent that an irregularity in feed of 10% (or .00045") will restrict the permissible excursions of the recording stylus by approximately 30%. (Note that modulated grooves must not run into each other or cross talk from the adjacent groove will result on playback.) Unless any irregularities of feed are at a minimum, the permissible undulations of the recording stylus will be restricted with the result that the signal-to-surface noise ratio will be reduced. Thus, higher playback gain will be used for a given listening volume and, consequently, higher apparent surface noise will result.

The feed mechanism discussed below produces a feed which is accurate to closer than 10% and this result is accomplished without resorting to ultra-precision parts. The turntable shaft is driven by a small constant speed backgeared induction motor having an output speed of 33 r.p.m. A worm gear reduction, which is part of the motor, is housed in a zinc die cast enclosure which has four bronze bearings cast in place, two for the high speed roto-shaft and two more for the low-speed output shaft. This gear case is lubricated and sealed so that it requires no further lubrication for life. The output shaft of the motor is coupled to the turntable shaft by means of a fabric dual-membrane coupling. Since fast start is important in dictation, the motor is designed to start under full load in a split second.

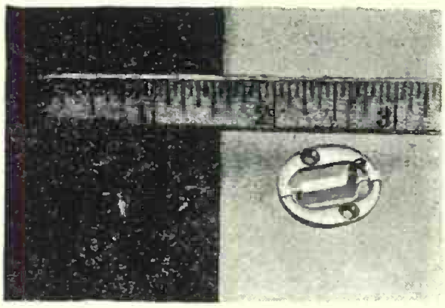
The turntable shaft has a worm cut on it and drives a bronze worm gear that is part of the recording arm feed mechanism. A drive shaft connects this gear box with another worm gear reduction unit. This latter gear box contains another worm and large bronze worm gear. The worm gear is force-fitted to a substantial spindle having a collar which carries the recording arm and head assembly. The bottom surface of the large worm gear rides on the cover of the gear box against which it is securely pressed while rotating by means of a conical pressure spring thus furnishing a constant frictional load on the gear train. The recording arm is held to the spindle and collar of this same assembly by means of a similar conical spring. It will be seen, therefore, that this spindle is positively rotated whenever the turntable motor is running. However, the recording arm can be manually re-positioned to any desired point on the disc since it is driven by the friction clutch arrangement just outlined. One unique feature of this system is the positive take-up of backlash in the gear train by virtue of the friction applied between the final gear of the train and the gear case cover. This friction is always greater than that between the recording arm and the collar which drives it, so that the manual repositioning of the recording arm will never introduce backlash in the gear train. Therefore, the recording arm again begins to feed the instant it is released.

The recording arm itself is a ribbed zinc die casting to which the recording head case is secured by means of a wide thin steel spring hinge. This spring hinge permits the recording head to be raised and lowered readily, but does not permit any lateral movement of the recording head with respect to the arm. This is important since lateral play would interfere with the accuracy of the spacing between the sound grooves.

In order to satisfactorily reproduce these closely spaced shallow grooves, a number of refinements and innovations of the reproducing arm and playback head are essential. The playback stylus is a permanent sapphire jewel ground and polished to a microscopically accurate radius. It, in turn, is mounted in a duraluminum shank permanently cemented to a featherweight lucite form in which is mounted the moving coil of the dynamic playback head. The mechanical impedance of this whole structure is much lower than conventional phonograph pickup units with the result that excellent tracking characteristics are obtained with only a fraction of an ounce of weight on the stylus. With this low weight, record wear is negligible, and the user can skid the playback stylus across the record grooves without harm. The playback arm is pivoted on a single hardened steel ball and counter-weighted so that an absolute minimum of friction will have to be overcome by the tracking effort derived from the groove. To free the groove from any gravitational forces from machines being off-level, the whole arm is laterally counterbalanced. This counterweighted arm also permits playback of the disc even though the machine is considerably off level (30° or more in any direction).

Still another essential feature of the playback system is the neutralizing of the sideways components of the frictional force between stylus and record. These forces are present in all playback arms to a considerable degree, except those having straight line feed or very long playback arms which minimize these forces. In the use of phonograph records with 100 lines to the inch, with deeply cut grooves, these tangential forces are not of great enough magnitude to interfere with tracking; however, with the shallow grooves obtained at 220 lines-per-inch, tracking is made positive by the combination of counterbalancing, low friction pivots, and by neutralizing these undersized tangential forces. This neutralization is accomplished by means of a tension spring so fastened to the playback arm that its component of pull on the arm will exactly neutralize the tangential forces. Tracking on these fine grooves is at least equal to standard phonographs on commercial shellac records.

The 7 inch diameter .010" thick non breakable, non inflammable vinylite disc used is the most compact, easily handled recording medium in use to-



(Left) The dynamic pickup showing moving coil, sapphire styluses, and lucite coil frame. (Right) Movable armature of recording head, showing brass mounting ring, vibrating armature and diamond.

day. It may be stored, mailed in an ordinary envelope (at letter postage), or filed for future reference as easily as a sheet of paper. In some business recording applications such as dictation, the record is clipped to the accompanying correspondence and is transcribed immediately to the typewritten page and then scrapped. In others, such as telephone recording, interviewing, language study, and talking correspondence, the disc may not be transcribed, but may be listened to or kept for future reference should a question arise. In these applications, the low cost plus filability and mailability of the thin disc are prime requisites. (Fifty hours of recorded material may be filed in a space 1"x 7"x7".)

In many recording applications, the ability to index and log the position of recorded material on the disc is important. SoundScriber machines are equipped with log scales and log pads for this purpose. The filing envelope for the disc is also used as a convenient accessory to logging.

Transcribing Conveniences

Where a volume of recorded material has to be transcribed to the typewritten page, a transcribing machine is used. This is only for playback, and does require a recording head, or a feed mechanism. However, it has various conveniences to enable the typist to work at top efficiency. It is equipped with two foot-pedals by means of which the typist can start and stop the turntable and disc instantaneously or "repeat" the last few words when necessary. Start and stop is accomplished by a magnetic brake which engages a light bakelite turntable shell driven from the heavy turntable through a felt friction ring. The heavy turntable rotates when the amplifier is *on* and the brake holds the turntable shell. When the *brake* is released, full speed is instantly realized and with the brake engaged, the shell slips on the felt ring. The *stepback* mechanism is also magnetically operated and when actuated by the foot pedal switch, its clapper engaged an arcuate plate fastened to the playback arm and moves the playback arm back by an adjustable amount (usually a few grooves). This stepback

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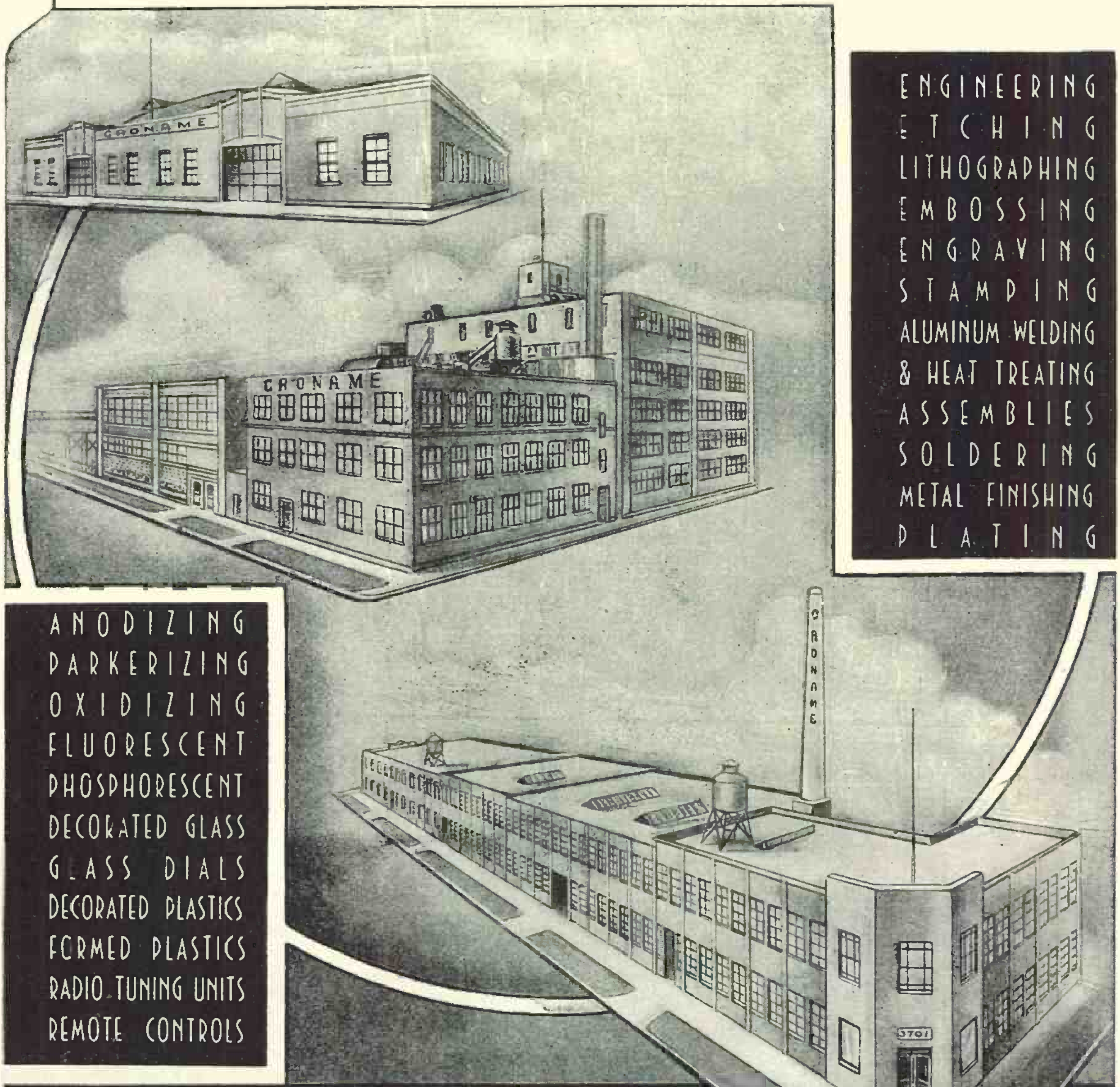

ENGINEERING
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LITHOGRAPHING
EMBOSSING
ENGRAVING
STAMPING
ALUMINUM WELDING
& HEAT TREATING
ASSEMBLIES
SOLDERING
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R_1, R_2—1000 ohm, ½ w. res.
R_3—200 ohm, ½ w. res.
R_4—500 ohm, ½ w. res.
R_5—500 ohm pot.
R_6—75 ohm, ½ w. res.
R_7—10 ohm, ½ w. res.
R_8, R_9—500,000 ohm pot.
R_{10}, R_{11}, R_{13}, R_{15}—100,000 ohm, ½ w. res.
R_{12}—2000, 1 w. res.
R_{14}—30,000 ohm, ½ w. res.
R_{16}, R_{22}—150,000 ohm, ½ w. res.
R_{17}, R_{23}—5000 ohm, ½ w. res.
R_{18}—4000 ohm, 1 w. res.
R_{19}—1500, 5 w. res.
R_{20}, R_{21}—250,000 ohm, ½ w. res.
R_{24}-R_{25}—500,000 ohm, ½ w. res.
R_{26}—100 ohm, 2 w. res.
R_{27}—1000 ohm, ½ w. res.
R_{28}—5000 ohm, ½ w. res.
R_{29}—25 ohm, ½ w. res.
C_1—1 µfd., 200 v.
C_2, C_3—100 µfd., 200 v. elec.
C_4—25 µfd., 200 v. elec.
C_5, C_8, C_{16}, C_{18}, C_{19}, C_{21}, C_{22}, C_{23}, C_{24}, C_{27}—.05 µfd., 400 v. cond.
C_6, C_{25}—.005 µfd., 400 v.
C_7—.002 µfd., 400 v.
C_9, C_{12}, C_{13}—.0005 µfd., 400 v.
C_{10}, C_{15}, C_{17}—8x8x8 µfd., 200 v. elec. cond.
C_{11}—25 µfd., 25 v. elec. cond.
C_{14}—.02 µfd., 400 v.
C_{20}—80 µfd., 200 v. elec. cond.
T_1—500 to 1000 ohm line transformer

CR_1, CR_2—Copper oxide rectifiers
S_1, S_4—D.p.d.t. sw.
S_2A, S_2B, S_2C, S_2D, S_2E—5 pole, 3 pos., ganged sw.
S_3—D.p.s.t. sw.
Tubes—2-12SC7, 2-35L6, 1-35Z5

Parts lists corresponding to diagram on page 34.

is done by skidding the playback stylus across the grooves without lifting which does not harm the record grooves since the stylus pressure is so low. The excellent tracking produced without need for a feed mechanism makes for easy positioning of the pick-up and simple backspace construction.

The transcribing machine is also equipped with a log scale so that corrections, etc., may be spotted readily. In order to further simplify the typist's work, two types of listening devices are available.

The first is a small speaker unit mounted in a desk stand which is positioned 2 or 3 inches from the typists ear. This has the distinct advantage over conventional headphones of not mussing the hair. Further, there is no physical attachment to the machine. The volume level used can be kept low enough so that it will not be disturbing to others in the same room.

In very noisy locations, it is often desirable to wear a head set which delivers sound to both ears and at the same time excludes the room noise. It was found that conventional head sets were extremely uncomfortable for the operators over long periods of time and were a source of annoyance (because of the tendency for hair to become caught in the gadgets necessary for adjustment to fit various heads). As a result, a special head set was developed, using a wide bakelite band molded to fit the head, on which are mounted 2 hearing aid type units. This whole headset weighs less than 2 ounces. The diaphragms of these units are rigidly coupled to the band so that the whole band acts as a second diaphragm, thereby producing improved low frequency response, due to the large size of the band. Since the whole band vibrates there is no need for accurate alignment with the ear. Furthermore, there is extremely light pressure on the head and none on the delicate surfaces of the ear. Also, no adjustments are necessary with the result that the whole assembly is made in such a way that there is no possibility of catching the hair. The broad band with its light pressure causes a minimum of disturbances to the girl's hair-do.

The resulting performance of this device is as good as the best headphones available without the necessity for high pressure and tight sealing around the ears of the wearer.

With this simple electronic business recording system, the same desk recorder may be used for dictation, conferences, or authorized telephone recording. Records made can be filed for future listening or conveniently transcribed to the written page. Voice letters are practical and now regularly in use. The portable recorder weighs about 20 pounds and is regularly used by salesmen and engineers for dictating reports to discs which are mailed to the home office for listening, transcription, or filing. An unusual system of business recording is thus provided which may find as important a part in the business world as the typewriter.

—30—

Short-Wave

(*Continued from page* 45)

broadcast of *United Nations* in Algiers as well as *America Speaks to Europe* from New York.

"I will be very interested to learn if any amateurs can pick up our broadcasts in the U.S.A. We have been monitored several times by RCA, but with rather poor results because of our directional antenna."

FXE, 8.036 (actually 8.25), is scheduled for the winter as follows: Weekdays, 12:15-1:15 a.m., news in French, Arabic, oriental music; 5:25-6:30 a.m., news in English and French, musical program, oriental program; 10 a.m.-4:15 p.m., news in Turkish, Armenian, Czech, French, etc., with an English transmission between 11-11:40 a.m. The Sunday schedule is 1 a.m.-4:15 p.m., intermittently; English transmission is the same as weekdays, with English newscast at 5:25 a.m.

John J. Kernan, Massachusetts, reports hearing FXE, 8.025, at 4 p.m. with English news, best on Sundays; he also reports hearing Radio-Damascus, 7.090 (frequency listed by Capt. Badin), actually on 8.000, at 11:04 p.m. *(It is believed that the 7.090 frequency listed by Capt. Badin was a misprint, and that Radio-Damascus actually is on 8.000 mc.—Ed.)*

Captain Badin's address is: Captain

Badin, Signals Officer, I/C of Radio-Levant, Forces Francaises Libres au Levant, Beyrouth.

* * *

AUSTRALIAN REPORT

From Cleve Maher, Gladesville, Sydney, New South Wales, Australia, we have the following information with regard to the power of Australian transmitters:

VLC, 50 kw.; VLG and VLQ, 10 kw.; and VLR and VLW, 2 kw.

Mr. Maher reports that there are about 135 broadcasting stations in Australia. About 30 are controlled by the Australian Broadcasting Corporation. These are financed by the paying of about $3 for each set in use. The ABC has two networks. The other hundred-odd stations gain their revenue by advertising. There are two nationwide networks, the *Macquarie* and *Major*, having about 40 and 25 units. The highest power permitted for commercial stations is 2 kw. and for ABC stations, 10 kw. "Here in Sydney we have 8 stations. All use 1 kw., except 2FC and 2BL (10 kw.) and 2VW (750 watts)," he explains.

Mr. Maher furnishes us the following schedules of short-wave transmitters in the South Pacific islands:

FK8AA, 6.205, Noumea, New Caledonia, *Radio Noumea,* heard nightly in French, 2:30-4 a.m.; English on Tuesdays.

VPD2, 6.135, Suva, Fiji Islands, good signal at 2:30 a.m. Sundays; heard 3-4 a.m. Tuesdays in Fijian.

ZLT7, 6.715, Wellington, New Zealand, English news at 4:30 daily; at 4 a.m. Sundays.

FO8AA, 6.980, Papette, Tahiti, closes in French at 12:30 p.m.

* * *

NEW

Here's good news! *The Dutch Broadcasting Station, PCJ,* at Huizen, Netherlands, has been heard daily testing at 2-3 p.m., 6-6:45 p.m., and 8-9 p.m. on 9.590 (a prewar PCJ frequency); signals have been strong, with severe interference from OWI transmitters, especially during the last two test periods. Was also heard on 19.71 meters, 8-9 a.m.; after a few days on 15.240, PCJ moved to the assigned frequency of 15.220 where it was blotted out by CHTA, Sackville, N. B. By this time, regular transmissions from this Dutch transmitter may have been inaugurated. Reports of reception should be addressed to the nearest Dutch Consulate or Legation.

United Nations Network, 6.160, Munich, Germany, relays *Radio Luxembourg* 2, 11 p.m.-2 a.m.; on 7.265 relays *Luxembourg,* 11 p.m.-2 a.m. also. MCD, Press Wireless, Berlin, operates on 8.130 and 15.870 with point-to-point relays; MCD2 is on 12.007.

American Expeditionary Station, 6.135, Milan, Italy, new 5th Army station, uses a 50-kw. transmitter which is probably the one formerly heard on 6.400; signs on at 11:15 p.m. and broadcasts to 11 a.m.; opens at 1 a.m. on Sundays, relays 1276 kc., a station operated by the Information and Edu-

cational Division, Mediterranean Command, U.S. Army.

A new Bern, Switzerland, transmitter is reported as radiating on 9.355, 2-3:30 p.m., announcing as on 9.345.

Moscow has a new station on 11.878, heard to Latin America, 7-10 p.m., irregularly, and after 12:45 a.m., 5-5:15, 5:30-7, 7:30-10:15 a.m., 10:40-11:15 a.m., and 11:30 a.m.-1:40 p.m. Other new Moscow frequencies reported are 12.080, 8-11 a.m.; 13.400, 10:30-11 a.m.; 13.610, 4-4:30 a.m.; 15.270, 8-9:25 p.m., 10 p.m.-12:30 a.m., 1-10:50 a.m., 15.280, 6-7 a.m. and later to Europe; 15.320, 12 midnight-2:30 a.m. and 5-11:30 a.m.; 15.340, 5:30-10 a.m. Constant changes from this quarter are expected during the next several months.

Two new BBC frequencies are reported operating 15.270, not heard yet, and GVR, 21.680, replacing GVP, 17.700, at 6:30 a.m.

FZI, Brazzaville, French Equatorial Africa, is reported on 6.023, 12 midnight-1:25 a.m. and 4-8 p.m.

The Post and Telegraph Department of New Zealand, at Wellington, heard testing between 2-5 a.m., announcing as on 9.896; good signal. (Johnson). ZLM5, 15.50, Wellington, heard testing daily, 10:30-10:45 p.m.; has music; announces as being a New Zealand *telephone* station; strong signal. (Balbi).

Australia has added a new transmitter (VLA) with the following calls, frequencies, and schedules: VLA, 7.280, 8:35-10 a.m.; VLA4, 11.770, 5:15-8:30 a.m. and 8:55-9:45 p.m.; VLA6, 15.200, 10 p.m.-12 midnight and 12:10-12:45 a.m. Location of the new transmitter is not yet known, but is believed to be Shepparton. The VLA transmitter is reported to be 100 kw. (Balbi).

OAX4Q, 6.010, Lima, Peru, *Radio Victoria,* is a new station using 2 kw. power; relays OAX4X, 6-11:30 p.m. and on Sundays to 2:40 a.m.; interference is quite bad. OAX7A, 6.123, Cuzco, is also believed to be on the air, according to sketchy information in *La Prensa.* OZX4N, 7.050, location yet unknown, *La Voz de la Democracia,* may possibly be the new station reported in Iauitos; is heard 6 p.m.-12 midnight.

* * *

CHANGES

ZNR, 12.115, Aden, Aden, is being heard again, 11:30 a.m.-12:15 p.m.; ZNR2, 6.750, is reported at 12 midnight.

WVFG, 12.250, located in Alaska, has been heard the last few months with contacts from servicemen, 10:30-11 p.m., or later.

The Voice of America in North Africa on 6.040 is now scheduled 11:30 a.m.-5:15 p.m.; on 9.610 is scheduled 2:15-5:15 p.m.; on 11.765 has been heard coming on at 4:30 a.m., operating to 2:15 p.m.; on 15.155 is heard on Tuesdays, Thursdays, Saturdays, 10:15-10:30 a.m.; United Nations Radio, 9.540, is now off the air. These stations in Algiers no longer use the *United Nations Radio* slogan. Verifications by letter are sent from these

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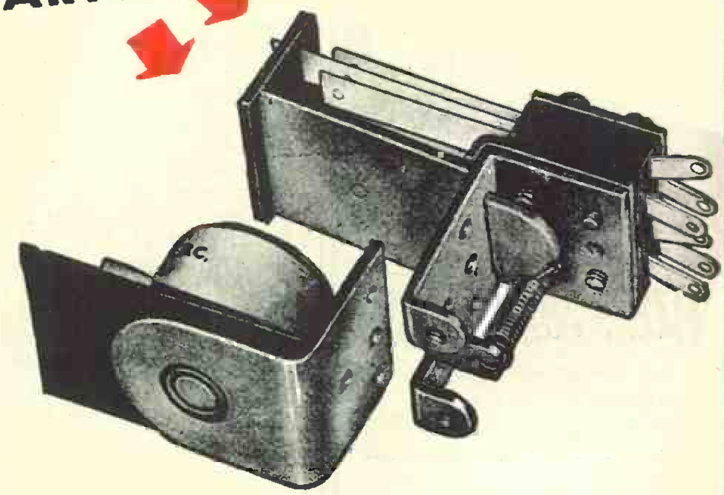

SERIES 200 RELAY

Two basic parts — a coil assembly and a contact assembly — comprise this simple, yet versatile relay. The coil assembly consists of the coil and field piece. The contact assembly consists of switch blades, armature, return spring, and mounting bracket. The coil and contact assembly are easily aligned by two locator pins on the back end of the contact assembly which fit into two holes on the coil assembly. They are then rigidly held together with the two screws and lock washers. Assembly takes only a few seconds and requires no adjustment on factory built units.

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See it today! . . . this amazing new relay with interchangeable coils. See how you can operate it on any of nine different a-c or d-c voltages — simply by changing the coil. Ideal for experimenters, inventors, engineers.

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The Series 200 is available with a single pole double throw, or a double pole double throw contact assembly. In addition, a set of Series 200 Contact Switch Parts, which you can buy separately, enables you to build dozens of other combinations. Instructions in each box.

NINE COIL ASSEMBLIES

Four a-c coils and five d-c coils are available. Interchangeability of coils enables you to operate the Series 200 relay on one voltage or current and change it over to operate on another type simply by changing coils.

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OWI-operated transmitters. Reports may be sent by 6-cent airmail to Radio Section, Office of War Information, APO 497, U.S. Army, c/o Postmaster, New York City.

Radio France, 12:120, also in Algiers, is scheduled 11 p.m.-4 a.m., 7-8:15 a.m., and 9 a.m. to 12 noon; French news is reported to be given at 11:30 p.m.

Radio Omdurman, 13.320, Anglo-Egyptian Sudan, is reported to be on the air now daily 11 a.m.-1 p.m.; an English transmission is heard Thursdays, 12:30-1 p.m.

CR6RB, Benguela, Angola, is now on 9.165 instead of 6.095. CR6RA, 9.470, Louanda, is heard some days to sign-off at 3:30 p.m., interferes with TAP, 9.465, Ankara, Turkey.

LRS1, 5.985, Buenos Aires, Argentina, has returned to this frequency from 6.065, relaying LR4, 5-10 p.m. LRX, 9.660, also in Buenos Aires, is heard to 10:20 p.m. or 11 p.m.; recently verified in three months. LRR, Rosario, 11.880, comes on at 6 a.m. with Spanish news at 6:15 a.m.

Radio National Belge, Leopoldville, Belgian Congo, has moved to 9.763 from 9.783, after having operated on 9.745 and 9.750 for a short time; now avoids interference from TGWA, Guatemala, 9.780; latest schedule reported is 12 midnight-1:30 a.m., 11 a.m.-8 p.m. in French and English; English news, 11:45 a.m., 1:45, 3:45, 6:15, 7:15, 8:10 p.m., with afternoon English newscasts being heard irregularly. Apparently, Leopoldville is not going to move transmitters, as previously reported, but will only relay Brussels when the latter station begins operation. On 15.170, is scheduled 2-4 a.m. and 9-10 a.m. A new frequency of 17.770 is reported as heard very strong, 4:30-8 a.m.

Radio Congo Belge, 9.385, Leopoldville, is reported relaying the North American and General Overseas BBC services, 9:45 p.m.-on; regular programs terminate at 2 a.m.; on 11.720, is heard 6-7:15 or 7:30 a.m.

Vienna, Austria, is reported on 7.140 and 9.350 at 3:30 p.m.

Emisora Nacional, Ponta Delgada, Azores, 11.090, is now heard 2-3 p.m. (Harris). Ponta Delgada on 4.040 is now heard 3-5 p.m.

Sofia, Bulgaria, 9.355, comes on the air at 11 p.m. weekdays, at 12 midnight Sundays; reception is reported *very good* in Washington, D.C.

XGOY, 11.910, Chungking, China, is scheduled now as 4-5:30 a.m. and 6-7 p.m.; reported heard in Sweden, 11 a.m.-12:45 p.m.

HI2A, Santiago de los Caballeros, Dominican Republic, has moved to 7.080 from 7.070; verification received from this station gives address as *Cafe del Yaque,* the slogan printed on the card is *La Voz de Trujillo,* however. HI3X, 12.105, Ciudad Trujillo, has moved back here from 11.850, heard from 11 a.m. to 1:30 p.m. and from 5:10 to 9:15 or 9:30 p.m.; also reported heard in mid-afternoon.

JCPA, 7.190, Cairo, Egypt, broad-

casts 10:30 p.m.-12:30 a.m. and 2 a.m.-3 p.m.; news at 2:30, 5:30 a.m. and 11:30 a.m., 2 p.m.; reported heard in USA at beginning of radiation. SUZ, Cairo, is scheduled 5-6 a.m. and is reported to broadcast English news at 1 p.m. Sundays.

Effective August 5, operations of the Armed Forces Network transmitter on 6.080 (London or Paris) became: 11 p.m.-2:45 a.m. and 11:30 a.m.-7:15 p.m., with 8.565 being used 3-11:15 a.m., replacing 6.080 for that transmission; address is reported as APO 887.

Although Brazzaville, French Equatorial Africa, has reported they would curtail activities in favor of *Radiodiffusion Francaise*, Paris, transmissions from FZI have been expanding lately, with 9.440 adding an English newscast at 5:15 p.m. together with 11.970; the later evening English newscast on these frequencies is still at 6:25 p.m. Additional English newscasts may be heard on 9.440 at 1:45 and 3:45 p.m. *Radio Brazzaville* is now also being heard on 17.530, 12 midnight-1:30 a.m. and 4-7:45 a.m. with English news at 7:15 a.m., but is no longer heard on this frequency from 10 a.m. to 8 p.m.

Radio Guadeloupe, 7.540, Point-a-Pitre, Guadeloupe, has moved here from 7.445, heard 6-7:30 p.m.

KRHO, 15.250, Honolulu, Hawaii, now operating on this frequency, 6-9:15 p.m. with excellent signal; on 17.800 is scheduled, 9:30 p.m.-2 a.m.

EPB, 15.120, Teheran, Iran, reported moved here, 2:45-4 a.m.; formerly was reported as 15.100.

IRF, 6.025, Rome, has dropped all its early morning broadcasts.

SHARQ EL ADNA, 6.135, Palestine, is heard 11 p.m.-12:15 a.m. in parallel with 6.790 and 6.710; this is the former frequency of the *British Mediterranean station.* JCKW, 7.220, Jerusalem, has replaced JCJC with the Forces Service on this frequency which was formerly used by the *British Mediterranean station.* JCKW is scheduled 10:30 p.m.-12:30 a.m. and 2 a.m.-3 p.m. in parallel with JCPA (795 kc.), JCLA (1,080 kc.), and 1,450 kc.; English news is scheduled for 11:30 p.m., 6, 10 a.m., 12 noon, and 2 p.m.; is reported heard in USA with fair signals.

HER3, 6.165, Bern, Switzerland, is now off the air. HEK3, 7.380, is heard 10 a.m.-12:30 p.m. and 3:10-3:25 p.m. most days, in addition to 8:30-10 p.m. daily except Sunday. HE15, 11.710, is no longer listed to Australia, 3-4:30 a.m. HEK4, 11.960, is heard generally, 3:35-4 p.m. and on Tuesdays and Saturdays, 12 midnight-1:30 a.m. HBJ, 12.967, also in Bern, is no longer on the air. HER6, 15.315, was heard recently signing on at 10:4g a.m. in a foreign language.

Leningrad, USSR, 5.960, is heard 4-6 p.m. Moscow on 6.230, has news at 12 noon, 1, 2, 4, and 6:15 p.m.; on 7.300 is scheduled 11 a.m.-5 p.m., 5:15-6:25, 7-10 p.m. with news hourly, and at 5:47 and 6:15 p.m.; Leningrad on 7.430 is heard well some evenings; Radio Tiflis is heard on 7.490; Leningrad on 9.713, reported heard 5-5:30 p.m. to Japan and 5:47-6:30 p.m. to North America.

ZRH, 6.028, Johannesburg, South Africa, reported moved here from 6.007.

HVJ, 15.120, Vatican City, heard with Papal nuncios at 12 midnight in Italian; may be Wednesdays only.

YUE, 11.735, Belgrade, Yugoslavia, is now off the air.

Radio Maroc, Rabat, French Morocco, reported heard again on 9.093, 1-5 p.m. sign-off; CNR2, 11.940, is now being heard with CW only.

Radio Centre, Komsomolsk, 15.230, is reported now carrying the 5:47-6:25 p.m. broadcast from Moscow, replacing 15.750; it is generally buried under Cincinnati; have been hearing this transmission some evenings, however, also on 15.750.

Bern, Switzerland, has inaugurated an interesting new feature, consisting of messages from U.S. soldiers on furlough in Switzerland, at 9:45-10 p.m. nightly except Saturday, over HEF4, 9.185, and HEK3, 7.380, during the *Full Edition* transmission to North America, 8:30-10 p.m. The Bern afternoon—or *Short Edition*—radiation is now heard on 15.875, 2:20-2:50 p.m., with English news at the start of the

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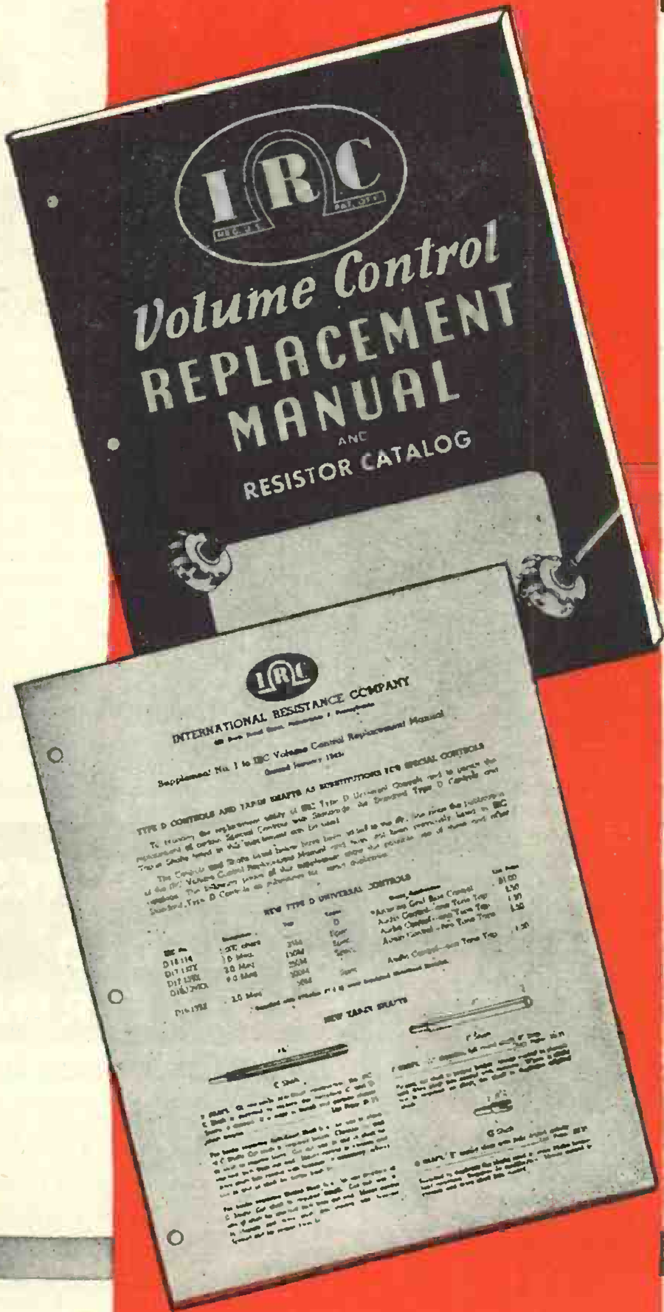

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broadcast; the names of persons to be called "7 hours later, or at 9:45 p.m. EST by soldiers furloughing in Switzerland" are given at 2:45 p.m., just before sign-off.

Under the auspices of the International Red Cross, HBF, 18.450, Geneva, Switzerland, is being heard 10:30-11:30 a.m., Tuesday, Wednesday, and Saturday.

* * *

EAST COAST REPORT

ZEBR, 11.820, Hermosillo, Mexico, heard at 9 a.m. Radio Centre, 12.265, Moscow, heard on this frequency recently at 8:25 p.m. Radio Nacional de Espana, 9.370, Madrid, Spain, heard signing on at 6:30 p.m. Radio Centre, 15.750, Moscow, heard between 12 noon and 12:30 p.m. Sunday in English. Radio France, 12.120, Algiers, heard at 1 p.m. (Harris).

Radio Centre, Komsomolsk, USSR, on 15.23, heard 5:47-6:25 p.m. and 7-8:15 p.m. with English news at 6 and 7 p.m. JCJC, 7.220, Cairo, Egypt, heard 10:30 p.m.-3 p.m.; news at 2:15 a.m., 3 p.m. FGY, 7.210, Dakar, French West Africa, 1:45-4:25 p.m.; news at 2, 4 p.m. Radio France, 12.120, 6:30 a.m.-4:10 p.m.; news at 10 a.m., 4 p.m. OIX4, 15.190, Lahti, Finland, heard 1-3, 7:25-7:50 p.m.; English news, 7:45 p.m. SBT, 15.155, Stockholm, Sweden, 11:30 a.m.-5 p.m. in English and Swedish; English news, 12:40 p.m. Radio Centre, Komsomolsk, 15.11, heard 7-7:40 p.m., with news at beginning of transmission. TFJ, 12.235, Reykjavik, Iceland, heard 9-9:30 a.m., Sundays only, in Icelandic. CNR1, 12.19, Rabat, French Morocco, 4:10-4:30 p.m., irregularly, in French; news at 4:15 p.m. ZNR, 12.115, Aden, Arabia, 11:30 a.m.-12:17 p.m. (Sundays best reception), in Arabian; news, 11:30 a.m. EPA, 10.810, Teheran, Iran, 12 noon-3:30 p.m., irregularly, in native language and music; sometimes has R-9 signal. TAP, 9.465, Ankara, Turkey, heard Thursdays at 5:55-6:15 p.m., native and English; English news, 6 p.m. VUD8, 15.35, Delhi, India, heard 8:45-10:30 p.m., English news at those times. VLG6, 15.23 Melbourne, Australia, has English news at 10 p.m. Radio Centre, 11.835, Moscow, has English news at 11 p.m., 11 a.m., and 6:35 p.m. CSW6, 11.040, Lisbon, Portugal, has English news at 1, 2, 3:45 p.m. Radio Club, 9.970, Brazzaville, French Equatorial Africa, heard 12 midnight-2 a.m. FXE, 8.025, Beirut, Lebanon, is heard best at 4 p.m. Sundays. Damascus, Syria, 8.000, heard at 11:04 p.m. SUX, 7,860, Cairo, Egypt, heard with English news at 3:45 p.m. Radio Club, 7.530, Macao, Portuguese China, heard with English news at 7:15 a.m. CKFX, 6.080, Vancouver, British Columbia, has news on the hour, 12 midnight-2 p.m. (Kernan).

PJC1, 7.250, Willemstad, Curacao, *Radio Princesa Juliana*, heard 7-9:30 p.m. in Dutch and Spanish; on with clock striking. HET3, 7.360, Bern, Switzerland, heard 6:30-8 p.m. in Portuguese, Spanish; on Saturdays only also in Italian, French, German; HEF4, 9.185, is sometimes used in par-

allel. Radio Nacional de Espana, 9.370, Madrid, Spain, Arganda del Rey, heard 3-5, 6:30-8:30 p.m. in English, Arabic, Italian, Spanish, German, and French; English news at 3 p.m.; is all-Spanish to Latin America, 6:30-8:30 p.m. Singapore, Malaya, 9.555. heard in English, 5-5:35 a.m. OLR3A, 9.550, Prague, Czechoslovakia, heard 2 a.m.-5:15 p.m.; English news: 3:30 p.m. CSW7, 9.470, Lisbon, Portugal, 7-8 p.m., in Portuguese; very good signals. CSW6, 11.040, Lisbon, heard 4-6 p.m. in Portuguese, to Cape Verde Island and Brazil. Paris on 11.845 heard 8-9:40 p.m. in French and English; generally parallels 9.520 instead of 9.613 now; has English news usually at 8:30 and 9:30 p.m. SBT, 15.155, Stockholm, Sweden, heard in English, Swedish, German, 10-11 a.m. and 12:30-1 p.m.; English news at 10:05 a.m. and 12:40 p.m.; on Tuesdays at 10:05 a.m. answers letters from listeners. (Cooper).

Radio Tananarive, 12.127, Madagascar, identified at 7:35 a.m., in French, fair signal. XGOY, 9.810, Chungking, China, heard around 7 a.m., sometimes in English; usually relays to network a few minutes after 7 a.m.; fair signal. (Duggan).

CHTA, 15.22, Sackville, New Brunswick, Canada, broadcasts in Czech at 11 a.m., radio letters to relatives in Czechoslovakia. CHTA invites letters from Czechs desiring to have their letters short-waved to relatives and friends in Czechoslovakia. Announcement made both in English and Czech.

PRL8, 11.72, Rio de Janeiro, Brazil, heard 9:30-9:55 p.m., daily except Saturday; still asking for reports. (Kentzel).

WVLC, 9.300, Manila, Philippines, heard in English at 6 a.m. LRX, 9.660, Buenos Aires, Argentina, heard at 4 p.m. in Spanish. CHNS, 6.132, Halifax, Nova Scotia, heard 6 a.m.-9:15 p.m.; English news at 5:30 p.m. VONH, 5.970, St. John's, Newfoundland, has English news at 5:45 p.m. CSW7, 9.740, Lisbon, Portugal, *Emissora Nacional*, heard 7-8 p.m. in Portuguese. EAQ, 9.860, Madrid, Spain, heard at 6 p.m. in Spanish. Radio Centre, 7.560, Moscow, heard with news in English at 7 p.m. (Cotter).

* * *

MIDWEST REPORT

Larry Gutter, Chicago, writes:

"Stations in Asia and Oceania have slacked off tremendously here, except Australia. Melbourne is heard clearly from about 5 a.m. with broadcasts to Forces in the Pacific and Asia, over 9.54, 9.58, 9.615, 9.68. The 7-7:45 a.m. transmission over VLC5, 9.54, is heard like WGN During the summer the 12:10-12:45 a.m. transmission over VLC4, 15.315, was like a local, but it has become weak this fall; the 11.84 frequency is little better. The 10-10:45 a.m. radiation over VLC6, 9.615, is fair. The transmitters on the West Coast that maintain contact with network correspondents in the Pacific—the boys who arrange all Pacific short-wave pick-ups to this country—are very interesting to listen to. They are RCA transmitters. I have heard them for about two years as they talked to and arranged with CBS, NBC, OWI, and so on, for spot broadcasts from the Pacific area.

"Frequently, network officials in San Francisco are given a line into the transmitter and talk with their own men. All 'go-aheads' for network pick-ups are given through these stations. These transmitters include KQJ, 18.02, 3-10 p.m.; KEM, 15.49, used irregularly 12 noon-12 midnight; KKL, 15.475, 3-10 p.m.; KKQ, 11.95, 12 noon-12 mid-

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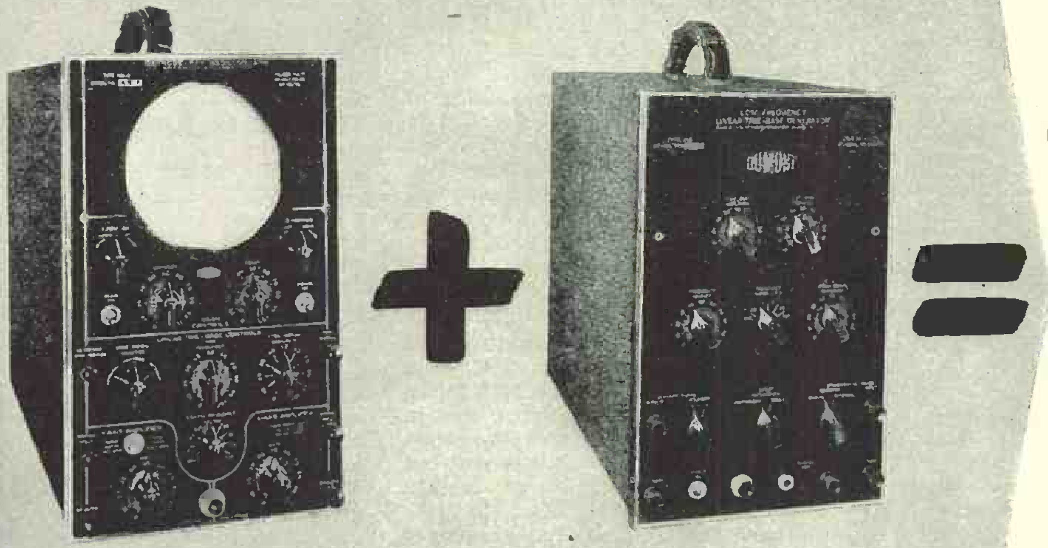

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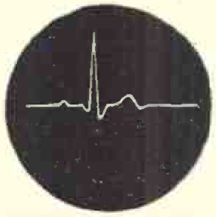
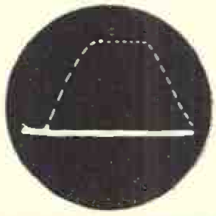

ELECTROCARDIOGRAPHY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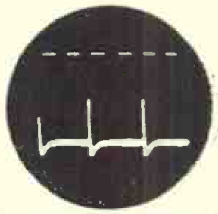
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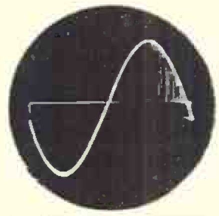
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ALLEN B. DUMONT LABORATORIES, INC., PASSAIC, NEW JERSEY • CABLE ADDRESS: WESPEXLIN, NEW YORK night; KES3, 10.62, used irregularly, 12 midnight-12 noon; KER, 10.39, 12 midnight-12 noon; KES2, 8.93, 3 a.m.-12 noon; KEB, 6.89, 12 midnight-12 noon; times are approximate. These West Coast transmitters, in San Francisco, talk to Tokyo, Guam, Manila, and Honolulu. Radio Tokyo is in American hands. As of September 4 the studios were in Yokohama and the transmitters in or near Tokyo. Tokyo transmitters that I have heard for Traffic with RCA are JLT3, 15.225, 3 p.m.-12 midnight; JZK, 15.160, 12 midnight-4 a.m.; and JLU2, 9.525, 4 a.m.-3 p.m.; times are approximate. JLT3 is heard best around 6 p.m. talking to San Francisco. Frequently, Tokyo is relayed through KU5Q, Guam. That happened the night of the surrender ceremonies broadcast. The 'go-ahead' cue from this country was given through KQJ (18.02) to KU5Q, Guam, then fed to KU5Q's *Queen Channel* (17.82) which was received by Tokyo. Broadcast of the surrender signing was recorded an hour and a half before 8:30 p.m., which was *air time*. The recording was sent by speedboat to the press communications ship, *Anton*, in Tokyo Bay. There it was broadcast to Radio Tokyo where it was sent out over JLT3, 15.225. This was received by Guam and fed to KU5Q's *Mike Channel* (13.36), and that frequency was heard in San Francisco. For traffic with Tokyo, best bet from 3-10 p.m. is KQJ (18.02). The others sometimes split up and *gab* with Guam, Manila, and Honolulu. Mornings, I find KEM (15.49) and KES2 (8.93) best. Hawaii talks to San Francisco approximately 12 noon-3 p.m. over KIO, 11.63; 3 p.m.-12 midnight, over KHE, 17.98; 10 p.m.-10 a.m., over KKH, 7.52 or KEQ, 7.37. Manila transmitters have calls of KXE, KXG, KXH, KXI; I do not have their frequencies. Something odd was heard recently when Manila was relayed to Tokyo through KEM (10.39). The Manila transmitter was KXG. Also heard JLU2 report that station 'RVD' was QRMing KEM (10.39) for reception in Japan. Where is 'RVD'? Heard a Press Wireless station, KBE, near 18 mc., Los Angeles, recently calling WVLC, the Philippines."

From Charles Sutton, Toledo, Ohio, we have this log:

XGCA, 9.625, Kalgan, China, 6-7:45 a.m., English news, 6 a.m. SUV, 13.830, Cairo, Egypt, 1-1:15 p.m., English news, Sundays. TFJ, 12.235, Reykjavik, Iceland, 9-9:30 a.m. in Icelandic, Sundays only, probably directed to Sweden. ZOY, 7.050, Accara, Gold Coast, Africa, 1-2 p.m., English at 1 p.m. JZHA, varying from 9.465-9.520, Hongkong, China, 6:45-8 a.m. Radio Moscow relayed on 6.820, 6:45-7 p.m. Radio Ejercito, 12.270, Punta Arenas, Chile, 7:30 p.m.-12 midnight. ZOJ, 11.810, Colombo, Ceylon, *British Southeast Asia Command,* 5:55-7:45 a.m., English news, 7:15 a.m. HEF4, 9.185, Bern, Switzerland, 8:30-10 p.m. except Saturday. Radio Tifilis, 11.960, Tifilis (Georgia), in Russian, 3:45-4:30 p.m. Radio Tananarive, 12.127, Madagascar, relays Brazzaville in French, 5:45-7:15 a.m. Radio Vatican, HVJ, 17.445, Vatican City, English program on Saturdays, 8:45-9:45 a.m. Radio Club Macao, 7.520 to 7.540, Macao, Portuguese China, English news at 7:15 a.m.; at 8:30 a.m. announces in English as *The Voice of Portugal in the Far East.* Radio Centre, Moscow, 15.750, 7-8 p.m., added 11:40 a.m.-12:30 p.m. and 1-1:30 p.m., with English news at 11 a.m. and 12 noon. HC2DC, 7.345, Guayaquil, Ecuador, 6 p.m.-11:45 p.m. Radio Leningrad, 9.715, heard 4-6 p.m., in Japanese at 5 p.m. VLW7, 9.520, new one at Perth, Australia, has good signals, 10:30-11:30 a.m., news at 11 a.m. VUD10, 11.760, Delhi, India, on at 5 p.m., fades out at 6:10 p.m. Radio Brazzaville, 15.595, heard, 4:45-8 a.m. and on 17.525, 6:45-8 a.m., 10:58 a.m.-5 p.m. Radio Andorra, 5.997, Andorra, heard in Spanish, 6:10-6:30 p.m. CMA5, 15.505, Havana, Cuba, heard with test program, 5:25-5:45 p.m. KEM, 15.490, San Francisco (Radiophoto Station), calls WQB, 17.940, at 6 p.m. Radio Eireann, 9.595, Dublin, Eire, heard 4:06-4:35 p.m.; English news, 4:15 p.m. A Russian on 13.420, Moscow, is heard in English, 10:30-11 a.m., and in Russian, 10-10:25 p.m. RNB, 9.783, Leopoldville, Belgian Congo, was heard on 9.745 recently, with less QRM and better signals than on former 9.783 frequency. CE970, 9.728, Valparaiso, Chile, has good signals, 6:30 p.m. evenings, sign-off is 11 p.m. PRL7, 9.720, Rio de Janeiro, Brazil, has good signals to 9:05 p.m. Moscow on 9.860, heard 8-9:15 p.m., good signals. On 9:480, Moscow is heard 7-9 p.m., with English news at 7, 8 p.m., at times also at 8:25 p.m. HJCAB, 9.690, Bogota, Colombia, heard evenings to 11:10 p.m. COCX, 9.270, Havana, Cuba, heard early evenings, scheduled 7 a.m.-11 p.m. KU5Q, Guam, 17.820, calls WVLC, NBC, sends dispatches, 6-8 p.m. ZNR2, 6.760, Aden, has good signals, 11 a.m.-12:15 p.m. HH3W, 10.130, Port-au-Prince, Haiti, has good signals evenings to 10 p.m. *Polskie Radio*, Lublin, Poland, has good signals, 6-9:15 p.m.

VUD7, 15.160, Delhi, India, heard 10 p.m.-9 a.m.; English news at 6:30 a.m.; fair signal. XGOY, 7.153, Chungking, China, heard 5:35-11 a.m., with English news at 8 a.m.; good signal. JCJC, 7.220, Cairo, Egypt, heard 10:30 p.m.-3 p.m. VIG, 15.080, Port Moresby, New Guinea, signs on at 8 p.m., has English news at 8:30 p.m., poor signal. JZHA, 9.470, Hongkong, China, has fair signal at time of English news, 7 a.m. Radio Dakar, FGY, 7.210, French West Africa, heard 2 a.m.-4 p.m., mostly in French; English news, 1:30 p.m. (Kierski).

Radio National Francaise, 9.520, Paris, France, scheduled 4:30-5:45, 6-7 a.m., 11 a.m.-12 noon, 12:35-1:25 p.m., 2-5 p.m., 5:30-7 p.m., 8-9:30 p.m.; English news at 8:45 p.m.; fair signal. London frequencies heard with good strength include GSP, 15.310, GRH, 9.825, GWJ, 9.525, GWN, 7.280, GSU, 7.260. VLC6, 9.615, Shepparton, Australia, has good signals, 4-5, 5:15-6:45,

7-9:30, 9:40-10:45 a.m.; news at 4, 5:15, 9, 10, and 10:35 a.m. HCJB, 9.958, 12.445, 15.100, Quito, Ecuador, heard well. XEWW, 9.500, Mexico City, heard in Spanish only, 8 a.m.-2 a.m., good signal. (Massey).

* * *

WEST COAST REPORT

From Los Angeles, August Balbi reports:

On September 3, the BBC announced that Gen. MacArthur had ordered the "suspension of all foreign broadcasts by Japan." *(Since it is likely that Radio Tokyo transmitters will be used by the occupying forces, we are listing below schedules of Radio Tokyo as beamed at the time U.S. occupying forces took over. It is probably that Radio Tokyo will be used to relay network correspondents to the U.S. and for other communications work—Ed.)*

JLP2, 15.325, 10:45 p.m.-2 a.m.; news at 11 p.m., midnight, 1, and 1:45 a.m.; to West Coast.

JVU3, 11.897, 10-11 a.m.; news at 10 a.m. only; in Japanese, 10:30-11 a.m. sign-off; to West Coast.

JLT2, 9.645, 10-10:30 a.m.; to West Coast.

To Southeast Asia, JZJ, 11.80, JLT2, 9.645, 7:30-9:40 a.m.; in French at 8:30 a.m.

To India, JVU3, 11.897, heard irregularly, 7:30-9:40 a.m.

Radio Macao, 7.530, Macao, Portuguese China, heard with English news at 7:15 a.m.; future of this station is doubtful.

CHTA, 15.22, CHOL, 11.72, Sackville, New Brunswick, Canada, heard in test program, 5:45-8:30 p.m. to Caribbean, Central, and South America; English news, 7:30 p.m., sometimes immediately after sign-on.

The BBC was to have resumed GMT as of October 7, 1945.

The only good signal in Los Angeles from the USSR is on 11.78, 10 p.m.-1 a.m., in Home Service only.

KRHO, 17.80, *The Voice of America in Hawaii,* Honolulu, heard signing on at 9:30 p.m. (Morton).

KXG, 10.70, Manila, heard in English about 11 a.m. PJY11, 11.55, Manila, heard mornings in English. KXG carries correspondents' reports for networks. Radio Brazzaville informs that their newscasts now stand (GMT) 10:15 to U.S., 12:15 to Far East, 18:45 and 20:45 to Europe, 22:15 and 23:30 to the United States and Canada. (Curtiss).

XEQQ, 9.680, Mexico City, heard evenings with good signal; XEWW, 9.500, Mexico City, also good evenings, in Spanish. (Woolley).

KRHO, 6.120, Honolulu, heard 11:30 p.m.-2 p.m.; English news on the hour. CBFX, 9.630, Montreal, Quebec, Canada, heard 6:30 a.m.-10:30 p.m., partly in French; good musical programs. LRSI, 6.065, Buenos Aires, Argentina, heard 4-10 p.m. in Spanish and English. (Morris).

COCY, 11.740, Havana, Cuba, *RHC-Cadena Azul,* heard evenings in Spanish and English; strong signals. ZYC8, 9.610, Rio de Janeiro, Brazil, heard evenings in Spanish; fair signals

JZHA, 9.520 sometimes now although should be 9.495, Hongkong, China, heard 4-8 a.m.; English news on the hour. (Freund).

PY11, 11.64, Manila, Philippines, heard in English, 10-11 a.m., relaying American correspondents to networks. KGIM, 13.80, either aboard ship or Okinawa, heard in English, irregularly. VPD2, 6.135, Suva, Fiji Islands, heard Sundays, 1-2:30 a.m., English and native; BBC newsrelay at 1 a.m. FO8AA, 6.98, Papeete, Tahiti, heard Tuesdays and Fridays, 11 p.m.-12 midnight; French and native, no English. KRHO, 6.120, Honolulu, heard 2:15-10:45 a.m.; on 9.65, heard 11 a.m.- 2 p.m. (Hanson).

* * *

ACKNOWLEDGEMENTS

We are grateful for the fine reports and letters received recently. We are always glad to hear from short-wave enthusiasts anywhere in the world. Our especial thanks go this month to the following:

ARIZONA—Morton; AUSTRALIA—Maher; CALIFORNIA—Balbi, Dilg, Curtiss; CANADA—Cooper, Kennedy; COLORADO—Woolley; DISTRICT OF COLUMBIA — Havlena, Netherlands Information Bureau, Embassy of the USSR; GEORGIA — Duggan; ILLINOIS—Clark, Massey, Gutter, Johnson; KANSAS—Seckler; MASSACHUSETTS — Kernan, Cotter, Harris; MINNESOTA—Ecklund; MISSOURI — Kierski; NEW YORK — Kentzel, Yates, Kleinlein, BBC, ABC; NEW ZEALAND — Milne; OHIO — Sutton; OKLAHOMA — Brewer; OREGON — Morris; PENNSYLVANIA — Davis; TEXAS—Freund; VIRGINIA—Howe, URDXC; WASHINGTON — Hanson; WEST VIRGINIA—Gonder.

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LAST MINUTE TIPS

Bill Howe, short-wave editor for the URDXC, reports receiving a verification by regular mail from RADIO ANDORRA, Andorra, LaVieja, *Roch d'Ello Escolls;* verification has picture of antenna towers.

ZOJ, 11.810, Colombo, Ceylon (Southeast Asia Command), is heard 5:55-11:30 a.m., English news at 7:30, 9:30 a.m. This is really DX, especially for East; reported recently from Indiana, Ohio, California.

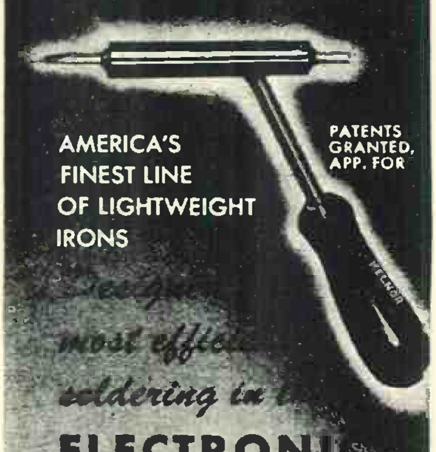
PJC1, 7.250, Willemstad, Curacao, is heard 6:45-9:30 p.m.; verifies with prepared card addressed by airmail to the Gov. Radio & Telephone Administration; requires three weeks to verify.

OLR2A, 6.010, Prague, Czechoslovakia, is now heard 11 p.m.-12:55 a.m. OLR3A, Prague, 9.550, has replaced OLR4A, 11.840, from at least 2 p.m. to sign-off at 5 p.m.; has English news, 3:30-4 p.m.; usually sends fair signal to East.

SUP2, 6.320, Cairo, Egypt, heard recently signing on at 11:30 p.m.

Addis Ababa, Ethiopia, on 6.965, is reported to have English news at 11 a.m.

OIX2, 0.502, Lahti, Finland, is reported as still heard in English, 7:15-7:30 p.m. OIX3, 11.780, Lahti, is scheduled 7:15-7:35 p.m.; 1:30-2, 5-6, 7:15-



7:45 a.m., 12 noon-4 p.m. and 5-5:15 p.m.; good in USA, 7:15-7:35 p.m., fair in afternoon.

CNR1, 12.190, Rabat, French Morocco, is believed off this frequency. CNR3, 16.660, Rabat, is scheduled 5:30-7:45 a.m.

Reports requesting verification from Guam's KU5Q, 7.671, 9.330, 9.670, 12.250, 17.820, should be addressed: CINCPAC, Advance Headquarters, c/o Fleet P.O., San Francisco, California.

TFJ, 12.265, Reykjavik, Iceland has fine signals Sundays, 9-9:30 a.m., believed directed to Sweden. Verification from this station gives only long-wave schedule on 208 kilocycles. TFJ usually comes on the air at 8:55 a.m. Sundays, with 3 bars every minute.

VUB2, 6.150, Bombay, India, is believed to be the station heard around 8:30 a.m. (Dilg). VUD5, 7.295, Delhi, heard after 11:40 a.m., good signals reported in Massachusetts. VUD9, 11.870, Delhi, reported under WOOW, 8-9 p.m. and also after 9:40 p.m. VUD3, 15.290, Delhi, has good signals in the East in 6-7:15 a.m. broadcast; I heard English news clearly from this station recently at 10:30 p.m.

HNF, 9.800, Bagdad, Iraq, is scheduled 8 a.m.-3:15 p.m., according to *Roster i Radio.*

RADIO LUXEMBOURG 2, 6.020, broadcasts 12 noon-2 p.m. and 11 p.m.-2 a.m.

Tananarive, 12.127, Madagascar, is heard 6:15-8:40 a.m., weak but clear.

The three frequencies of Lusada, Northern Rhodesia, are 3.914, 4.900, and 7.220; they operate 10:30 a.m.-1 p.m. daily with a lady announcer, in native tongues.

Radio Tetuan, 6.065, Tetuan, Spanish Morocco, reported 3-4 p.m.

PZX3, 5.750, Paramaribo, Suriname, verifies with a card. PZX5, 15.405, Paramaribo, is heard in Dutch, 11:30 a.m.-12 noon.

Latest available schedule of SDB2 10.780, Stockholm, Sweden, is reported as 12 noon-4:15, 4:20-5:50 or 5 p.m.; English news, 12:40 p.m.

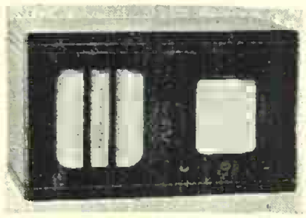
Radio France, 12.120, Algiers, reported to new late sign-off at 5:30 p.m.

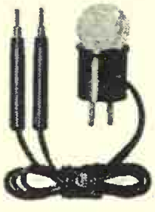
EDV10, 7.010, Madrid, Spain, *Radio Seu,* reported 3-6:25 p.m.

Erivan, USSR, reported heard on 6.766 after 5 p.m. with news at 5:47 and 6:15 p.m.

ZFY, 6.000, Georgetown, British Guiana, rebroadcasts the West Indian Newspaper (originating in Washington, D. C., and radiated nightly 5:15-5:45 p.m. over WRUL, 11.73, and WRUW, 15.35, Boston); at 6:30 p.m. nightly, ZFY relays Radio Newsreel from the BBC, London. Has English news at 6 a.m. Announces schedule as 6-7 a.m., 10 a.m.-12 noon, and 3-7:15 p.m.; gives preview of programs at beginning of radiations.

According to the French Press and Information Service, 501 Madison Ave., New York 22, Radiodiffusion Francaise over *L'Etranger 118,* Champs-Elysees Paris, radiates to Great Britain, in English, 12 noon-1 p.m. on 9.500 and 9.560. Full schedules are available up-





on request to the above address.

Have been hearing KRHO, 6.120, Honolulu, with perfect reception around 4-5 a.m.; they are carried by medium-wave KFAI, 1,010 kcs., on Saipan; on Sunday mornings around 5-6 a.m. KFAI sends a fair to good signal to West Virginia.

XGOY, 7.153, is heard with fair signal, especially Sunday mornings here in East when there's less interference than on weekdays, 5:35 to around 7:30 a.m. fadeout; on 9.810 has good signal to 8:30 a.m.; always has English news now at 8 a.m., irregularly at 6:30 a.m.

VLQ2, 7.215, Brisbane, Australia, heard 2:30-8:30 a.m.; peak is around 6 a.m. when news is given; other news heard at 3, 5, 7, 8 a.m.

Radio Centre, 9.565, Komsomolsk, Siberia, has good signal relaying Moscow with news, commentaries, music, 6:40-7:25 a.m.

The Voice of America in Europe, location unknown, heard mornings in 25-meter band.

OLR3A, Prague, 9.550, heard with English news at 3:30 p.m.

Signals from 15.875, Bern, Switzerland, 2:20-2:50 p.m., are much improved; usually excellent now.

Radio Nacional de Espana, 9.370, Madrid, Spain, puts through a good signal late afternoons; English broadcasts are irregular; usually has English news and commentaries, 3-3:30 p.m., using both man and woman announcer; sometimes English news has been heard at 3:45 p.m.

TAP, 9.465, Ankara, Turkey, heard in English to England, 3:30 p.m., Mondays and Thursdays; has *Postbag* program in English, same time Sundays. Usually has a fair to good signal in West Virginia.

ZQI, 4.700, Kinston, Jamaica, has a fair to good signal, 3:30-6:30 p.m.; peak is around 5:45 p.m. when usually gives English news; sometimes there is bad CW interference.

On Wednesday, August 15, 1945, Brazzaville's FZI, 9.440 and 11.970, inaugurated a special broadcast to Sweden at 8:30 p.m. GMT (3:30 p.m. EST), "due to so much interest from that quarter." Is heard every four weeks on Wednesday.

VLC4, 15.315, Shepparton, Australia, relays BBC news at 11 p.m. for Pacific Forces; another station in 19-meter band (believed to be VLG6, 15.230, Melbourne), is heard in parallel.

ZRK, 5.885, Capetown, South Africa, sometimes inaudible at sign-on, 11:45 p.m., still comes through terrific interference most nights; peak is around 1 a.m. when ZRK relays the BBC newscast from London.

XMHA, 11.86, Shanghai, sang its *Swan Song* shortly after the Japanese surrender; expected back on the air under Chinese control. (Dilg).

VUD7/10, 9.635, Delhi, India, has good signal to West Coast, 9:50-11 a.m.; breaks for 15 minutes and returns at 11:15 a.m.; heard until after 12 noon, but fades out soon after that. (Dilg).

Radio Eireann, Dublin, is scheduled

12:40-1 p.m. on 17.840; heard well here most afternoons. On 9.595, is scheduled 4:10-4:35 p.m.; this frequency has not been heard here for several months.

The following last-minute tips on the Far East situation were furnished by Paul Dilg, Monrovia, California:

JAPAN—Appears to have eliminated all English news; using JVU3, 11.897, on at 10 a.m., leaves the air at 10:30 a.m.; program consists of Jap talk and music. At 11 p.m. use JLP2, 15.325. It is believed that JLT, 6.19, is used mornings around 7 a.m., but not positively identified; also JLG, 7.285, same time, appears to be in parallel. JL2, 9.645, is heard with poor modulation around 8 a.m.

American-controlled stations in Tokyo are JLU2, 9.525 and JL3, 15.225, the latter being used after 5 p.m. Announced they would be also on JZK, 15.160 at 4:30 p.m.

HONGKONG—Now under British control; gives the call ZBW, using same frequency of 9. 495; heard around 7:30 a.m., weak signal, is blotted out by XEWW, Mexico City, when they come on the air at 8 a.m.

MALAYA—The first day under British control used 9.555 and 11.855, the latter being weak; gave schedule in Malayan time; announced schedule equivalent to 11:30 p.m.-1:30 a.m. and 5:30-10:30 a.m.; did not state frequencies but stated they were using 25 and 31 meters. Had English program at 8:30 a.m.

MACAO—The Portuguese China station on approximately 7.53 was still on the air the second week of September; audible when KU5Q was not broadcasting; signal was rather weak.

SHANGHAI—XGOO, 11.695, audible around 8 a.m. when HP5A, Panama, is not on; schedule unknown, but heard as late as 9:30 a.m. Reads POW messages; heard reading dispatch for Tass News Agency in Moscow. At times breaks and calls XGOA, Chungking.

INDIA—VUD, 9.635, Delhi, has very good signal around 9:50 a.m.; sometimes has special programs earlier. VUD6, 9.68, comes on at 8:15 a.m. but it is believed they have an earlier transmission around 7:30 a.m.; signal at best is only fair; program is native; badly QRMed.

VUD5, 7.275, consistently good around 9:15 a.m. Calcutta on 4.84 is weak at 8:20 a.m.; will probably shortly move back to 3.305.

FRENCH INDO-CHINA — Radio Saigon is still off the air. (The FBIS, however, advised that Saigon on 11.778 was still operating, but irregularly; it was recorded signing off at 5:05 a.m.)

By the time you read this, KRHO, Honolulu, will probably have dropped its transmissions in 31- and 19-meter bands, to be heard on 17.80 from 3 p.m. to around 2 a.m. The Australian broadcast on VLG3, 11.71, is also carried by two 19-meter stations, VLC4, 15.315, and VLA6, 15.200, 10 p.m.-12 midnight.

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Radar Terms

(*Continued from page 44*)

Indicator—Any of several types of cathode ray oscilloscopes.

Indicator gate—See Gate.

Isolating circuit—A stage which passes signals in only one direction through a circuit.

Klystron—A velocity modulated tube used to produce low-power u.h.f. oscillations.

Lighthouse tube—A high-frequency triode of special design used to produce u.h.f. oscillations of medium power.

Limiter—A circuit which limits, clips, or removes either (or both) the positive or negative extremities of a wave form.

Listening period—The time during which a radar transmitter is quiescent or not radiating energy.

Magnetron—A high-frequency magnetic-field diode of special design used to produce u.h.f. oscillations of very high power.

Main pulse—See Transmitter pulse.

Master oscillator—A source of timing oscillations which control or affect all other radar circuits.

Microsecond—One millionth of a second.

Modulator—A circuit which directly controls or triggers the radar transmitter.

Multivibrator—A relaxation oscillator which oscillates of its own accord (a free-running multivibrator), or which oscillates only when triggered by an external voltage.

Peaking circuit—A differentiator circuit used to sharpen a wave form.

Peak power—The maximum output power of an r.f. pulse at the transmitter.

PPI-Scope—Plan Position Indicator. A radial time base displaying range and azimuth.

Presentation—The form in which radar echoes appear visually on an oscilloscope.

Pulse—A sudden change of voltage (or current) of brief duration.

Pulse duration—The time duration of a pulse.

Pulse generator—See Electronic timer.

Pulse rate—See Pulse recurrence frequency.

Pulse recurrence frequency or p.r.f.—The timing rate of radar pulses, originating in the electronic timer.

Pulse recurrence time—The reciprocal of pulse recurrence frequency.

Pulse width—See pulse duration.

Quiescent period—See Listening period.

R.F. oscillator—Output stage of the radar transmitter in which u.h.f. oscillations are generated.

Range—The direct-line distance between a radar set and a target.

Receiver—The component of a radar set which receives, detects, and amplifies echoes reflected from targets.

Recurrence rate—See Pulse recurrence frequency.

Reflector—A metallic object or surface behind a radiating dipole to reinforce radiation in a desired direction.

Repetition rate—See Pulse recurrence frequency.

Ring oscillator—Any number of pairs of high-frequency triodes operated as an r.f. oscillator in a tuned-grid tuned-plate circuit.

Rotary spark gap—A pulse-protruding device in which circularly arranged electrodes are rotated past a fixed electrode producing periodic high-voltage arc discharges.

Saturation limiting—Limiting action of an amplifier when operated beyond the point where grid current flows.

Scanning—The direction of pulsed r.f. energy over or across a given region or area.

Sea return—That part of the r.f. pulse reflected by water surrounding a sea-borne radar set.

Selsyn—Single-phase, self-synchronous device for converting mechanical position to an electrical signal, or vice versa.

Spark gap—An arrangement of two fixed electrodes between which a high-voltage arc discharge takes place.

Squegging oscillator—An extreme form of grid blocking in an r.f. tuned-grid tuned-plate circuit.

Sweep—See Time Base.

Synchronism—The relationship between two or more periodic or recurrent wave forms, when the phase difference between them is zero.

Synchronizer—See Electronic timer.

T-R switch—A device which switches a radar antenna between the radar transmitter and receiver, preventing transmitted energy from reaching and damaging the receiver.

Tail—Attenuated decay of an r.f. pulse.

Time base—The trace produced on the screen of a cathode-ray tube by deflection of the electron beam.

Time constant—An indication of the speed with which a circuit can be charged or discharged.

Timer—See Electronic timer.

Transmitter pulse—Burst of r.f. energy radiated by the radar transmitter. The pulse appears as a strong signal at the left end of the oscilloscope time base.

Unidirectional—In one direction only.

Video amplifier—A circuit amplifying a very wide range of frequencies which includes and exceeds the audio range.

Wave guide—A hollow pipe or tube, having a circular or rectangular cross-section, used to transmit r.f. energy.

—30—

112 Mc. Receiver

(*Continued from page* 31)

system, it will be necessary to use some other means of coupling.

Several coils may be seen in the under view of the chassis that are not shown in the diagram. In all cases, they are filament chokes located in the heater leads of the various tubes, and were added as an additional precaution when the receiver was first constructed. Their use is not necessary except in the case of the oscillator choke, *RFC*. This consists of 5 turns of #22 pushback wire wound to a diameter of ⅜" and a length of 1".

When construction has been completed, the first step is to align the i.f. system, using a signal generator or some other source of signal at 15 mc. Alignment is carried out by disconnecting C_8 from the grid of V_2, removing V_9, and applying the lead from the signal source in its stead. Beginning with T_4 and working backwards, the stages are aligned in order to give maximum response. Tuning of these stages will be relatively broad and, barring errors in wiring, no difficulty should be experienced in this operation.

After the alignment of the i.f. has been completed, the lead from C_8 should be re-connected, V_9 replaced, and the signal from a high frequency signal generator or low powered transmitter applied to the antenna terminals. With the tuning condensers at minimum capacity, the padder condensers should be set to bring in the high frequency end of the 112 mc. band. When this has been completed, the tracking should be checked at various points in the band as the tuning condensers are varied. It is probable that the coils will require some adjustment, squeezing the turns together slightly to lower the frequency, and spreading them to raise the frequency. It may also be necessary to vary the bandspread tap slightly.

The receiver was designed to cover a range of 112 to 116 mc. but if a greater range is desired, the bandspread condensers may be moved to the top end of the coils in which case the range will be approximately 100 to 116 mc. This range can be shifted somewhat by means of the padding condensers to give approximately 16 mc. at any point in the range of the receiver.

The selectivity of the receiver, as shown, is rather broad in order to accommodate modulated oscillators. If it is desired to increase this selectivity, the 10.000 ohm resistors across the windings of the i.f. transformers should be replaced with ones of higher value. 50,000 ohms represents a good compromise value. If this change is made, it is well to loosen the coupling of the i.f. transformers by spacing the windings 1" to prevent double peaks.

The *S* meter indicates relative signal strength and may be calibrated in arbitrary units to suit the user. In use the reading will never fall completely to the zero mark even with a strong signal, as there is always some plate current flow, even when the a.v.c. circuit develops a high grid bias. This is not troublesome as the meter may be set to give an optimum reading on a strong signal by adjusting the meter resistor R_{11}.

Future plans for the receiver call for the addition of a provision for FM reception, as well as some means of varying the selectivity by means of a panel control. There is also a possibility that the r.f. coils may be made plug in to allow coverage of additional bands.

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Saga of the Vacuum Tube
(*Continued from page* 56)

quired a higher anode voltage (up to 150 volts) for good operation.

World War I, with its imperative demands for communication equipment, brought about forced draft development in Britain as well as in America. When the need for vacuum tubes in quantities became manifest, the British military communications officers could turn only to the incandescent lamp manufacturers for production in quantity. These manufacturers, like the General Electric Company in America, made use of the materials and techniques with which they were familiar, and the background of the makers was reflected in the product. They abandoned the oxide-coated cathode of Round and went to a filament of tungsten, in the working of which they were experienced. This channeled the development along incandescent lamp lines, in order to permit of quantity production in the shortest possible time.

In America, where the high vacuum tube was developed from 1913, the situation was different. For military purposes, the American government had another source of supply in the Western Electric Company, who by the time of the war were already manufacturing high vacuum tubes for use in the telephone system. Their development had followed a different line. Their thinking was also conditioned, not by experience in the manufacture of similiar devices but by the objective of insuring the operation of the device over long periods, with complete reliability and uniformity of characteristics, and with only infrequent routine attention. In the quest of this desideratum, they had surveyed the possibilities and had focussed their effort on the oxide-coated cathode as being the best suited to these requirements. Hence, in this country, development had proceeded along both paths and in the end both types of tubes were used by the armed services.

The result of these parallel lines of development is that there are excellent cathodes of either type available today. The tungsten filament has proven to be peculiarly well fitted for use in large transmitting tubes while most of the tubes used in the home radio receiver are of the oxide-coated cathode type.

CAPTIONS FOR ILLUSTRATIONS

Fig. 215. Osram type "R" with European base. Photograph courtesy Bell Telephone Laboratories.

Fig. 216. Dimensions of European base.

Fig. 217. Osram R4A valve equipped with candelabra base. Photograph courtesy Bell Telephone Laboratories.

Fig. 218. Osram R4B valve with European base. Photograph reproduced from page 646 of Wireless World for August 19, 1922.

Fig. 219. Osram R5 valve. Photograph courtesy Bell Telephone Laboratories.

Fig. 220. Air Force "C" valve. Photograph courtesy Bell Telephone Laboratories.

Fig. 221. Two views of Marconi V24. Photograph courtesy Bell Telephone Laboratories.

Fig. 222. Marconi type "Q" valve. Photograph courtesy Bell Telephone Laboratories.

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(To be continued)

Electronic Volt-Ohmmeter

(Continued from page 50)

lating tube, sometimes called a cathode follower. This cathode follower is a simple resistance coupled amplifier, the entire load resistance of which appears in the cathode circuit. Any input voltage applied to the grid of the tube will cause an increase in current through the tube and a consequent increase in the voltage at the cathode. This increasing voltage is in opposition to the action of the initial applied voltage, consequently reducing the effective amplification of the tube. The final result is that the tube does not amplify at all; the voltage at the cathode "follows" that at the grid, to a close approximation. However, one useful purpose has been achieved. The *input* resistor for the cathode follower stage can be made very high. The *cathode* resistor can be of the order of

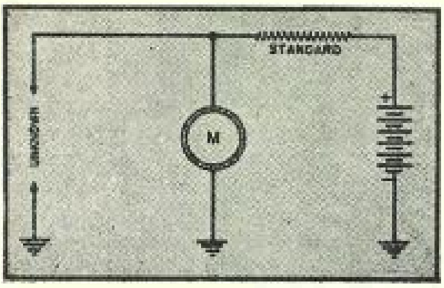

Fig. 5. Basic design of Ohmmeter portion of the instrument.

a few thousand ohms. By coupling the grid of V_1 to the cathode of this cathode follower, we can then have a very low grid resistor in our bridge tube and still maintain a very high input impedance to our electronic measuring instrument.

The final circuit of the meter, the construction of which is being described, is shown in Fig. 4. A pair of 6F6 tubes, triode connected, have been chosen for the bridge tubes. A 5 ma. 9" meter was used for the indicator. A 6SL7 tube was used for the cathode follower. It will be noted that the other half of the 6SL7 has been used to connect to the opposite grid of the bridge. This provides a convenient means of setting the meter to zero and also helps stabilize against line voltage fluctuations. The addition of resistors R_{16} and R_{17} provides inverse feedback for further stabilization against line voltage fluctuations and also against changes in tube characteristics. The range switching circuit is a simple voltage divider, made up of an 11 point single deck rotary switch and a number of resistors. These should be the best quality obtainable, as the accuracy of the meter depends upon them. However, carefully selected carbon resistors may, if necessary, be substituted.

The ohmmeter section of the meter uses a 6 volt battery in a *voltage divider* type of ohmmeter circuit (Fig. 5). The basic sensitivity of the meter is 6 volts, so that the meter will read full scale when switched to ohms. By shorting the test prods together, the meter will obviously read zero, as this essentially shorts the input terminals of the meter. On the low ohms range, it can be seen that a ten ohm resistor, connected between the test leads, will cut the voltage at the meter terminals in half, as the six volts are now connected across two ten ohm resistors in series, the voltage across only one of which is applied to the meter. This, obviously, will cause a half scale deflection of the meter. Similar values can be calculated for various values of *unknown* resistors and a chart to facilitate calibrating the meter scale is shown in Table 1.

The power supply is a simple RC filtered full-wave, high vacuum rectifier, using an 80 tube. Regulation was found unnecessary, as wide line voltage fluctuations caused practically negligible changes in voltage and resistance readings.

Ohms Resistance	Voltage Reading (on 6 v. scale)
TABLE I	
.5	.3
1	.55
2	1.
3	1.4
4	1.75
5	2.
6	2.25
7	2.5
8	2.65
9	2.8
10	3.
15	3.65
20	4.
30	4.5
40	4.8
50	5.
75	5.3
100	5.45
500	5.75

Table 1. Meter scale calibration.

The entire unit is constructed on a chassis made of 18 ga. galvanized iron. This chassis is approximately 8"x12" at the top, and 10½"x12" at the bottom, having a sloping front panel to provide for easy visibility and control of the various operating controls mounted thereon. It is 3¼" deep. A sub-panel is used for mounting the tubes and power transformer and control R_{22} is also mounted on this sub-panel. R_{22}, incidentally, is a screw-driver operated control, and once adjusted this control need not be touched, except when changing tubes or parts in the bridge circuit. Its purpose is to set the full scale reading of the meter to the proper value on the low range (6 volts).

All other controls are mounted on the sloping front panel. This makes for easy wiring and a neat appearance. The phone jack through which all low voltages are read and the pin jacks for resistance measurements are also on this front panel. A large porcelain feed-through insulator serves the double purpose of providing adequate insulation for the high voltages applied through it (up to 6000 volts) and of necessitating the use of a test lead, particularly for high voltage. The banana jack at the end of the insulator will not fit a standard pin plug and thus protects the operator from the careless use of a standard test prod for high voltage measurements.

The ohms zero potentiometer is equipped with a switch which removes it from the circuit when it is turned full counter-clockwise. This makes possible an exact zero setting when on the ohms ranges, but allows the initial setting of the calibration potentiometer (R_{22}) to control the meter reading when on the voltage ranges.

The other control on the front panel is the polarity switch *SW-2*. This simply reverses the meter's polarity, so that a voltage of either polarity with respect to ground can be made to give an up-scale deflection on the meter. This switch must be in the positive position when the meter is used for measuring ohms.

The resistors used for multipliers and resistance standards are mounted on a fibre terminal strip immediately to the rear of the front panel. The battery which is used for resistance measurements consists of four penlight cells connected in series, and mounted in an insulating sleeve between the resistor terminal strip and the front panel of the meter chassis.

Other details of construction should be obvious from the photographs and schematic diagram. Incidentally, the meter used on the model described herein was a 5 ma. 9" milliammeter, salvaged from one of the old *counter* type tube checkers, vintage 1920 some odd.

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Radio Jobs for GI Joe

(Continued from page 28)

Another department visited was the line section. In this section, radio mechanics install and remove radio equipment in planes. They do not overhaul or repair the equipment, as this is done by the department mentioned above. However, the "line" radio mechanics must possess at least an FCC radio telegraph license or better, and they are usually men who have had previous experience in the overhaul and repair shop. Their duties are a little more specialized, in that they inspect and test the equipment before and after installation, make numerous radio checks with the control tower and other points.

For those "brass pounders" who are wondering where they fit in—there are ground station operators' jobs available, in which a radio man merely pounds brass. For this particular operator's job an applicant must have not only an FCC radio-telegraph license, but must have a code speed of not less than 25 w.p.m., and the ability to type, which is obviously necessary. In addition to these requirements, all radio operators must be certified by the CAA; which certification is obtained by the employer. The ground station operator's job is not one of continuous eight hours of "brass pounding" however, as Pan American has formulated some very interesting courses of learning, to break the monotony. The operator is allowed training in both meteorology and navigation, so the opportunity to advance himself is within easy reach. It might also be well to mention that these ground station operators are not required to repair or do maintenance work on their radio equipment.

One of the most interesting radio positions of which we have heard, seems to be that of a flight radio officer. To you fellows who like to travel a little, have the qualifications to offer, and desire the touch of romance added to your work, we would suggest that, by all means, you try for this particular job. It is not expected that you have experience right "off the bat" as a flight radio officer, as you will go to school, but there are a few requirements set up. A code speed of at least 15 w.p.m. is necessary, as well as some radio experience.

Applicants for radio mechanics; radio ground station operators; and flight radio officers' positions with Pan American Airways system must be at least 21 years of age and not more than 29 years of age. They must have had some experience in radio, a knowledge of code, and a bona fide interest in radio. They will be expected to pass certain aptitude tests and I. Q. examinations. Certain disabilities will be allowed radio mechanic candidates, but no disabilities will be permitted for flight radio officers. All candidates selected for radio positions will be given a three months' training course at Pan American's special training schools, Coconut Grove, Miami, Florida. This training consists of radio, both practical and theoretical, radio construction and repair, radio code, blinker and semaphore, radio telephone procedure, and emergency duties.

After the training period, those individuals who aspire to become flight radio officers are given a further eleven weeks' training in navigation, meteorology, seamanship (theoretical), first aid, swimming, life saving, and culture. The latter course involves customs, history, and a working knowledge of the language of at least one of the countries to which they will ultimately fly.

Under the GI training program, an applicant who qualifies, may take a special training course on the job in any department, of the particular company he selects, provided that company has been recognized as an approved training institution under the GI Bill of Rights. This means in substance, they obtain a job and learn as they go along, until they reach the final classification they have set for themselves. The government pays the difference between salary received from the company, and that of the classification they will eventually attain. Any veteran who served 90 days in the service and receives an honorable discharge is eligible for this program.

The broadcast field seems to be of particular interest to a very large percentage of returning GIs. When we say broadcast, we include standard broadcast and FM. While most of the jobs in this field are of a highly technical nature, and usually require an FCC first class radio telephone "ticket," there are a number of jobs which do not require vast knowledge or experience. Control room operators or technicians fall in the latter classification. Their duties usually consist of placing microphones, regulating volume ("riding gain"), mixing circuits (fading speech and music in or out), operating transcription turn-tables, cueing in records, balancing program lines before broadcasts, and operating speech input circuits. These men are expected to be able to repair their own equipment in the event of a breakdown; however, they are also expected to be able to use their own judgment as to whether it would be desirable and expedient to merely switch on an auxilliary unit. Desirable qualifications for such positions are good hearing, mental dexterity, an ear and appreciation for good music, and supple wrists and agile fingers to manipulate the maze of plugs, switches, and controls before them.

All programs are timed to a split second and adhere to a rigid time schedule, so for this reason, control room operators must have excellent training in attaining time consciousness. Most stations prefer to hire men with at least a second class FCC radio-telephone license, as a holder of such a class license evidently knows something about radio. However, if you can demonstrate your ability or knowledge otherwise, a ticket will not be a necessity for obtaining the job. On the other hand, if you intend to "get any place" in the broadcast field, you will eventually have to have one —so get it now!

For you who aspire to become broadcast transmitter engineers, or radio operators, an FCC first-class radio-telephone license is the first requirement, plus a thorough knowledge of transmission lines and antennas (both theory and practice). In fact, you must be well versed in all phases of power and communication engineering. An inherent sense of responsibility is necessary since you will be in close association with very-high voltages and currents and will be trusted with the upkeep of costly equipment. Anyone holding a first-class "phone" ticket is well aware of a transmitter operator's duties. There will not be too many openings in this type job, as most of them will be filled by former employees returning from service, and former control room operators advancing. With the balance of the jobs, it will be "first come, first gets." Too, it is not expected that the broadcast companies will spend the time or effort to train anyone, as both experience and knowledge are requisites for this type position.

Television broadcast positions will closely parallel those of the standard broadcast, except for the many new positions such as video operators, camera men, light men, boom microphone operators, sound effects men, technical directors, and technicians of various kinds.

Because of the highly complex nature and newness of most jobs, practically all the television broadcasters have well established training programs in which men will be paid as they learn.

Police and fire departments will hire radio operators possessing at least an FCC second-class telephone and second-class telegraph license. These men will be hired with the same rank and pay as that of police inspectors.

Although the primary purpose of this article is to show how certain jobs in the service parallel those in civilian radio industries, the writer has no intentions of taking titles such as radio technician second-class, technical corporal or radar technician and making the statement that any one of these men can handle any one or more of approximately eighteen jobs in civilian radio industries. This would not be a true parallelism because the technical corporal may have operated a motion picture projector, may have been a radio mechanic, or may even have been strictly a radio operator. The radio technician second-class was possibly a radar technician. This, incidentally brings up a very pertinent point. It is an established fact, that all of the civilian radar manufacturers have maintained highly trained civilian field engineers, whose job has been to travel all over the world installing, servicing, and maintaining radar equipment for the armed forces. For this reason, radio men in the armed forces have had little or no occasion to repair or service radar equipment in the field. When something does go wrong, the radar technician has, on occasion, referred to a bulky instruction book, telling him exactly what to do for that particular incident.

The most sensible procedure in comparing your service job with a job in civilian radio would then seem to be to forget your title or rank, and compare your duties for your particular work with those of the work you intend to follow. Perhaps, you will be able to walk right into the civilian job immediately upon discharge; on the other hand, you may need additional training, or an FCC radio operator's license of some particular class. Then again, while it would seem, after a casual resume, that your service job seems to parallel to certain civilian radio job, it actually may not, and may be out of your reach for a number of reasons.

In the foregoing, we made an attempt to brief certain desirable civilian radio jobs. We say desirable, because most of the returning veterans seem to indicate a preference for them. However, about the best way of enabling a GI to decide just what radio jobs he can best fit into, is by means of charts, showing how his service experiences actually parallel qualifications for civilian jobs.

Despite the continually growing shortage of radio tubes and other radio parts, a large percentage of returning servicemen who have been in radio in the armed forces wish to go into the radio business and open their own repair shop. The picture seems to become more complicated all the time, with the returning GI impatient to open a business, not taking time to consider the fact that should he fail, he will not be given a second chance. Under the GI Bill of Rights, he is allowed only one loan and he must, thereafter, apply for credit assistance through normal commercial channels. With the advent of new radio sets ready to roll off the assembly lines of radio manufacturers any day, the idea is not a sound one, in most cases.

We have heard considerable talk of, "I'm going to South America after the war, to work." In most instances, this would be a very foolish move on the part of any American radio man. Opportunities are not as plentiful or as easy as they are painted by certain individuals. The peoples of the South American countries are becoming increasingly nationalistic minded. Evidence that many American radio and communications industries are well aware of the situation is the fact that they are training the peoples of those countries in which they intend to operate, rather than send Americans to work there. Pan American Airways systems has already started radio schools for ground station radio operators of seven of their bases in the lower Caribbean area. The three schools in operation at the present time are in San Jose, Costa Rica; Port of Spain, Trinidad; and Martinique. Additional schools will be opened later, in various parts of South America.

Civil Service will, of course, be an excellent placement medium for certain type radio jobs. It is propitiously set up for efficient handling of all applications, since it has been consistently engaged in such procedure for many years, advancing in knowledge and equipment as the demand increased and expanded.

The CAA and FCC will soon inaugurate many civil service jobs in radio which can be filled by returning veterans. If a returnee was fortunate enough to have worked directly with radiosonde, or other meteorological equipment used in conjunction with radio and direction finding, then he has some of the basic requirements for many of the positions which the CAA will no doubt have to offer, such as radio operators or traffic control operators, meteorologists, radiosonde technicians, radio mechanics, and inspectors.

With the approach of television, FM and new standard broadcast stations, radio equipped taxi-cabs, trucks, small boats, and possibly radio controlled equipment such as planes, a demand for an accompanying expansion of regulations is imminent and for this reason it is assumed that necessary jobs such as radio inspectors and examiners will be established in addition to numerous new positions which will result from the predicted expansion of post-war commercial airline routes, plus the entry of the family airplane into transportation circles.

Physical requirements for CAA positions, such as control tower radio operators, will be high in respect to vision and hearing. It will also be required that applicants have negative responses to tests for stomach ulcers, nervous disorders, hay fever, and other chronic diseases. This does not mean however, that disability such as amputations needs be considered a barring element for veterans.

Experience in military air traffic will naturally be preferred as those who are so trained will be able to step into advanced positions without benefit of further instructions. Nevertheless, a knowledge of airlanes, traffic patterns, aircraft maneuvering, and physical problems attached thereto, will be distinct assets to those veterans who aspire to such positions.

It is to be expected that the educational requirements for such positions will vary in accordance with experience. As a general rule, completion of high school will be the accepted minimum.

In addition to the base pay accorded these jobs in line with established Civil Service scales, overtime compensation will be in order, as well as pension facilities in line with present Civil Service regulations, plus five points' benefit for war veterans without service-connected disability, and ten points benefit for those with service-connected disability.

Here, we feel that certain phases of the point system within Civil Service should be explained. It has been said that preference will be bestowed upon veterans in seeking civil service positions. By that, it is meant that a veteran with a service connected disability will be given ten additional points towards his earned rating, and placed at the top of the list of eligibles, or five additional points if it is not service-connected disability. However, in spite of the above, it must be remembered that after securing the job, should a reduction in force become necessary in the agency or department to which they are ultimately assigned, there are certain rules governing such a reduction that would course affect them.

In reducing Civil Service personnel, the number of accrued points are the deciding factor. The additional points given the veteran at the outset are only in connection with securing the job and should not be confused with those points given during time for employment. These latter points depend upon retention credits, involving length of service, (1 point for each full year's service) and efficiency ratings, (80 points for "good," 88 points for "very good" and 96 points for "excellent." No points are given for "fair," and demotion or termination of employment usually follows such a rating.) Both veterans and non-veterans have equal opportunity to amass efficiency points, but it should be remembered that length of service plus efficiency ratings may give the non-veteran a "slight edge" over the returnee, in case a forced reduction occurs.

At the present time, the personnel, or public relations department plays a major role in the placement and subsequent performance of an employee in most large and progressive plants. If a great deal of foresight has been used in the selection of individuals within such departments, a new employee stands a much better chance of succeeding in his particular endeavor. By that, we mean that the intelligent use of existing information in the parallelism of service jobs to plants will be simplified in those plants where the manager interviewer, job instructor, and department head have an unclouded over-all picture of the returnee's place in civilian life.

The principal requisite, as we see it, for efficient and expedient job placement of veterans will be the thorough knowledge and understanding of those jobs in service which have counterparts in civilian life. A complete list, with cross reference information will be necessary for all interviewers before they can attempt to place or counsel any returnee applicant.

For maximum efficiency in the radio placement fields, technical men are needed, men with a thorough knowledge of radio and a vivid picture of their particular plant's needs and the qualifications for those needs. With this foundation, these men should be well versed in the jobs in the service and the training and experience derived from such jobs—not through information gleaned from some publication, but from top authorities in all branches of the service. Being so informed, it would then be a comparatively simple matter to make a conclusive chart or cross reference job analysis for their own particular use. These technical men are essential to the staff of personnel and public relations departments for the obvious reason that technical applicants "know the score," and are only satisfied when talking to someone on familiar ground, and on the "same frequency" level.

In too many instances, it has been found that personnel or public relations executives and those working under them, are too arrogant. They "pull their rank" whenever the opportunity presents itself. In prewar days, they could afford to be indulgent with prospective employees, as qualified help was plentiful. With the advent of war, and the subsequent help shortages, this condition was mollified in a measure, and it became the applicant who could show his independence.

Now, with postwar activity a present reality, a middle-course must be trod by both employer and employee. Competition will be keen in all fields, for both industrial organizations and workers.

A pertinent need for "down-to-earth" humanism, together with a thorough understanding of the entire industrial picture is needed. Many "swivel-chair" personnel employees have never taken a trip through their organization or plant, have never made a study of the jobs in the company and the qualifications for their fulfillment. This, many authorities will challenge, is because there is no such need, but if these individuals are to act as recognized representatives of management, they must be equipped to qualify as such. A great many reasons may be advanced for this seeming negligence. The most obvious one appears to be that most personnel workers are segregated within their department; that is, they know and perform one particular job, such as maintaining employee records, and have little or no knowledge or interest in other related jobs.

Every member of the department should be able to "take over" whenever necessary. In order to do this, it is of course an undisputed fact that they "know the ropes," and are sufficiently informed on all aspects of personnel procedure. Knowing employees and perhaps some personal items surrounding their "off-work" hours is conducive, naturally, to a closer relantionship between employee and management, and can, in many cases, avert misunderstandings. As Dale Carnegie says in his book, "How to Win Friends and Influence People," "a man's name and that of his family are to him, the most important things in his life."

If more humanism was practiced within industry, less turnover would occur. It's all very well to make fun of the "big family" attitude of many far-sighted companies toward their employees, but scrutiny of their records will show the returns it yields.

All things considered then, it is definitely established that there are many jobs in radio and allied fields which American GIs will be able to fill, upon their return to civilian life.

The "short cut," as we see it, for them to assure themselves of a job in this "bumper field," involves certain rules:

1. After taking "stock" of themselves, their interest, potentialities and experience, just what field of endeavor do they wish to follow?

2. What do they have, from prewar day, to fall back upon and that will benefit them now—education, experience, and interest?

3. What did they glean, from those weeks, months, or years spent in alien atmosphere of service, that will now be of benefit to him in the field he has chosen to enter?

4. What civilian jobs in radio do his particular qualifications and potentialities parallel?

The rest is, of course, up to him. What he makes of his life and its latent talents will not be submerged in the continuous ebb and flow of American life, if he is conscientious about its survival. All Americans are eager to help him in his return to civilian life. What he makes of that gesture is of course what he will reap from it.

Radio and allied industries will employ the services of thousands in the near future. They offer unlimited chances to the men who are earnestly interested in getting ahead and who have the qualifications with which to enter the field. Television, standard broadcast, FM, manufacturing, and micro-wave stations will all provide adequate openings in a "sure thing" for the far-sighted returnee.

Commercial airlines offer much inducement to the returnee, both in romance and stable prospects for the future, with "on the job" training.

Unless a veteran is "well-heeled," he should think twice however, before launching himself in a business of his own, as he may have a rude awakening upon application of a second loan, or an extension of the first one.

Civil Service, being a stable branch of the government, may be a "good bet" for many returnees and should be examined for entrance, if it appears interesting or seems to hold possibilities for the use of particular talents.

It is suggested that those returning to civilian life should make all possible effort to enter their chosen field of endeavor as soon as possible.

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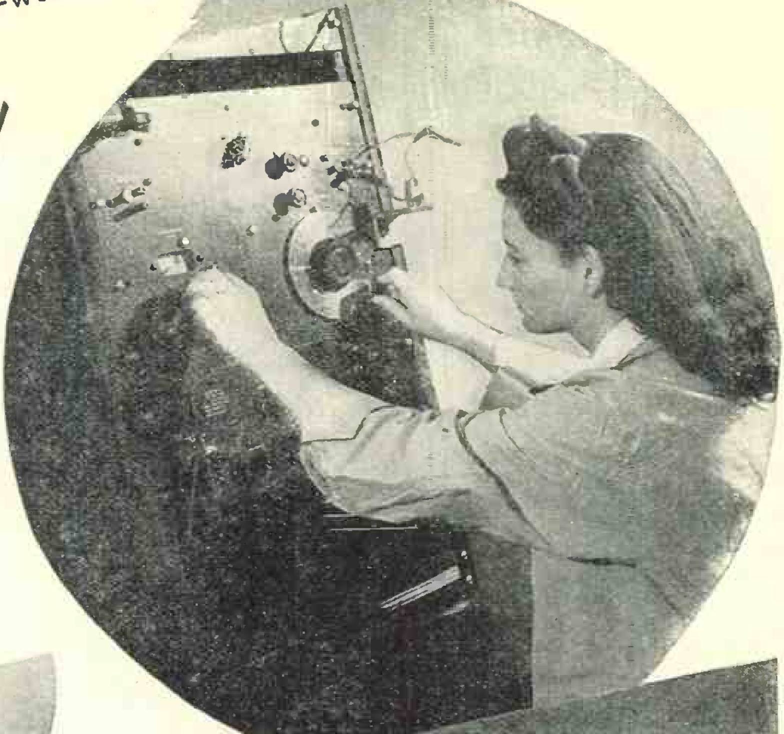

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NEW INSTANT-HEATING BEAM TETRODE

Ruggedized 2E25

FOR MOBILE OPERATION

Developed for Signal Corps portable, mobile, or emergency communications equipment, the 2E25 r.f. beam tetrode is easy on the battery. The thoriated tungsten filament permits simultaneous application of filament and plate potentials. Precious battery power is conserved during standby periods.

Completely shielded for r.f., the 2E25 requires no neutralization even at its maximum frequency of 100 megacycles. Other features are: low-loss octal base, plate connection to top cap, filament potential centered at 6.0 volts, and extremely rugged construction.

Consider the advantages of the 2E25 as an instant-heating replacement for the 6V6GT or 6L6G in older equipment, or for use in modern equipment such as the new Kaar mobile FM set illustrated. Remember, the versatility of the 2E25 beam tetrode simplifies the spares problem; this one type can power a whole transmitter—R.F. and A.F. Order your engineering samples today.

HYTRON 2E25

Instant-Heating 15-Watt R.F. Beam Tetrode

TENTATIVE ELECTRICAL DATA

Filament Potential	6.0 ± 5% ac or dc volts
Filament Current	0.80 amp.
Plate Potential	450 max. dc volts
Screen Potential	250 max. dc volts
Grid Potential	−125 max. dc volts
Plate Current	75 max. dc ma.
Plate Dissipation	15 max. watts
Screen Dissipation	4 max. watts
Grid Driving Power (Class C)	0.5 watt approx.
Power Output (Class C)	20 watts

AVERAGE DIRECT INTERELECTRODE CAPACITANCES

Grid to Plate (with external shielding)	0.18 max. mmfd
Input	8.5 mmfd
Output	6.0 mmfd

MECHANICAL DATA

Maximum Overall Length	4 3/16 inches
Maximum Diameter	1 7/16 inches
Bulb	T-11
Cap	Small metal
Base	7-pin med. short shell low-loss octal

The New 2E25 Supersedes and Replaces the HY65

New instant-heating mobile FM transmitter developed by Kaar Engineering Co. uses 7 Hytron 2E25 and 2 Hytron HY69 or HY1269.

WRITE TODAY to Dept. 18 for these: New Hytron transmitting and special purpose tube catalog; 21 x 17 inch sheet illustrating Step-by-Step Assembly of Typical Hytron Tube.

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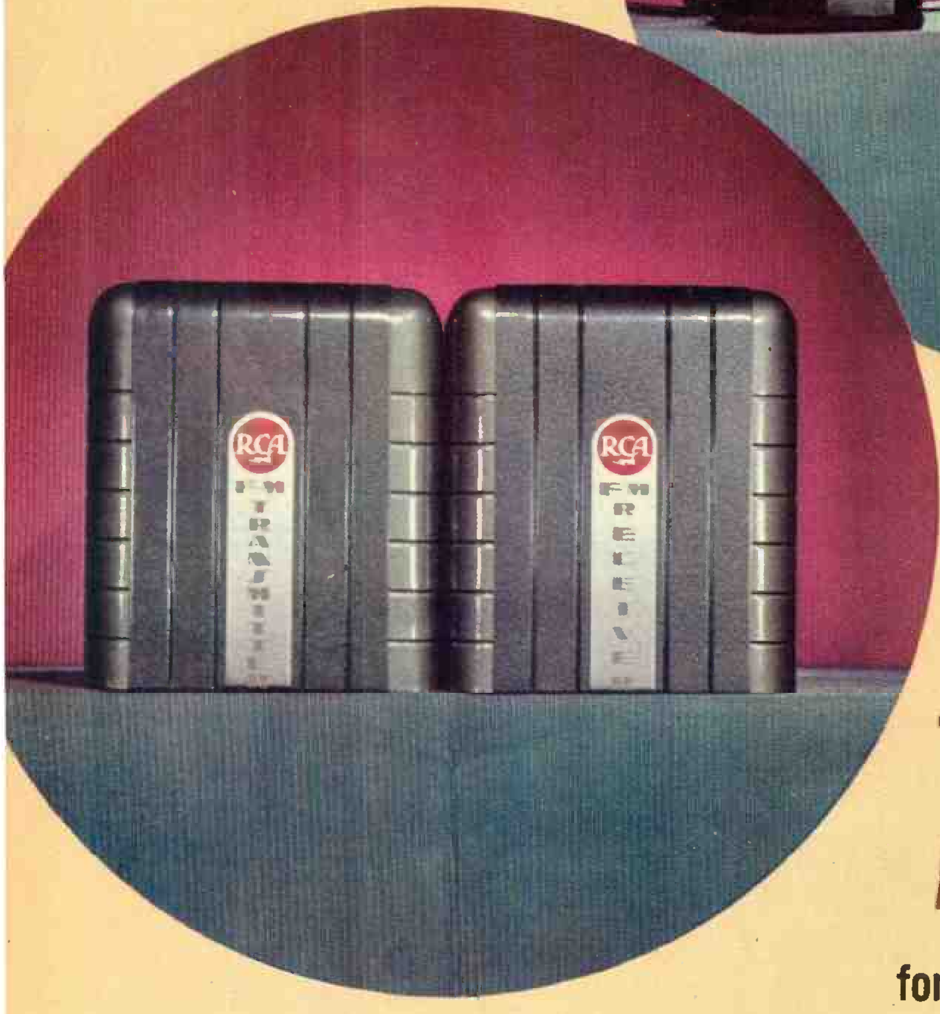

ABOVE: Station Handset and Control Unit — Control unit contains loudspeaker, plus controls for adjustment of "volume" and "squelch." Also, "transmit," "receive," and "stand-by," signal lights.

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