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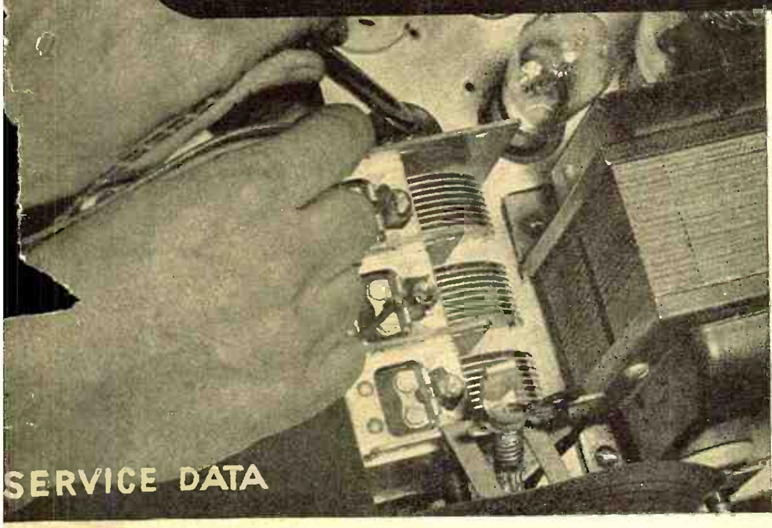

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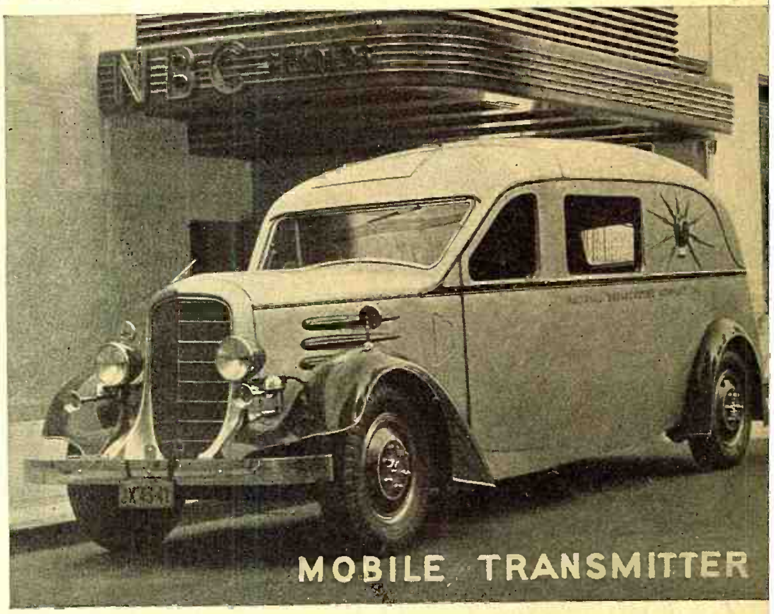

MOBILE TRANSMITTER

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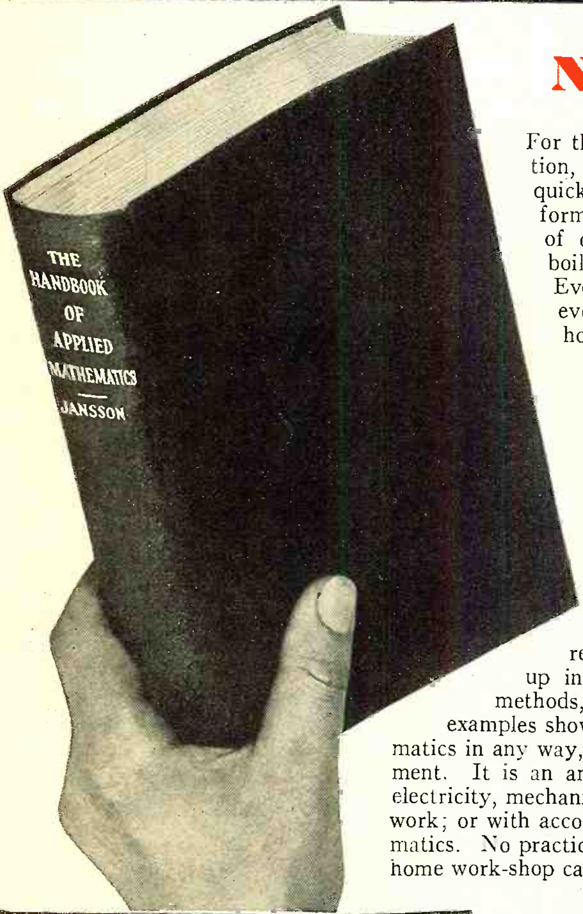

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Vol. XI
No. 8

RADIO NEWS

February, 1934

THIS MONTH—

Future Trends • *Electronics* • *Rural Radio* • *Short Waves* • *Servicing* • *New Sets* • *Departments*

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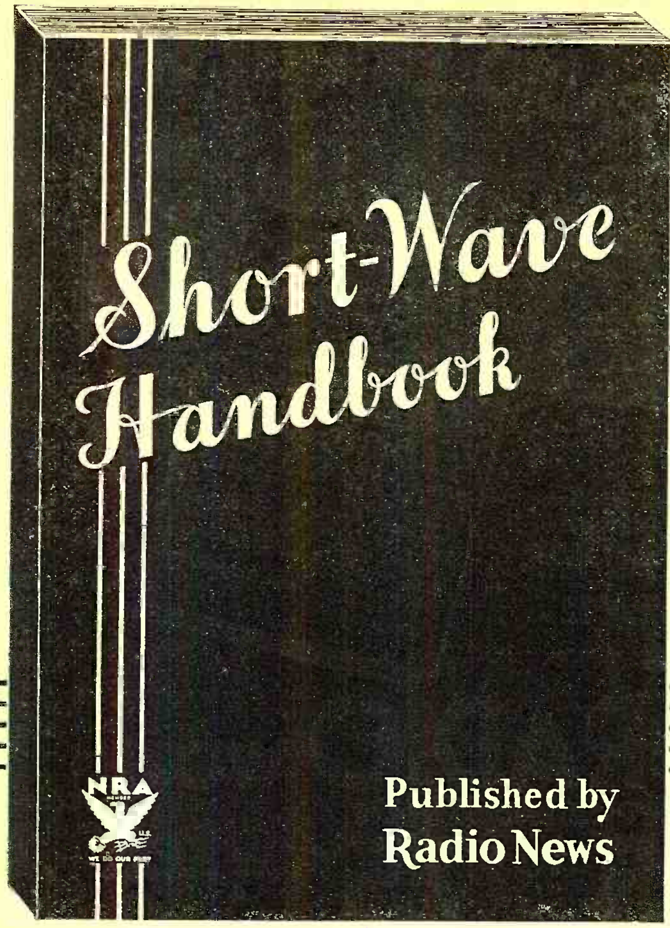
VOLUME XV — December, 1933 — **NUMBER 6**



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We now offer, for the first time, a copy of the new *Short-Wave Handbook* absolutely free with a five-month subscription for RADIO NEWS at the money-saving price of $1. (Canada and Foreign $1.50.) Get your copy *now!*

Partial Contents

Fundamental Principles

The *Short-Wave Handbook* begins with a discussion of the principles underlying short-wave communication — explaining the various theories, atmospheric effects, and peculiarities.

Helpful Short-Wave Data

Foreign announcements are explained—a time chart is included—a brief discussion on receivers follows—and hints on tuning are given.

Short-Wave Receivers

Having explained the fundamentals, the *Short-Wave Handbook* follows with full instructions, diagrams and circuits for building five simple short-wave receivers ranging from two to four tubes and two more-complicated receivers of five and six tubes.

Popular Commercial Apparatus

For the man who wants to buy his receiver ready-made, brief descriptions and circuit diagrams of popular commercially-built short-wave apparatus are printed.

Short-Wave Accessories

Various short-wave antenna systems and noise-control circuits are described—with constructional details where necessary.

Best Bets For DX

Chapter 8 contains a list of the short-wave stations now being received daily in the United States and reception reports by short-wave listeners.

Learning the Code

The complete International Morse Code is shown in Chapter 9 and simple instructions are given for learning it. Details for building various code practice sets are included.

Amateur Transmitters

Building instructions for several good amateur transmitters and valuable hints on R. F. amplifiers are presented in Chapter 10.

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Radio News

**222 West 39th St.
New York, N. Y.**

Radio News

February, 1934

TAXI RADIO

The Editor—To You

The Editor points out another field for radio expansion. Watch this page for news of significance to the radio trade and tell your friends and acquaintances they will find additional inside information on these money-making ideas in future issues of the magazine

THE 2000 radio equipped taxicabs on the streets of New York City are gobbling up fares and taking paying riders away from all the other cab services. All New York is talking about these cabs and *riding in them!* If the present plan of the associations operating these cabs go through, theatre goers will soon be able to ride down to the theatre and listen to a radio program describing the play, the actors, etc., just before theatre time. Right now women shoppers can listen on their way downtown in a taxi to a description of items offered in sales held by the big department stores. And many other plans are being made to make radio a real headliner in taxi service. At any rate the installation of radio receivers on the Radio Fleet cabs has made them the most wanted ones on the city streets, and they are *rushed with business!* The drivers themselves are happy—they are making real money.

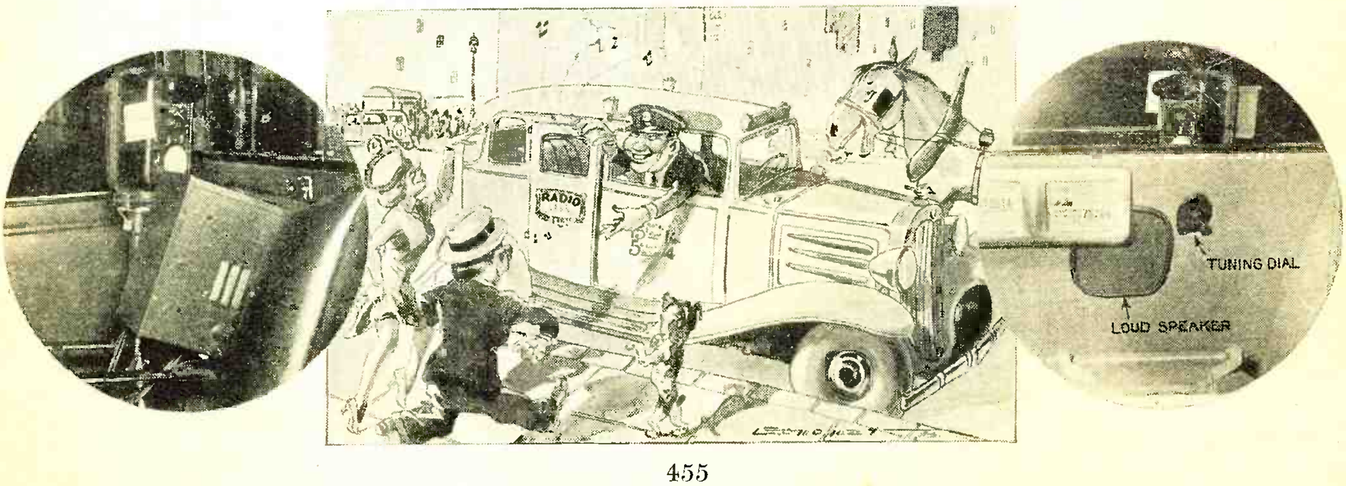
These new radio cabs are the latest General Motors creations. They are small, swift cabs and the Radio Fleet owners have installed in them a compact auto-radio receiver as shown in the two illustrations, in circles below. The view at the left shows the installation of the receiver case alongside of the taximeter. The illustration at the right gives a view of the loudspeaker and the tuning dial as the passenger in the cab would view it. The tuning dial, which is illuminated, contains one knob for tuning and one knob for volume. The sets automatically maintain a given signal level as chosen by the passenger. Reception from these sets is quiet, from the standpoint of interference, and of excellent quality of reproduction. Both the Fleet operators in New York, and the manufacturers of the radio sets that have been installed, are being besieged, since the appearance of the first radio equipped cab, with requests from visitors to New York, from outlying districts in this country and also from foreign countries, who foresee the possibilities of such equipment installed in taxis in their cities. These requests are for information as to types of equipment, costs, installation data, etc.

And there is no doubt as to the improved psychological demeanor of the taxi drivers of these radio-equipped cabs. They seem more confident, more courteous and more willing to carry out, pleasantly and efficiently, the passengers' wishes. They seem to feel that they have in their cabs a new scientific ally that enables them to add to the comfort and enjoyment of their passengers.

The moral of this story is a significant one for the Radio Dealer and the Serviceman who have been installing auto-radio in pleasure cars in their communities. Get busy Mr. Dealer, and you too Mr. Serviceman—lose no time! Go immediately to your local taxicab services, both the large fleet and the individual operators, and show them this page of RADIO NEWS. It will be your sales message to them and you can immediately sell them the installation of motor radio on their taxicabs. Auto radio on the cab is a sure-fire business getter. The operators will "see" it immediately and you can help them to be the first in their community to employ this novel idea. You can install the sets for them, make a decent profit and at the same time institute a new promotional idea that will sell auto-radio very quickly to the owner of pleasure cars in your community. Everyone riding a Radio Taxi will have a free demonstration of the pleasure he could get out of an auto-radio in his own car.

So get busy, you installation men—be the first to cash in on this new field for auto radio in your locality. Write to the editor if you are not sure what sets to promote and to install. We will give you full details on the leading makes, prices, installation data, etc.

TAXI RADIO, PLEASE!



EXPERTS PREDICT THESE DEVELOPMENTS IN 1934

The authoritative survey presented herewith gives the reader the viewpoints of leading American experts on the progress in the various radio fields of future development. Read these statements!


E. F. W. ALEXANDERSON


A. G. HOFFMAN


H. C. LEWIS


KENNETH HATHAWAY

VERY encouraging reports are coming to us from all over the country, making the 1934 radio outlook much brighter than any of the last several years. Increasing employment is removing from the radio service field a lot of men who merely drifted into it as the easiest means of earning a little money during the depression. Increasing employment and better farm prices are enabling thousands of people to get new receivers or have their old ones overhauled and repaired. Radio manufacturers and radio men's associations are making it easier for the legitimate radio man to profit by his work, and more difficult for the "gyps" and unqualified "radio men" to stay in the business. So we feel that the honest, alert, aggressive and well trained radio man can make 1934 a very good year. **H. C. Lewis,** Pres., Coyne Electrical School.

THE supremacy of the dynamic cone speaker for general purposes is still unchallenged. The trend will, therefore, be toward the refinement of this type, with emphasis placed on performance rather than cost. No immediate revolutionary changes are anticipated.

Better sound reproducing combinations will include means for extending the frequency range upwards. This will be accomplished by modification in the cone speaker itself or by the addition of a high frequency unit capable of reproducing from 1000 cycles and up. An exponential horn, not over six inches long, on the high range unit, will permit better diffusion of high frequency radiation than is now possible in single cone speakers. **Peter L. Jensen,** Jensen Radio Mfg. Co.

A New Deal for the Serviceman—New Testing Instruments

THE radio service industry never had an outlook so bright as it has today. The enactment of the National Industrial Recovery Act placed in the hands of the members of the industry a tool with which to legalize a program to rid the field of the "gyp" and cut-throat practices that have been so prevalent in the industry and to establish standards to determine who shall be considered as legitimate servicemen. Fortunately, the Institute had sufficient foothold, in spite of the serious economic conditions of the past years, to sponsor the cause of the servicemen of the country before the Recovery Administration in Washington. The next few months will, no doubt, see things accomplished which would have required years of painstaking effort or which would have been well-nigh impossible to attain fully. **Ken Hathaway,** Executive Secretary, Institute of Radio Service Men.

RADIO service developments in the future present an interesting picture. There exists a definite need, and no doubt development will follow, for a device whereby the serviceman will be enabled to check the condition of fixed and variable condensers, without paying a great deal of attention to the actual capacitance of the unit. The primary function for this device will be such checking without removing the condenser from the circuit. It is very likely that oscillographic forms of alignment apparatus will be developed for service work. This equipment will be suitable for checking output, distortion, and even sensitivity. Every indication points to more elaborate forms of equipment which will be used for the work mentioned above. **John F. Rider,** Radio Treatise Co.

THE radio serviceman also gets a new deal—according to the new code, he will be established as a service engineer with the odds in *his* favor, for the unfair competition of the gyp will be gone. But the serviceman must also give a new deal to his customers—he must give better and more intelligent service. And before he can qualify he must demonstrate his abilities to the proper authorities. This means he must know more and learn more, he must keep up with the times. New tubes and new circuits have revolutionized service methods, and the salvation of the serviceman lies in his ability to handle his work right. He not only must know his fundamentals, but must understand the function of the new circuits with their various automatic control features, etc. Our organization is fully equipped to cooperate with the serviceman and to train him to occupy a front rank position. **A. G. Mohaupt,** Pres., Radio Training Association of America.

TELEVISION will be ready when science is ready for it. A number of advances have already been made in the art, each in response to an advance in science. Television was first thought of shortly after the invention of the telephone and developments have been gradual since then. The most important of late contribution has been the cathode-ray tube perfected by Dr. Zworykin. Whether this last step in the progress of the art is sufficient to make television available for the general public remains to be seen. **Dr. E. F. W. Alexanderson,** Consulting Engineer, General Electric Co.

OUR contacts show that a very definite improvement in the radio service business is under way. Some of the greatest advancements in receiver design have been made during the past three years and due to the complex circuits in modern receivers, competent radio service is rapidly attaining the status of a profession. With a general improvement in business, the public will again consider quality ahead of price, and service engineers with real technical training will force the incompetents out of this field, to the benefit of both the profession and the public. **E. H. Rietzke,** President, Capitol Radio Engineering Inst.

FURTHER progress in television will be reported from the various laboratories and by the end of the year commercial plans will be worked out for its commercialization. **Ernest V. Amy,** Pres., Amy, Aceves and King, Inc.

AT the present time the radio industry is experiencing an upturn in sales which is entirely unprecedented at this

(*Continued on page* 511)

PETER L. JENSEN

D. N. DULWEBER

ELLIOT LEEDS

L. F. BOCKOVEN

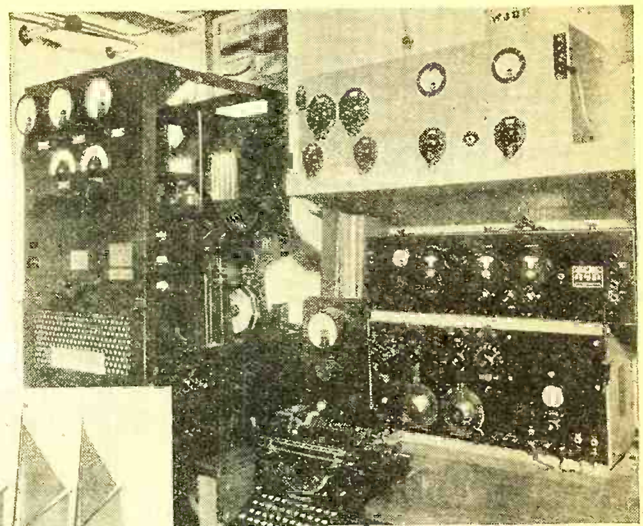
JOHN F. RIDER

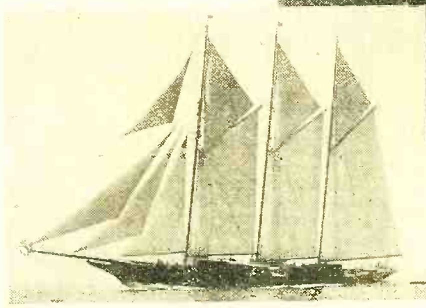
JOHN ERWOOD

S. W. RECEIVERS FOR YACHTS

A pioneer designer turns to the problem of marine radio installations

Charles R. Leutz





FULLY RADIO EQUIPPED

The auxiliary yacht Migrant contains the latest in modern transmitting and receiving equipment, including the long-distance short-wave receiver described in this article. At the upper right is a view of the radio cabin

SUCCESSFUL operation of a powerful short-wave superheterodyne aboard a large yacht is a much more difficult problem than it first appears. This problem was first approached by designing a special short-wave superheterodyne for the yacht *Migrant*, at which time there were no standard sets of this type available. Improvements have been added to this installation continually as they became available. This apparatus is for entertainment purposes and is entirely independent of the regular radio equipment for commercial radio telegraph communication which includes short- and long-wave transmitters and receivers.

The *Migrant* is the largest auxiliary schooner yacht in the world—steel hull, 223 feet long overall, 34-foot breadth and draws 15 feet. It has a crew of 33, officers and men. There are three masts reaching about 200 feet above the waterline. For auxiliary power there is a six-cylinder, 4-cycle Diesel engine. As a Diesel engine does not require spark plugs for ignition, there is no interference from this point. However, there are a large number of other electrically driven appliances, including oil burners, pumps, ventilators, generators, steering engine, etc., all of which set up disturbance, some of which are troublesome on certain short-wave bands.

To locate these disturbances it was necessary to shut down all these electrically driven machines, run them one at a time and note disturbances over the entire wavelength range. Later the different motors were fitted with filters and suppressors to eradicate all parasitic electric waves at these points.

To provide power when the electric generator is shut down, a heavy capacity Edison storage battery is used. Unlike an ordinary storage battery, the Edison type varies over a wide range from fully charged to discharge, viz., as much as 95 to 140 volts. An automatic regulating device tends to keep the voltage constant at 110 by a motor-driven rheostat. However, it does not stay steady as compared with regular power lines.

A yacht of this type makes long cruises to the Pacific, Mediterranean, etc., and it is essential that the apparatus be free from any service difficulties. While there is every facility aboard for repairs, including a complete machine shop, together with the skill of the officers, it is still expected that the radio instrument give continuous service free from any interruptions other than tube failure. Design considerations, therefore, included a very high degree of safety. By-pass condensers, ordinarily taking a continuous voltage of 200, are capable of standing 800 volts continuously. Where ordinarily a ½- or 1-watt resistor is used, a 5-watt size is inserted. The main voltage divider resistor is of heavy construction, vitreous enameled to withstand salt-air moisture like all the other parts. The motor-generator when delivering full load to the power pack is only running at 65% capacity. Consequently, it can run cool continuously. The power-pack transformer can stand a 50% overload for four hours.

In the accompanying photograph this special receiver is shown on the shelf above the operator's regular radio-telegraph receivers. The power pack is on a lower shelf, connected by a multiple cable and connector. The main containing (*Continued on page 506*)

CIRCUIT FOR THE RECEIVER

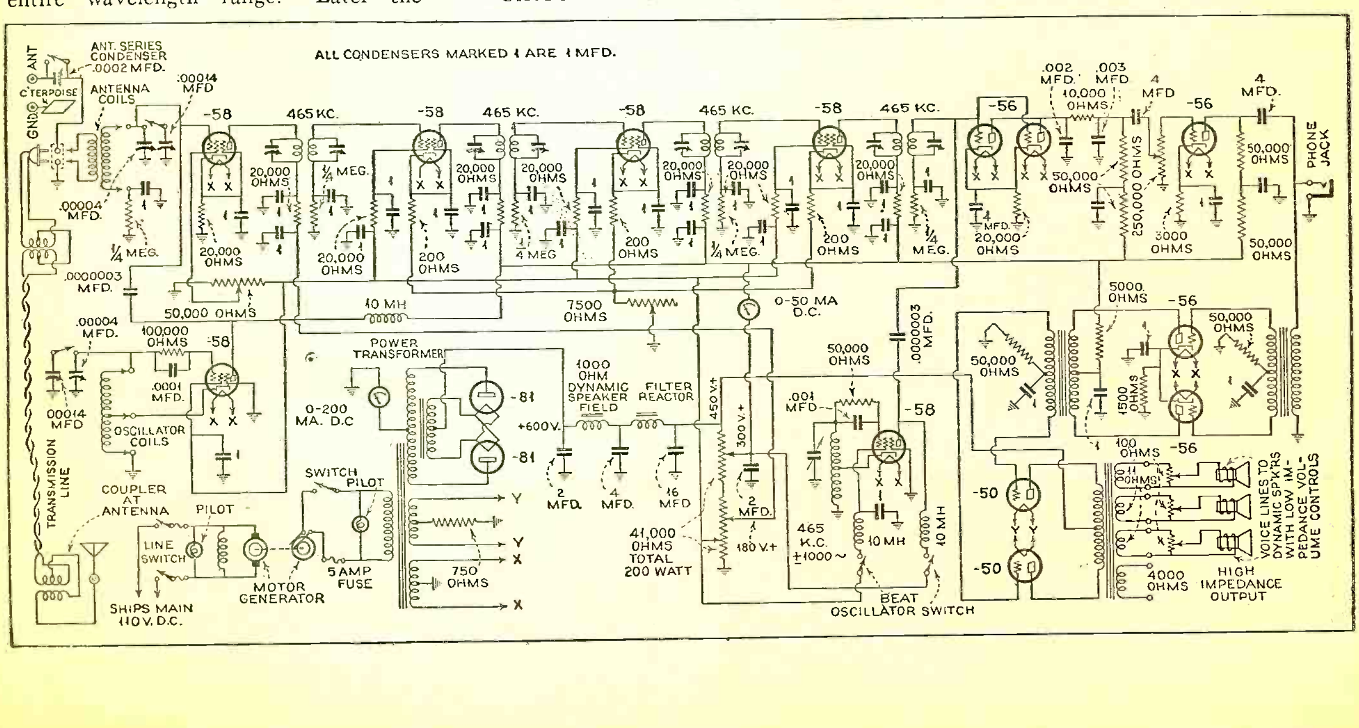


FIG. 1

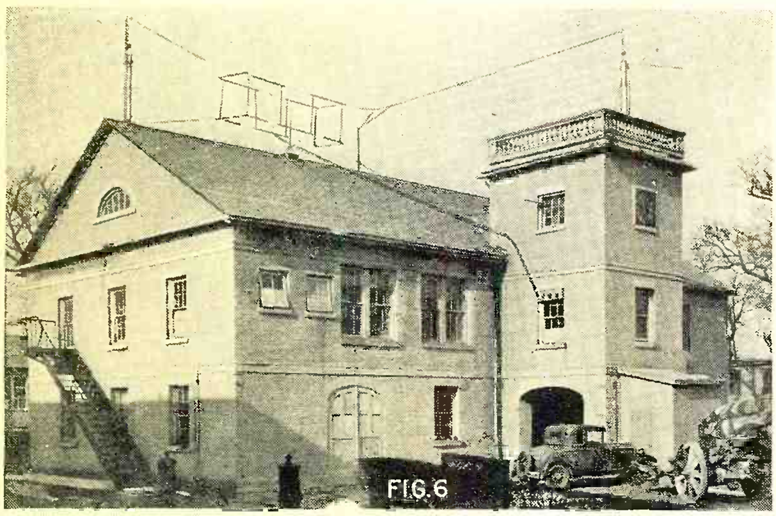


FIG. 6

REMOTE-CONTROL TRANSMISSION

Figure 1 is an airplane view of the location of the two islands in the lower bay where this interesting experiment has been carried out. Figure 6, at left, shows the beam transmitter, antenna and feeder for the control signals. Figure 7 shows the interior of the secondary receiving station at Bedloe's Island with the ultra-high-frequency remote-control receiver shown at the right. Figure 4 shows the interior of the receiving station with the five-meter short-wave transmitter and control

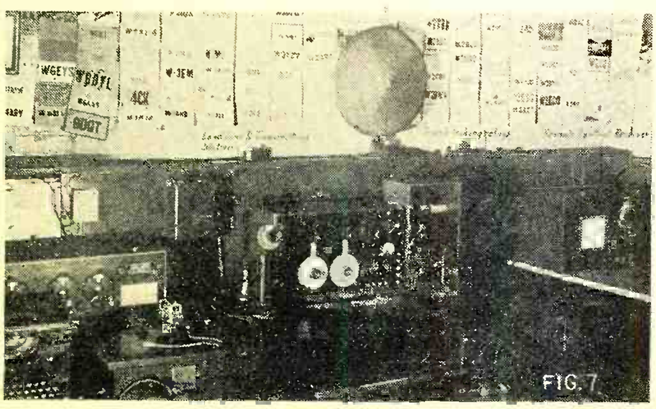


FIG. 7

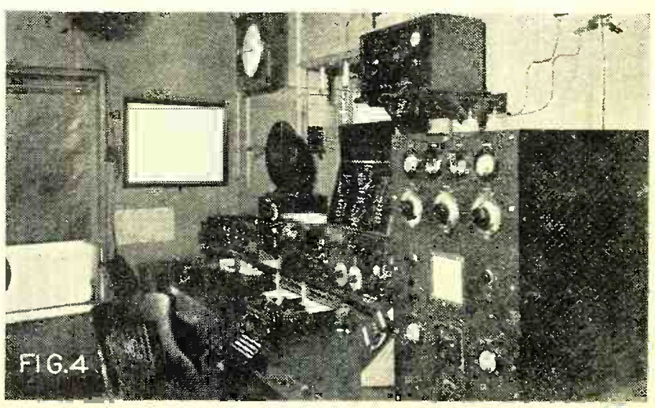


FIG. 4

REMOTE CONTROLLED TRANSMISSIONS

Describing the use of ultra-high-frequency signals for automatically controlling a radio transmitter on a distant island site

James A. Code, Jr., M.S.*

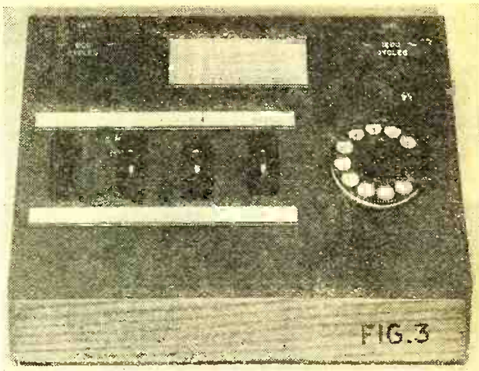


FIG. 3

THE REMOTE CONTROL TURRET

THE ingeniousness of American engineers is perhaps nowhere so well exemplified as in harnessing the Hertzian waves for the operation of practically any mechanical device. Wherever direct manual operation is impossible, impracticable or economically wasteful, whether to moving or stationary objects nearby, or at a distance, complete mastery is now possible through the use of especially designed electrical apparatus which functions by the radio signals it receives.

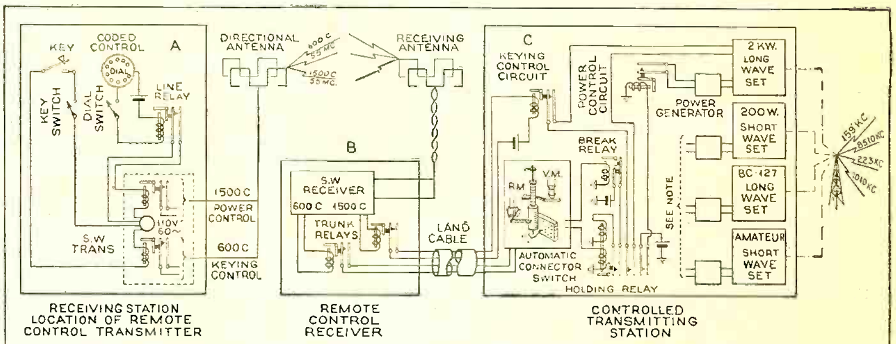
The usual name applied to this general type of functioning is "remote control," which implies the ability to direct and manage operations from a distance. However, while such practice is common to both the amateur and commercial fields of radio, the means of accomplishment has been dependent invariably upon metallic connections between the control station and location of the apparatus to be controlled. But, actually, such physical connection is not necessary, requires a high initial installation expense, costly rental and continued maintenance outlay, while providing but a few simple operations. It was because of the desire to be free from these expenses that the idea of remotely controlling a radio transmitter, by radio, developed.

A project was presented in New York Bay under the shadow of the Statue of Liberty, in which a transmitting station of four transmitters (whose signals are often referred to as "The Voice of Miss Liberty") was to be located upon one island and, through necessity, the receiving station upon another some two miles distant (see Figure 1). To connect these islands by submarine cable would have been expensive, especially as the cable would be subjected to intermittent damage from dragging boat anchors. Therefore, the distance was breached by a radio channel, without sacrificing any of the efficiency of a metallic link.

The radio channel not only provided a means of keying each of the four transmitters, singly or in pairs, but it also afforded the means by which the various sets and their associated power equipment could be started or stopped, without manual assistance.

Because of the interference experienced in the metropolitan area of New York, both from the numerous radio stations and from atmospherics, the 5-meter band was selected as the frequency to be used for control. A transmitter (*Continued on page* 499)

*Major, Signal Corps, U. S. Army.



THE QUASI OPTICAL TRANSMITTER AT -A- EQUIPPED WITH BOTH DIAL AND KEY OPERATES THROUGH A RECEIVER AT -B- A CONNECTOR SWITCH AT -C- THROUGH A SHORT LAND CABLE. THE AUTOMATIC SELECTOR AT -C- IN RESPONSE TO THE CODED SIGNALS TRANSMITTED FROM -A- CLOSES OR OPENS AT THE TRANSMITTING STATION -C- THE SELECTED CIRCUITS.

FIG. 2

THE COMPLETE OPERATING NETWORKS

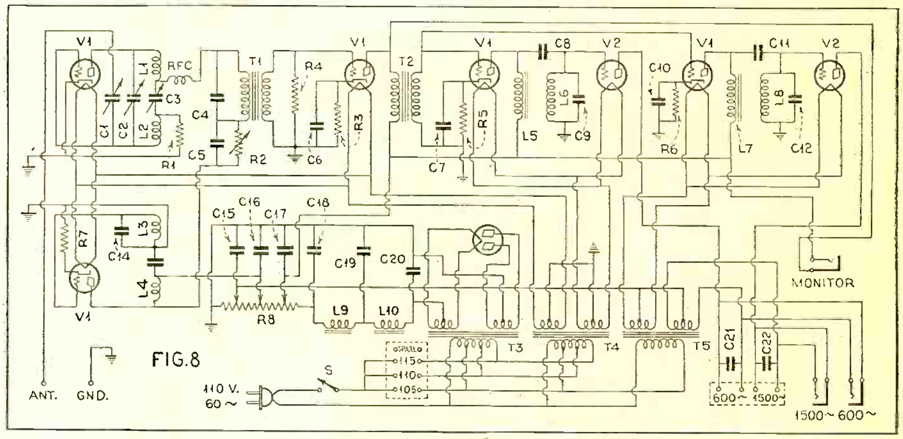


FIG. 8

ABOVE: THE RECEIVER CIRCUIT. BELOW: THE TRANSMITTER CIRCUIT

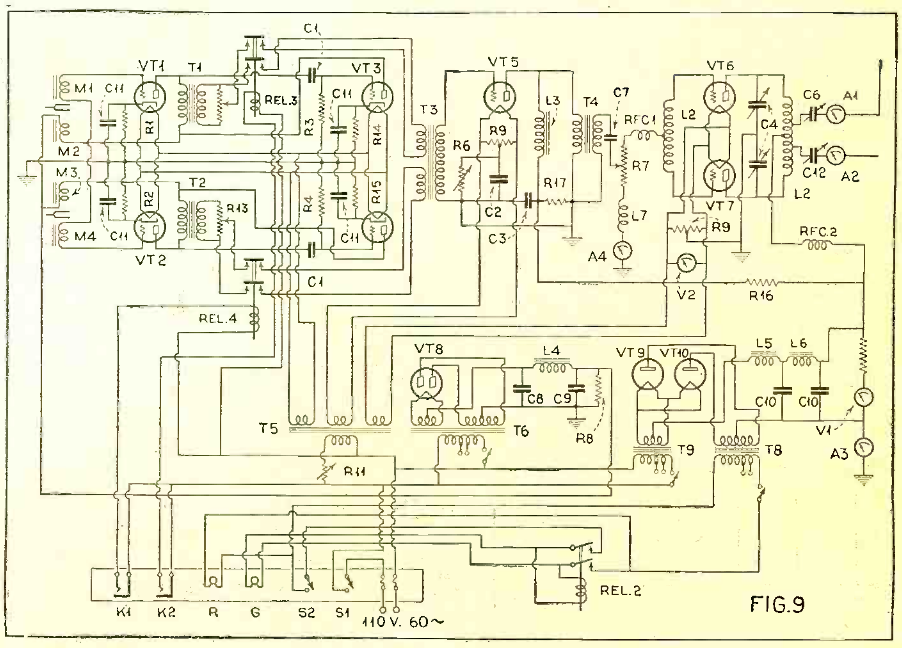


FIG. 9

HOW HIGH VOLTAGE VACUUM TUBES ARE USED AS

"ELECTRONIC RECTIFIERS"

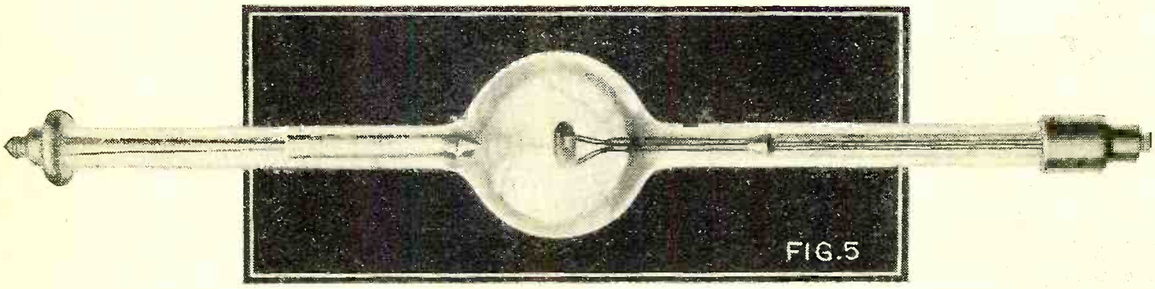


FIG.5

Thomas Clifton

HIGH-VOLTAGE rectification of alternating current is an important consideration in modern industry. For nearly thirty years the electric precipitator has been taking silver, gold, cement, sulphuric acid, arsenic, coal tar products, and other valuables out of the smoke and flue gases that go up the chimneys of smelters, chemical works, and manufacturing plants. By its means, solid particles, no matter how small, may be removed from any gaseous stream. The process depends on the electrophoretic motion of particles in a unidirectional electrical field accompanied by corona discharge. It has usually involved the troublesome feature of a mechanical rectifier—a sort of electrical pinwheel, turning at high speed, surrounded with flame, broadcasting uproar to all radio sets for miles around, and demanding frequent repairs.

Now the advance of the radio sciences brings the possibility of overcoming mechanically complicated parts, of working with a higher efficiency in direct-current, high-voltage generation, and, in addition, of avoiding annoying factors such as inductive interference.

Figure 1 shows a close-up of the rectifier wheel of the old style mechanical rectifier used in the Cottrel precipitator. Current coming from the transformer is impressed upon the contacts 1 and 3. A conducting wire, B, connects each arm with the arm 90° away from it so that the current can be taken off from the brushes at points 2 and 4. At the next half-cycle, at which the polarities of the transformer are reversed, the contacts 1 and 3 are changed. The wheel has moved over 90° so that the polarities impressed upon points 2 and 4 are again of the same direction as in the previous cycle.

A switch, W, at the input side of the transformer, can be reversed, thus accomplishing the result that the polarities produced on points E and F will always be the desired ones, irrespective of which phases of the alternating current the apparatus originally was started.

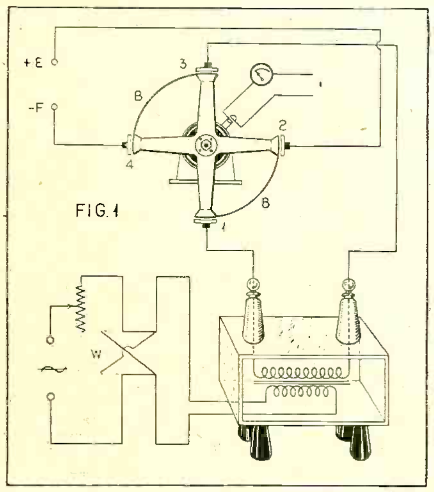


FIG.1

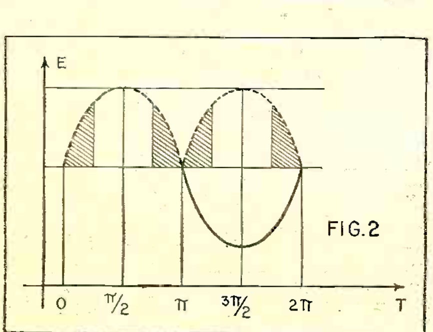
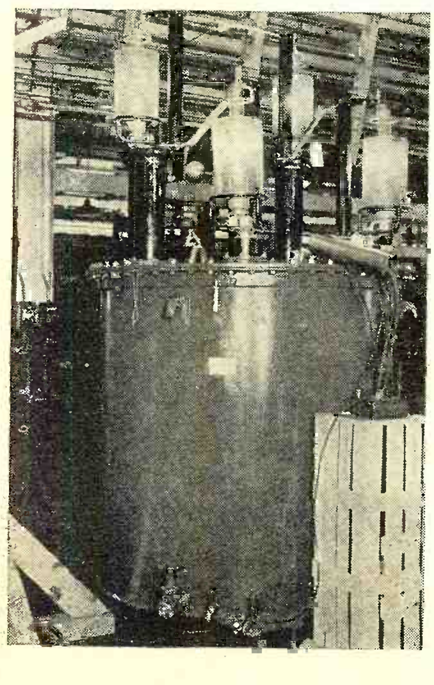


FIG.2

HIGH-VOLTAGE RECTIFIERS

Figure 3. A single-phase full-wave tube rectifier that produces 100,000-volt direct current



If an overlapping of two phases of alternating current is to be avoided, it will be readily understood that the total length of the sectors must be small enough so that no arcing in the opposite, undesired direction can take place.

However, if the entire part of each phase is not fully used, considerable losses occur in the utilization of the total available current and voltage.

Considering, for example, the alternating current as the sine-wave characteristic depicted in Figure 2, a disk covering one-quarter of the periphery only, which is the maximum possible coverage, will lose the area filled in, in black. Instead of utilizing the total available wave area, only the center parts, left white in the picture, have been applied gainfully. The total shaded area is lost.

In addition to losing part of the energy, resistances are introduced by the arcing distance between the brush

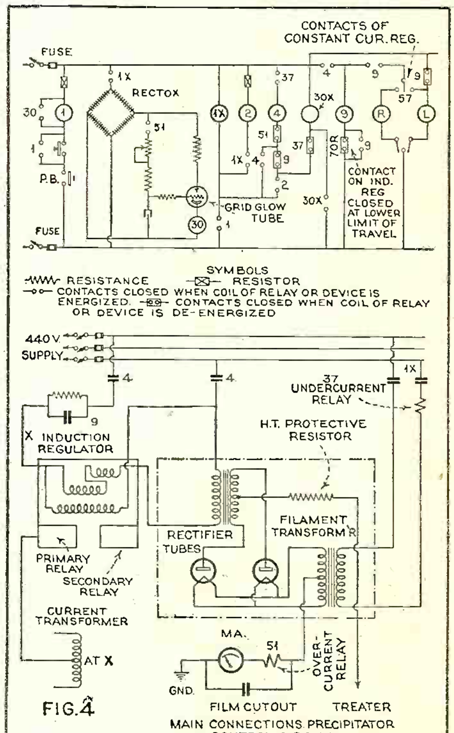
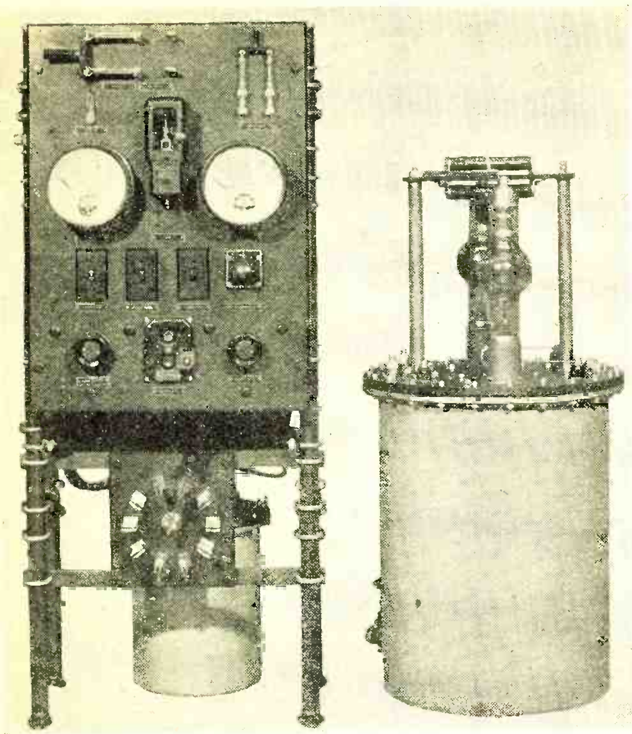


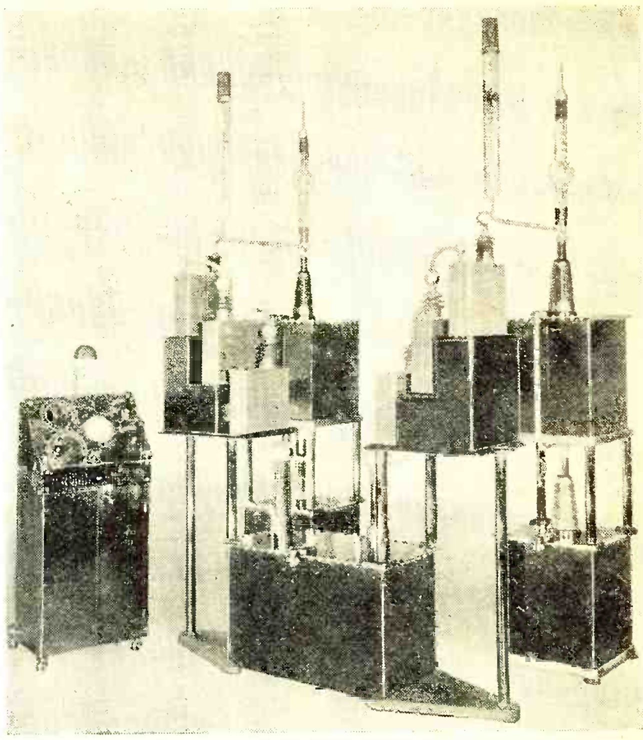
FIG.4

MAIN CONNECTIONS PRECIPITATOR CONTROL CIRCUIT

LEGEND

1- MASTER RELAY
1X- FILAMENT SUPPLY CONTACT
2- TIMING RELAY
4- MAIN CONTACTOR
9- CONTROL CONTACTOR
30- LOCKOUT RELAY
30X- AUXILIARY LOCKOUT RELAY (HAND RESET)
37- UNDERCURRENT RELAY
51- OVERLOAD RELAY
57- CONSTANT CUR. REGULATOR (PRIMARY RELAY)
R- RAISE COIL OF SECONDARY RELAY
L- LOWER COIL OF SECONDARY RELAY.
70R- INTERLOCK ON INDUCTION REGULATOR CLOSED AT LOWER LIMIT OF TRAVEL





CABLE-TESTING SET-UP

Figure 8. A G. E. Thyratron rectifier for testing cables capable of producing 5000 volts direct current at one-half ampere

and the rotating wheel, which further tends to decrease the efficiency of mechanical rotor rectifiers.

According to H. Speight and V. G. Rydberg[1], the disadvantages of the mechanical rectifiers may be summarized as follows:

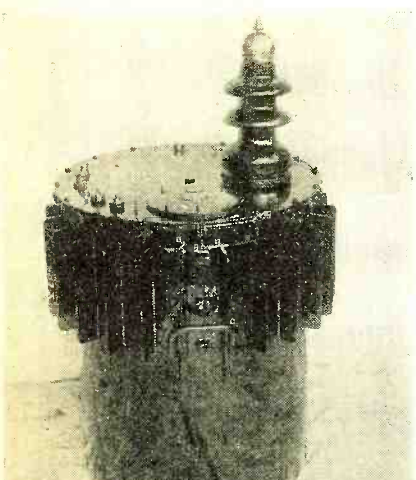
1.—The continuous spark discharges cause oscillating discharge and surges which create additional stresses on the transformer insulation.

2.—The wave form is irregular.

3.—The contact tips and shoes commence wearing when the rectifier goes into service, continually decreasing the actual voltage at the precipitator. In addition a considerable amount of fixed

AN OIL-IMMERSED RECTIFIER

Figure 6. In this equipment, made by Waite and Bartlett Mfg. Co., the rectifier tube is operated in an oil bath



resistance is necessary to assist in absorbing the energy of the surges caused by the spark discharge.

4.—Equipment for suppression of radio interference is necessary.

5.—Manual or automatic polarity control must be furnished, adding to the complexity of the control equipment.

6.—It is noisy in operation.

This, together with the necessity of using electro-motors, considerable space and other requirements which go hand in hand with the maintenance cost of rotating machinery of considerable size, make the advent of the electronic (vacuum tube) rectifier one of highest importance for electronic and allied industries.

How does such an electronic rectifier work? A distinction must be made in this case between the high voltage, high-vacuum rectifiers and rectifiers of the hot-cathode, gas-filled type. While the latter construction is capable of carrying greater currents at lower voltages, the first construction is used for the highest voltages, such as are necessary

POWERFUL X-RAY APPARATUS

Figure 7. A cascade rectifier tube equipment made by Victor X-Ray Corp., for producing 300,000 volts direct current using Kenotron tubes

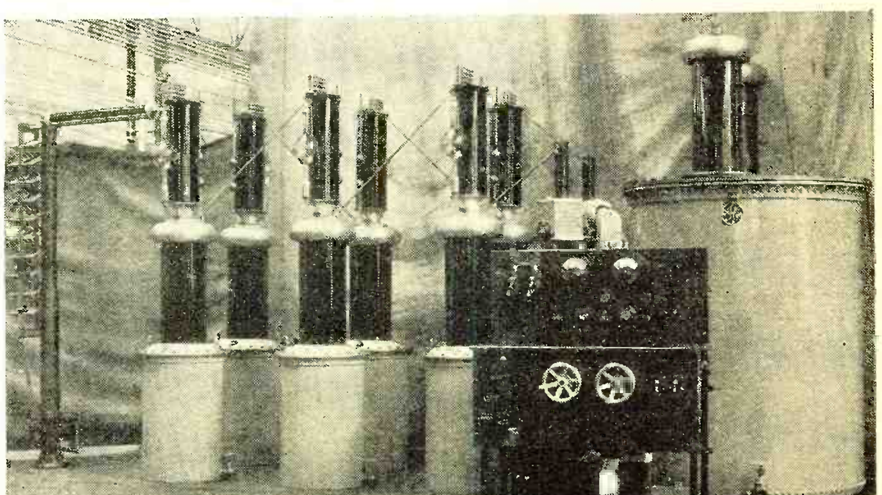
in X-ray work, dust precipitation, etc.

Smaller rectifiers, working on the average up to only a few hundred volts, are well known to every radio man. Electronic rectifiers, like the -80 type tubes (full wave) or -81 type tubes (half wave rectifiers) are part of the standard equipment of almost every a.c. operated radio receiving set, while mercury-vapor rectifiers of the -82, -83 and 866 type take care of many industrial applications which necessitate considerable power.

Still, the highest voltages permissible in an 866 (*Continued on page* 496)

ANOTHER HIGH-VOLTAGE CABLE-TESTING UNIT

Figure 9. A direct-current multiple-tube rectifier, made by G. E., for producing 250,000 volts at 250 milliamperes for voltage testing of cables



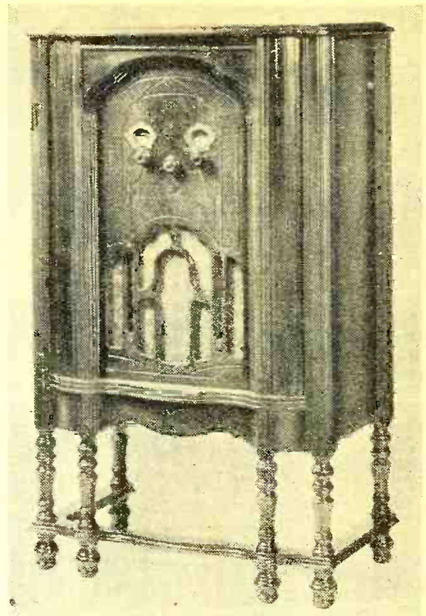
AT LAST!

ATWATER KENT TABLE MODEL

PRACTICAL FARM RADIO

How the constant-voltage air-cell "A" battery solves the rural radio problem

E. E. Horine



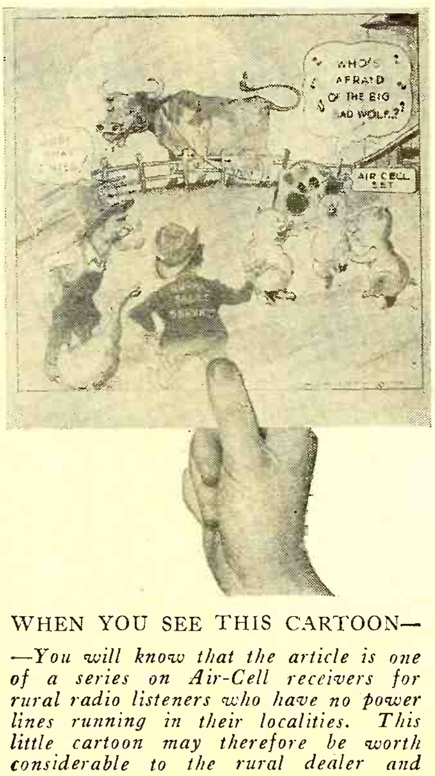
RCA VICTOR MODEL 241-B

EVER since broadcasting began, the farmer has been handicapped in his ability to get radio programs. Living beyond the reach of the power line, he must use a battery-operated receiver or do without radio. For the first six years of the radio era, the industry produced nothing but battery sets, presumably just what the farmer needed, but the rural market absorbed only a very small percentage of the several million "battery" receivers made in those years. Obviously something was lacking in those early battery sets to make them practical for farm use, and trying to find out what is required to make a practical farm receiver, and trying to supply it, has constituted the rural radio problem which has been with us since 1921, when radio broadcasting got its start.

The storage-battery receiver did not penetrate very deeply into the rural market because the storage "A" battery requires more or less expert maintenance, and it has to be recharged every time it runs down. The farmer has no charging facilities, and, in the vast majority of cases, he lives too far away from such facilities. Only those living close enough to town to make storage-battery operation at least half-way feasible bought radio, but they do not constitute the rural market; they are only its outermost fringe.

The dry-battery set, so called because it used an "A" battery consisting of a pack of dry cells, came out in 1925 when radio was "four years old," and gave promise of solving the rural radio problem. Freed from the recharging nuisance and expense, made completely independent of the power line, dry-battery radio was then expected to penetrate to every nook and cranny of the country, *but it didn't!* The dry-battery receiver was a complete commercial failure.

The reason is easily understood. The dry battery, essentially and inherently, is a *variable-voltage* generator whereas the tube filament, essentially and inherently, is a *constant-voltage* load. As long as these diametrically opposed characteristics remain unreconciled, premature tube failure or short "A" battery life will occur. Those whose radio experience goes back to 1925 will remember the grief and headaches resulting from trying to sell and service dry-battery receivers. This trouble, which eventually caused the failure of the dry-battery set idea, was due to just one thing—the opposing natures of the dry "A" battery and the tube filament. They were not reconciled then, and they have not been reconciled since. The cause of the dry-battery set failure in 1925 exists today, unchanged. The dry battery still delivers its output at *variable voltage,* the tube filament still requires its input at practically *constant voltage.*



WHEN YOU SEE THIS CARTOON—

—You will know that the article is one of a series on Air-Cell receivers for rural radio listeners who have no power lines running in their localities. This little cartoon may therefore be worth considerable to the rural dealer and serviceman

This, then, was the situation in 1927, when the all-electric set came out and shortly crowded the battery receiver out of the picture. The industry had bombarded the rural market with two kinds of battery sets for six years, and neither had met the requirements. The AC set was the latest thing, and the industry showed unmistakable signs of throwing the battery receiver into the discard, to concentrate on the new batteryless set. The future looked bright for the set makers, but it was not so cheerful for the rural radio users or for the battery manufacturers. The "B" battery business, which had grown with radio to large proportions, was seriously threatened by this move, and the only way to protect it was to make radio available to the vast, neglected rural market.

Accordingly, National Carbon Company started a research and development program in 1927 in its Eveready research laboratories, out of which eventually came the Eveready Air-cell "A" battery and a line of Air-cell tubes. (Sometimes called 2-volt tubes). This work was started, not merely to develop a new and different kind of "A" battery; it had a much broader object than that. It was undertaken, first to discover, then to develop, whatever might be necessary *to make rural radio practical.*

The kind of receiver needed was easy to visualize, but the means of making it did not exist. It must possess the rugged dependability of the storage-battery set, but must not have the recharging feature; it must possess the complete independence of the power line of the dry-battery receiver, but must not have a filament rheostat or other control features intended to reconcile the *variable voltage* of the dry battery and the *constant voltage* requirement of the tube filament; it must be as simple, easy and fool-proof to operate as the all-electric set, and it must approach, if not actually equal, the standards of performance established by this new development, but, of course, *it also must be battery operated.* Such a receiver would meet the requirements of the rural market, and would sell, but try to get it!

Nearly a year was spent trying to evolve a practical rural receiver around the dry "A" battery. This was a perfectly natural move, because National Carbon Company, being a large producer of dry cells, had visions of the rural radio market providing a new outlet for this product as well as re-establishing the "B" battery business. Everything imaginable was tried to bring the opposing characteristics of the dry cell and the filament into line, all the way from the idea of a variable-voltage tube to all sorts of automatic voltage regulators, including the ballast tube in all its ramifications, but there were serious shortcomings in all of them; not one was wholly or completely practical.

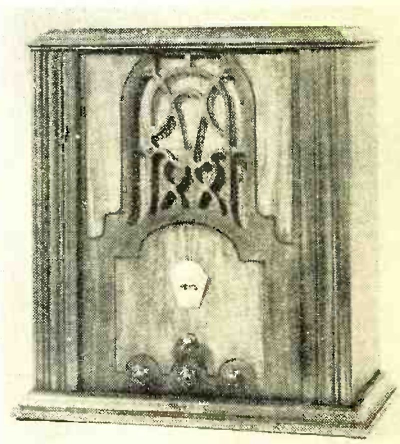
As the work progressed, it became increasingly evident that a *constant-voltage* "A" battery offered about the only solution of this baffling problem, but a constant-voltage primary battery was about as difficult a task as the *variable-voltage* tube, but not quite, for while the variable-voltage tube eluded all attempts to develop it, a constant-voltage battery *was* produced.

To impart this all-important and highly essential constant-voltage characteristic to a primary battery, recourse was had to the age-old idea of "air" depolarization—to obtain the vital depolarizing oxygen directly from the air instead of from oxygen-bearing chemicals packed into the battery at the time of manufacture. This problem was solved by developing a unique form of carbon which has the peculiar property of extracting oxygen from the outside air and making it available inside the battery, where needed, and in a form suitable for the necessary chemical reactions.

Since the battery thus developed "breathes" its oxygen out of the air, it is called the Air-cell battery. The depolarizer is one of the major ingredients entering into the construction of a primary battery. It always takes up considerable space, and it costs money. But in the Air-cell battery, it takes up no space, being drawn in from the atmosphere only as required, and it costs nothing. This is what makes the Air-cell battery the cheapest form of primary power known, as well as the lightest. Compared with "A" batteries made of packs of dry cells, it gives approximately twice as many ampere-hours per dollar of cost, and per unit of weight. This is of particular importance in an "A" battery, since one of the things essential to true rural radio popularity is low operating cost.

The voltage of the Air-cell battery is about midway between that of a storage cell and two dry-cells, connected in series. This being so, there were no tubes in existence with which it would work. It became necessary to develop a line of special tubes to go with the Air-cell battery, and this development work was carried out in the Eveready research laboratories, along with that of the battery. The outcome was the Air-cell tube, which some people call the 2-volt tube.

This tube most distinctly is *not* a dry-cell tube; to look upon it as a new and better kind of dry cell tube is a mistake. Being designed to go with the constant-voltage Air-cell "A" battery, it was not necessary to provide a wide margin of safety in the filament against accidental over-voltage, because in a correctly-designed receiver, the Air-cell battery *cannot* over-voltage the tubes. This made it possible to reduce the filament power materially below that required by the dry-cell tube, and while this made the filament more "delicate" electrically, the resulting operating economy fully justified taking the tube out of the dry-cell class. (*Continued on page* 507)

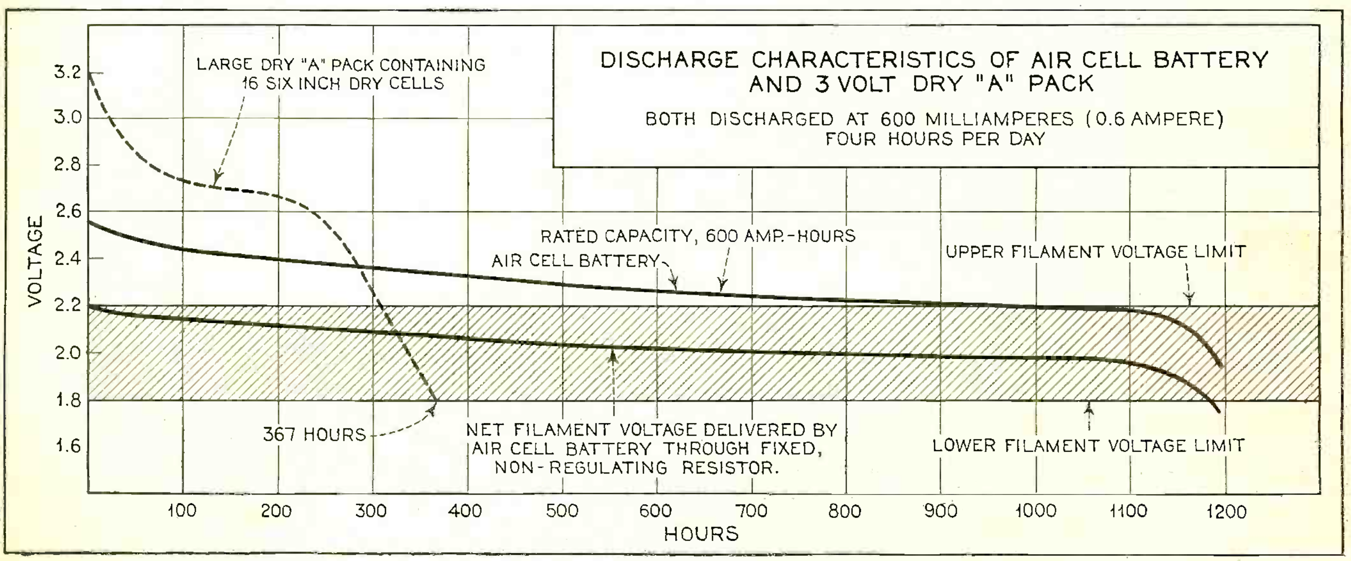


TWO AIR-CELL RECEIVERS

Above is the Sparton Air-Cell receiver model 81, a small set that can be placed on a table or on a mantelpiece. The larger receiver, at the left, is the Audiola Air-Cell console equipped with the large and powerful loudspeaker

AIR-CELL BATTERY CURVE

This curve shows how the voltage characteristic of the Air-Cell tube has been matched with the discharge characteristic of the Air-Cell battery. This is not true of the 3-volt dry battery, as can be seen by examining the curve in dotted lines. The net voltage reaching the filament through the fixed resistor used with the air cell keeps the filament voltage within operating limits throughout the entire air-cell battery life, which is considerably over 1000 hours at this rate

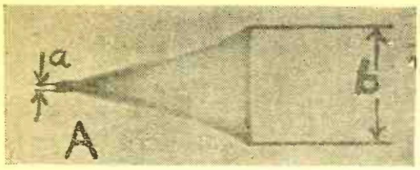


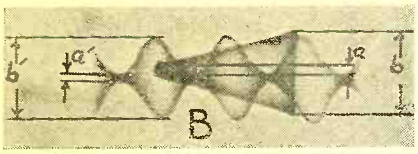
LABORATORY APPLICATIONS OF

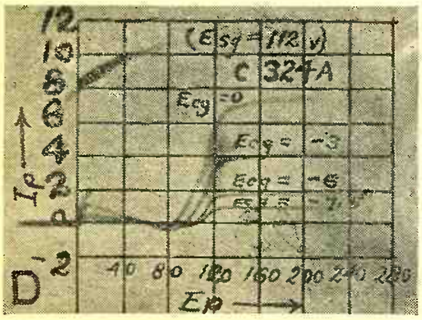
CATHODE RAY TUBES

The cathode-ray tube is suitable for many measurements which are difficult if not impossible with other apparatus. Some of these applications are discussed in this installment

J. M. Hollywood, M. P. Wilder







CATHODE-RAY MEASUREMENTS

(A) *Shows percentage of modulation and distortion in output of a 56,000 kc. transmitter. Some distortion and overmodulation is present.* (B) *Shows percentage of modulation and distortion in output of a 56,000 kc. transmitter. Both actual wave form and trapezoidal modulation figure are shown. Little distortion is present.* (C) *Plate-current-plate-voltage characteristics of a 227 for grid biases ranging from 0 to 9 volts in 1.5 volt steps. Obtained on cathode-ray tube.* (D) *Plate-current-plate-voltage characteristics of a 224 for grid biases of 0 to 7.5 volts, and screen voltages of 112 volts. Obtained on cathode-ray tube*

IN the applications so far discussed, the cathode-ray tube was used with deflection along just one axis. One of its chief features is that deflection may be obtained along two axes at right angles. A valuable application of this is in oscilloscopic observation of wave forms. This is done by applying a voltage proportional to time on one axis, and applying the voltage to be observed on the other axis. The previous article showed a combined power supply and sweep circuit for general use of this nature.

A simpler circuit for providing deflection proportional to time is shown in Figure 1. This circuit is not as good as the one given before, because the deflecting voltage is not so great, and the return of the spot to its original position after each sweep is not so fast. It may be attractive because its parts are to be found in the average "junk box". The operation is as follows. Tube V1 is oscillating at a frequency of about 2000 kc. (this will not cause much trouble as it is out of the broadcast range). In regenerative detectors, one often finds that considerable feedback causes a "motorboating" effect; this effect is used here. Condenser C becomes charged, due to flow of grid current when the circuit oscillates, and blocks the grid. Tube V2 is a pentode arranged to pass a constant current. This will discharge condenser C slowly until the grid is unblocked and oscillation again starts. Then C again charges rapidly, blocking the grid. When C discharges, its voltage falls off in proportion to time because the current is constant. When it recharges the time required is small compared to time of discharging required for the condenser.

The condenser voltage is applied to the deflecting plates of the cathode ray tube, giving deflection proportional to time. The frequency of the sweep voltage is increased if the condenser C is made smaller or its discharge current through V2 larger. The amplitude can be varied by changing the plate voltage with potentiometer P1. It will also depend on the type of tube used as V1. The frequency and amplitude controls are independent.

The locking voltage shown is to be taken from a source of the same frequency as the voltage whose wave form is to be observed; the sweep frequency can then by synchronised at this frequency, and the wave form on the screen will be stationary. This sweep circuit is to be used, of course, in conjunction with a power supply for the cathode-ray tube.

One application of great interest to those who operate radiophone stations is the observation of percentage of modulation and distortion in the radio frequency output. A simple system that shows both (without use of a sweep circuit) is given in Figure 2. The radio-frequency voltage is applied directly to one pair of plates and instead of a sweep circuit the modulating voltage is applied to the other pair of plates. In this arrangement the connections to the deflecting plates should be taken directly from the cathode-ray tube instead of being passed through the cable and power supply chassis to its socket. The connections between tuned circuit LC and the deflecting plates must be short. The power supply of the previous article can be used and the connections to the deflecting plates made at the cathode-ray tube socket instead of through the cable. One plate of each pair is connected inside the tube to anode. Figure 3 shows a convenient arrangement for using either direct connections or con-

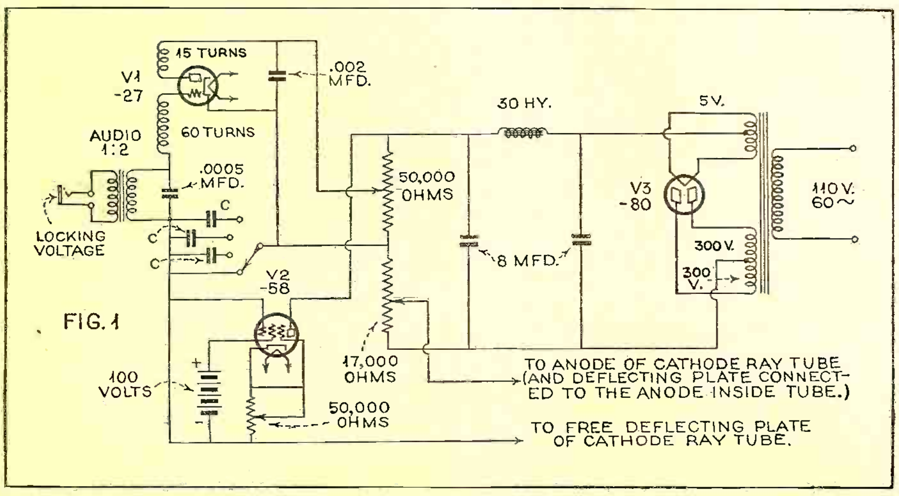


FIG. 1

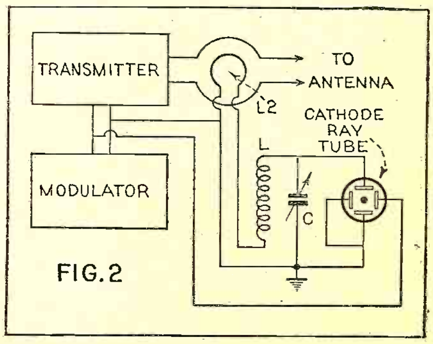


FIG. 2

nections through the cable. The tank circuit LC should be close to the cathode-ray tube, but the line from the coupling coil L2 may be made quite long, of twisted pair. Coupling coil L2 picks off a small amount of the radio-frequency power from the magnetic field around the antenna feeders. If the transmitter is very small, the coil may have to be coupled to the output tank circuit instead. The voltage is stepped up in tank circuit LC to a value sufficient for good deflection on the cathode-ray tube, along a vertical line. The audio-frequency modulating voltage is made to deflect the spot horizontally. The combination of the two results in a trapezoidal pattern on the screen as shown in photographs (a) and (b). The percentage of modulation is given by the value $\left(\frac{b-a}{b+a} \times 100\%\right)$ for less than 100%. If the radio frequency varies linearly with the modulating voltage there is no distortion. This linearity will make the sloping sides of the trapezoidal figure straight lines. The curvature of the sides will indicate the amount of the distortion present which can be calculated in harmonic percentage if desired, by the same methods used in calculating distortion in vacuum-tube audio amplifiers.

Instead of connecting the modulating output voltage to one pair of plates, the audio input to the modulator or previous amplifier may be connected to one pair of plates through an amplifier known to introduce very small distortion. By this means distortion present in a modulator or previous amplifiers can be investigated by observing the additional distortion due to each stage. Generally there is a small amount of phase shift in audio amplifiers. This will make the sloping sides in photograph (a) become ellipses. This can be corrected by shifting phase in the same direction in the amplifier feeding the cathode-ray tube. Figure 4 shows a phase shifting circuit suitable for insertion in this amplifier.

The arrangement of Figure 2 is very useful for continuous monitoring of voice transmission. It is also possible to observe percentage of modulation and distortion in the modulated stage and the r.f. amplifiers that follow, if any. The envelope shape of the pattern does not change when the modulating voltage is of a complex nature or of varying frequency. Monitoring therefore is very easy.

Another method of observing the percentage of modulation and the distortion is to use a sweep switch circuit as in Figure 5. The circuit is the same as that of Figure 2 except that the horizontal movement of the spot is made proportional to time, and the actual wave form is observed. The sweep frequency is synchronized with that of the modulating voltage, or better made a sub-multiple of it, as several modulating cycles will then be depicted on the screen. The pattern on the screen will then be the actual wave form and if sinusoidal modulating voltage is used, distortion will show up as a departure of the envelope seen on the screen from true sinusoidal shape. This distortion will be due to all circuits following the application of sinusoidal voltage, and can not be investigated for individual components as in the circuit of Figure 2. Using this method the pattern jumps around if voice modulation is used and can not be seen clearly. For sinusoidal modulation, the pattern appears as in photograph (b). The percentage of modulation is given by the value $\left(\frac{b'-a'}{b'+a'}\right) \times 100\%$, for less than 100%.

Incidentally, photographs (a) and (b) were taken for a 56,000 kc. transmitter. At such high frequencies, the gas focused cathode-ray tubes will not work but the high-vacuum, electrostatically focused tubes focus the same as at low frequencies. In photograph (b) a slight "slanting" effect is caused by radio frequencies picked up on the horizontal deflecting plates. This would not cause trouble at the more common radio frequencies.

There are so many other applications of interest in research and in industry that it would be impossible to cover many in this article. In general the cathode-ray (*Continued on page* 508)

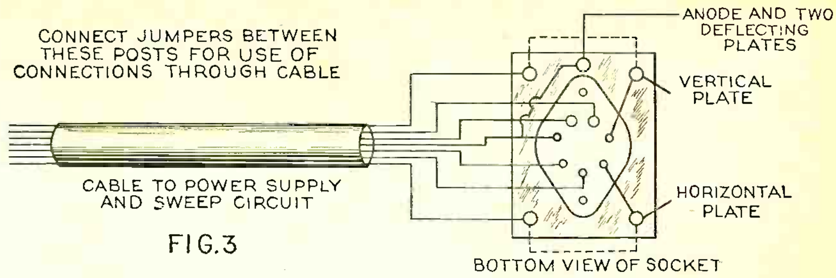


FIG.3

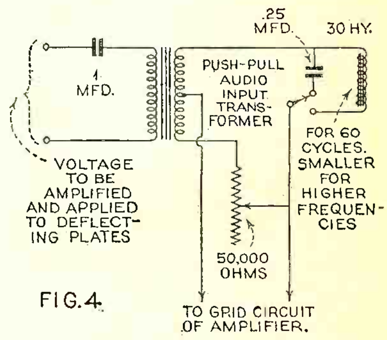


FIG.4

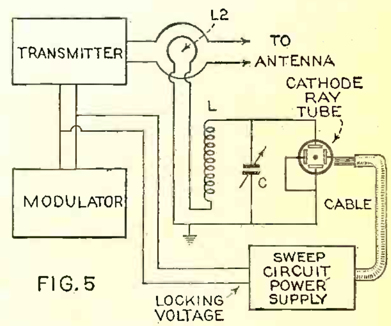


FIG.5

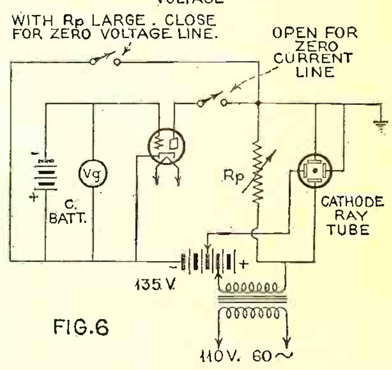


FIG.6

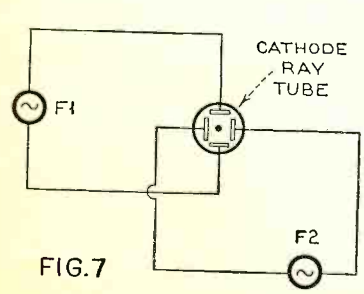
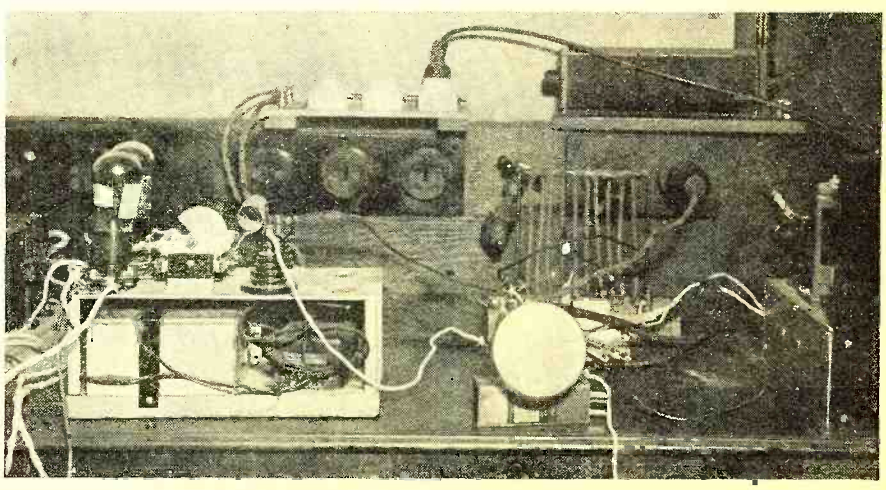


FIG.7



Sound Sources for

P. A. SYSTEMS

George E. Fleming

Part Three

THE source of signals for public address systems is subject to wide variations from a simple single microphone for addressing a group of people to several channels of radio inputs as well as a phonograph and numerous microphones. It is our intention in this and the next article to discuss the various types of signal sources and their actual application so that intelligent choice may be made of these sources to suit individual cases.

On the subject of phonograph motors and pickups one is confined to commercial products and the choice is rather limited. Pickups are available in practically any impedance from 200 to 10,000 ohms. As a rule, it is better to choose one of the low impedance type provided the level of the output is sufficient to drive the amplifier. If the pickup is to be used as one of several inputs, it is definitely advisable to choose a low impedance one as its level will roughly correspond to the output of a carbon microphone transformer or a condenser microphone. Then, again, the overall quality of a low impedance pickup is, as a rule, somewhat better than the high impedance units. A pickup should, as should any generator, be loaded with a load of equal impedance with the internal impedance. An apparently higher volume level may be obtained by loading with an impedance several times the impedance of the pickup, but this is due to the fact that the pickup will then have a tendency to become a voltage device rather than a current device, which is an undesirable condition and tends to accentuate the high notes in preference to the low. One should be careful, however, not to use a loading impedance lower than that of the pickup lest the low notes be accentuated to too great an extent.

It is possible, and sometimes desirable, to use an automatic record changer in place of the more conventional turn table and pickup. There are several such devices on the market. Care should be exercised in the choice of an automatic record changer to see that the mechanism is sturdy enough to withstand continuous usage without breakdown and that the pickup used on the device is of good quality. There has been something of a tendency by a few manufacturers to cheapen this portion of the instrument, which, of course, reflects itself in poor quality output. An automatic record changer is almost never desirable in a mobile system, for of necessity the apparatus is too delicate to permit its operation when subjected to jars and shocks. For mobile work, it is better to use an ordinary turn table, preferably spring suspended, although the necessity of changing records may be something of a nuisance to operators.

There has recently appeared on the market some long playing records of 33⅓ r.p.m. variety. It has been our experience that these records do not have the quality of the 78 r.p.m. records due to the very fine grooves and the consequent loss of amplitude on the low notes. If, however, their use is desirable, a two-speed motor will be necessary unless it is possible to use two separate motors. Two-speed motors are available. When using the slow speed records of most makes, it is necessary to use a special needle and a lighter weight pickup. These needles are rather expensive, about 5 cents each, and are intended to play from 15 to 25 records without changing. If the needle is removed from the pickup for any reason, it must be discarded. Therefore, if both types of records are to be played, it is almost a necessity to use two separate pickups, one for 33⅓ r.p.m. records and the other for 78 r.p.m. records.

As regards the choice of radio receivers for public address work, wide latitude is allowable. There are available upon the market numerous r.f. tuners built without audio systems that are almost ideal for the purpose. It is necessary to build a small power supply for these tuners, but that should present little difficulty. It is also possible to re-vamp a standard radio receiver, although considerable changes will have to be made in the receiver.

If one of the tuners is to be used, about the only change that will be necessary is to change the detector circuit to the one shown in Figure 1. This is a circuit known as a diode detector and is desirable for a number of reasons, principal among them being the fact that no potential is applied to the tube other than the signal potential so that any ripple in the power supply of the tuner is not applied to the detector circuit where it would be further amplified through the main amplifiers. Unless such a circuit is used, it will be almost impossible to eliminate the hum arising here. The transformer T may be anything from 20,000 to 500,000 ohms primary with a 500 ohm secondary. The 500 ohm secondary will be necessary to prevent the pickup of ground noises in the line to amplifier. A microphone transformer may be very nicely utilized here by reversing it and using the secondary as the primary and the primary as the secondary.

In case one desires to use a standard receiver, it will be necessary to change the detector circuit as explained above, and remove all the audio amplifying equipment from the receiver. The lessened load upon the power supply will probably cause (*Continued on page* 506)

Photo Courtesy Electrad, Inc.

A TYPICAL INSTALLATION

An excellent example of a public-address system of the type that finds increasing use in business houses, hotels, schools, etc.

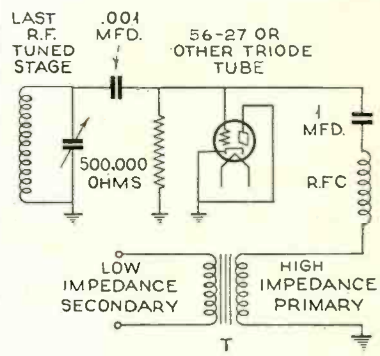


FIG.1

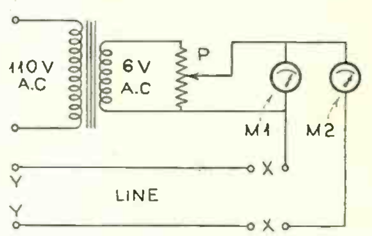


FIG. 2

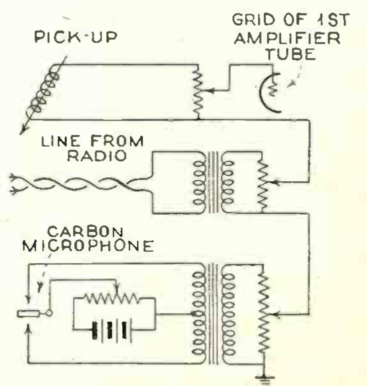
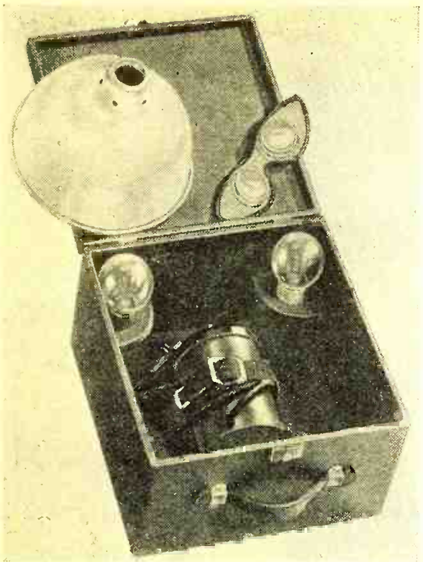


FIG. 3



SERVICE SIDELINES

(Ultra Violet Lamps)

Ultra violet lamps, especially the newer types, which are small enough to be readily portable, offer radio servicemen a unique and profitable sales sideline

G. E. De Nike

WHEN given only casual consideration, it may seem to the serviceman that the selling of ultra violet equipment and installations is out of his line. It should be remembered however, that the many daily contacts of the serviceman with home owners offer countless opportunities for sowing the seed which can grow into a profitable volume of ultra violet sales. Health, beauty, vitality and the welfare of children are of vital concern in modern home-life and when the serviceman is selling ultra violet, he is selling exactly those things.

Sales resistance is rapidly lowered as one sale tends quickly to lead to another in the neighborhood. The approval of a family physician also hurriedly dispels any doubt in the prospect's mind. Remember too, that the manufacturer of an ideal ultra violet source is able and willing to supply literature that minimizes the selling job.

Broad as the market of the radio owning homes may seem, there are in addition, further sales fields awaiting cultivation. Owners of apartment houses and unrented private dwellings are highly logical prospects for ultra violet installations. Just as the electric refrigerator or the oil burner has many times acted as a deciding factor in the signing of a lease—so is it possible that a permanent ultra violet installation might be the final clincher in a rental.

Imagine the interest which could be aroused by a rental agent able to say: "And here, Mrs. Jones, is a permanent ultra violet installation. We are one of the few apartment houses in the country that offer tenants the facilities of such a health and beauty culture device."

The ingenious serviceman will, of course, spot numberless places in houses and apartments for permanent or semi-permanent, low cost ultra violet installations. Bedroom, bathroom, den and nursery offer logical ultra violet installation spots.

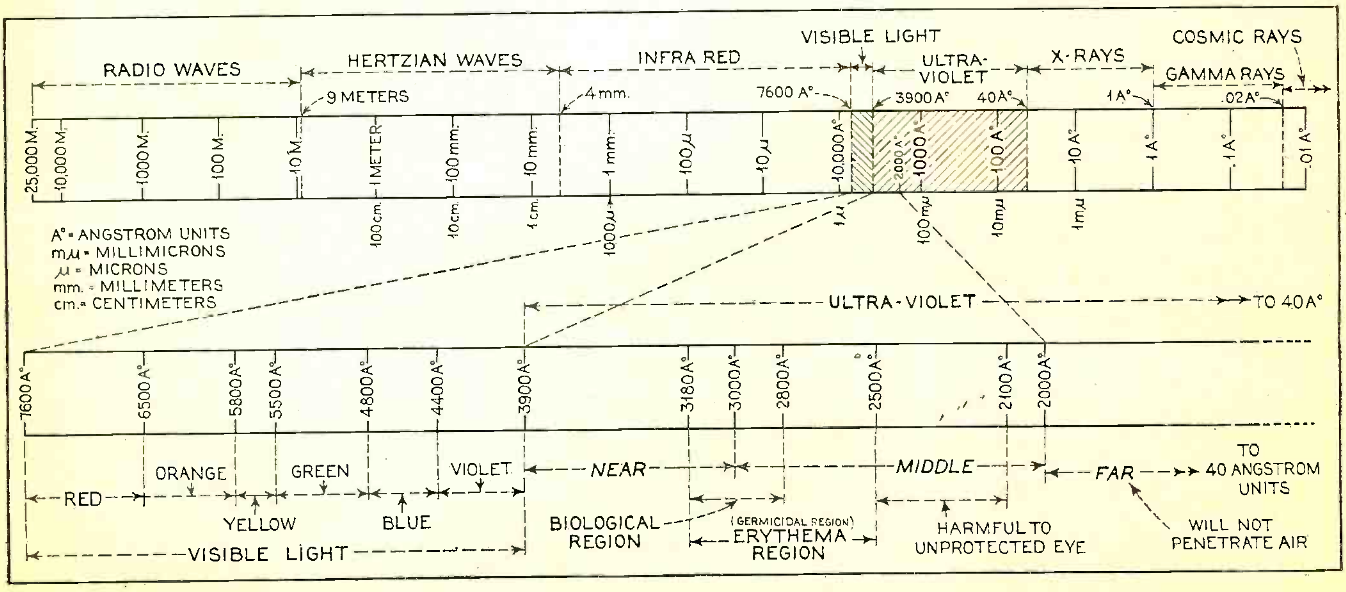
Placing the ultra violet equipment where it will encourage regular daily use is, of course, most desirable. The person who wants to maintain a high degree of disease resistance or sport a "Florida tan" the Winter through can do so with regular exposure to ultra violet.

Science, which has developed the great radio industry from the band of electro-magnetic vibrations in the sun's spectrum, known as the broadcast band has for many years been probing the mysterious health wave band which is found just below the range of visible light and has been called ultra violet. While invisible to the human eye, the ultra violet wave has been found to be vital to human well being.

The medical profession has studied the strange effect of ultra violet on man and animal life for many years. Until recent years, however, the action of ultra violet with reference to health and physical well being has been mere conjecture. The fact that vital ultra violet waves when allowed to play on exposed skin surfaces react to produce Vitamin D is now definitely established. It is known that the human body without Vitamin D fails to assimilate the mineral elements, calcium and phosphorus, so necessary to every healthy human body.

Further, Vitamin D is but scantily distributed throughout nature and it has been discovered that, practically without exception, its origin is due to the action of the sun's ultra violet rays on cell life. Fatigue, nervousness, irritability and loss of appetite are in many cases traceable to a deficiency of calcium and phosphorus in the blood stream lacking Vitamin D.

The visible physical effect of an exposure to ultra violet is to cause a reddening of the skin, generally known as sun-burn, which in turn develops into the well known tan. It is well to note here that sun- (*Continued on page* 501)



THE PLACE OF ULTRA VIOLET IN THE RADIATION SPECTRUM
The breakdown as shown here, based on physical effects, is that arrived at as a result of recent scientific investigations and discussions

A MODERN TUBE CHECKER

This instrument is capable of checking all available tubes and provides 7 positions with replaceable sockets which may be wired-in to care for special requirements of future tubes

O. J. Morelock

WITH the amazing succession of new tubes introduced during the past two years, dealers and servicemen have been hard pressed to maintain adequate tube-checking equipment to keep up with the procession.

There is, however, encouragement to be found in the fact that, while new tubes will continue to make their appearance from time to time, we will never again witness such a bewildering number of new types as have appeared in past months. Dealers can therefore afford to install high-grade tube-checking equipment such as is now available—with an excellent degree of assurance that this equipment will continue to serve for years to come.

Today, to correctly test all tubes on the market, we must be able to cover more than ninety different types, not including duplicates numbered or lettered variously by individual manufacturers. Theoretically, to test all of these tubes we would need almost one hundred sockets—a rather imposing layout. The tester must operate from any standard a.c. outlet; it should have very definite eye appeal and, resting on a dealer's counter, should attract attention and boost tube sales. With these facts in mind, the problem of developing a medium-priced tube tester with a low-obsolescence factor was undertaken by the Weston engineering staff.

After some study it became apparent that the tubes could be grouped in three different ways. The first group would include all tubes having like base connections but different filament voltage ratings. The second would include all tubes with like filament voltages but differing electrode connections to the tube base prongs; and the third group would be tubes with like physical base pin layouts. If one 4-, one 5-, one 6- and one double 7-prong sockets are included, all tubes in the third grouping are effectively taken care of; that is, all physical base pin arrangements are covered. If the filament positions on the four sockets are connected through a rotary switch to a transformer having taps for all nine of the filament voltages called for on commercial receiving tubes, any filament voltage can be applied to any tube socket. In this way all tubes included in the second group are taken care of.

Likewise, if a 3-deck rotary switch is used to interchange the potentials applied to the remaining electrodes, these tubes included in group 1 can be accommodated. Thus 9 active positions on "First Selector" or filament voltage switch and 11 active positions on "Second Selector" switch are available, making a total of 9 × 11 or 99 different circuit connections which can be made to each of the four sockets. This very definitely takes care of all single amplifier tubes without much complexity.

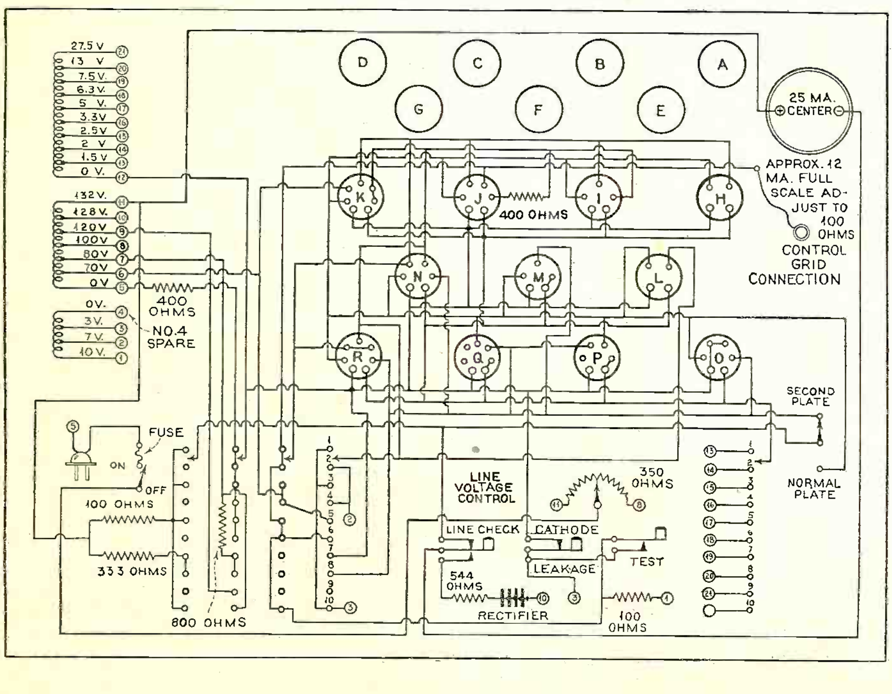
After further study in developing the new Weston tube checker, model 674, it was decided that separate sockets for the 6- and 7-prong double tubes such as the -53, -79, etc., and one socket each for the 4-, 5- and 6-prong rectifier tubes provided the simplest layout. All 5 of these sockets have their normal and second plate connections brought out to a toggle switch marked "Normal Plate" and "Second Plate." Thus, by manipulating this switch both portions of double tubes, whether rectifier or amplifier, may be tested separately without the tube being removed from the socket. It was also deemed advisable to add 2 more sockets for testing the diode portions of 6- and 7-prong combination tubes. The socket connections are so arranged that the same toggle switch may be manipulated to obtain a separate test on each of the diode plates. Thus a tube that is far off balance for full-wave diode detection may be easily spotted.

There are used, in all, 11 sockets to obtain tests on all tubes. By means of switches there are obtainable 99 different connections to most of the above sockets, or a total of approximately 459 combinations. Eighteen sockets are mounted on the panel, leaving 7 spares for future use *if necessary*. All sockets are removable and units with new prong layouts may be quickly substituted for those present should any need for them arise.

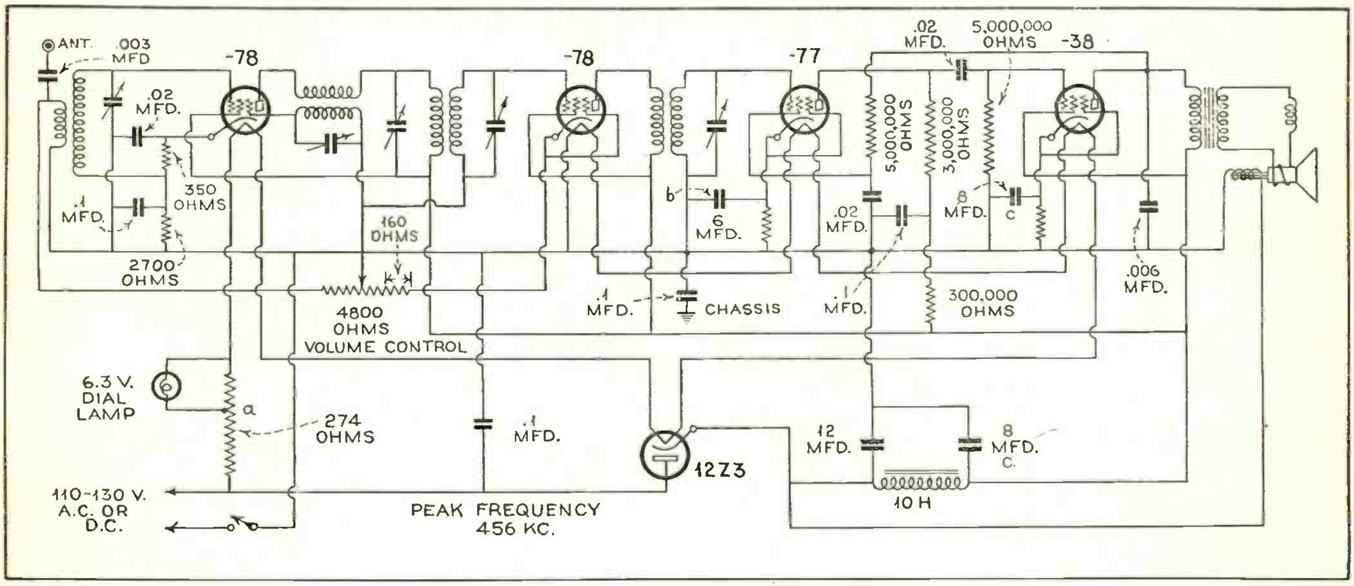
So far all common receiving tubes are covered with the assumption that they draw the same plate current. This, however, is not the case, and a fourth deck was found necessary on the electrode selector switch for controlling the sensitivity of the meter. Plate current is also controlled by the proper selection of grid bias automatically taken care of in this switch. Positive shifts on the grids of Class B tubes are also controlled in this manner. (*Continued on page* 503)

DIAGRAMMATIC LAYOUT

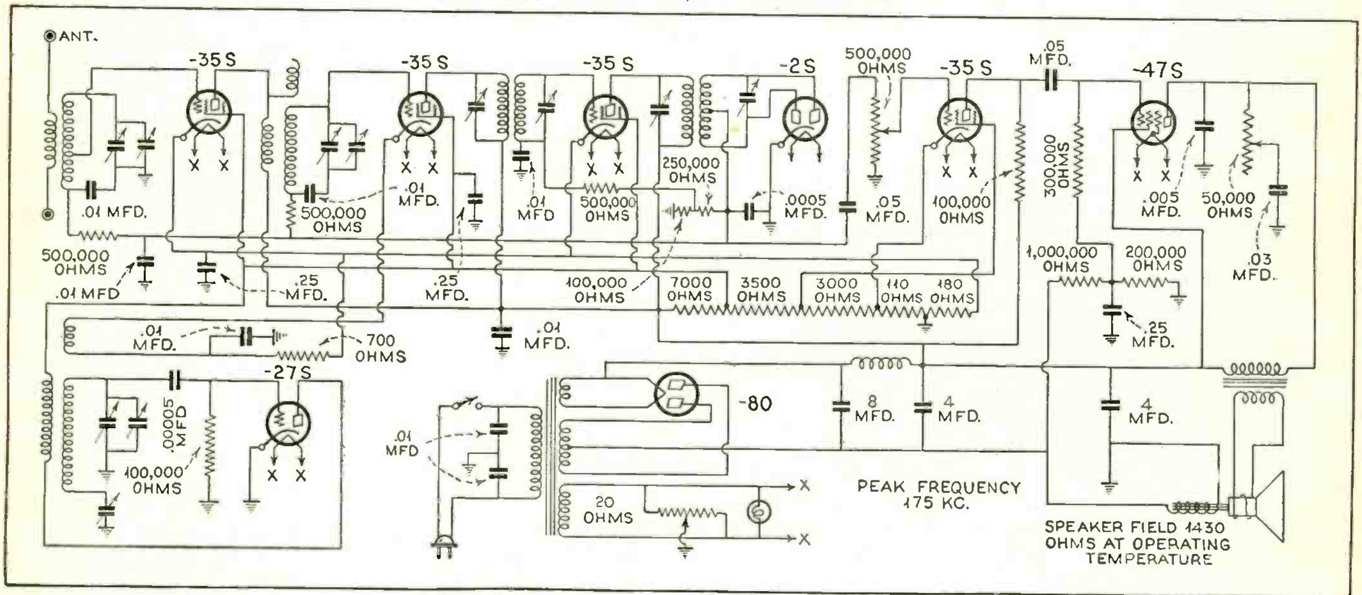
This drawing shows relative positions of parts as viewed from rear of panel. Similar numbers in small circles indicate points connected by wiring which has been omitted to simplify the drawing



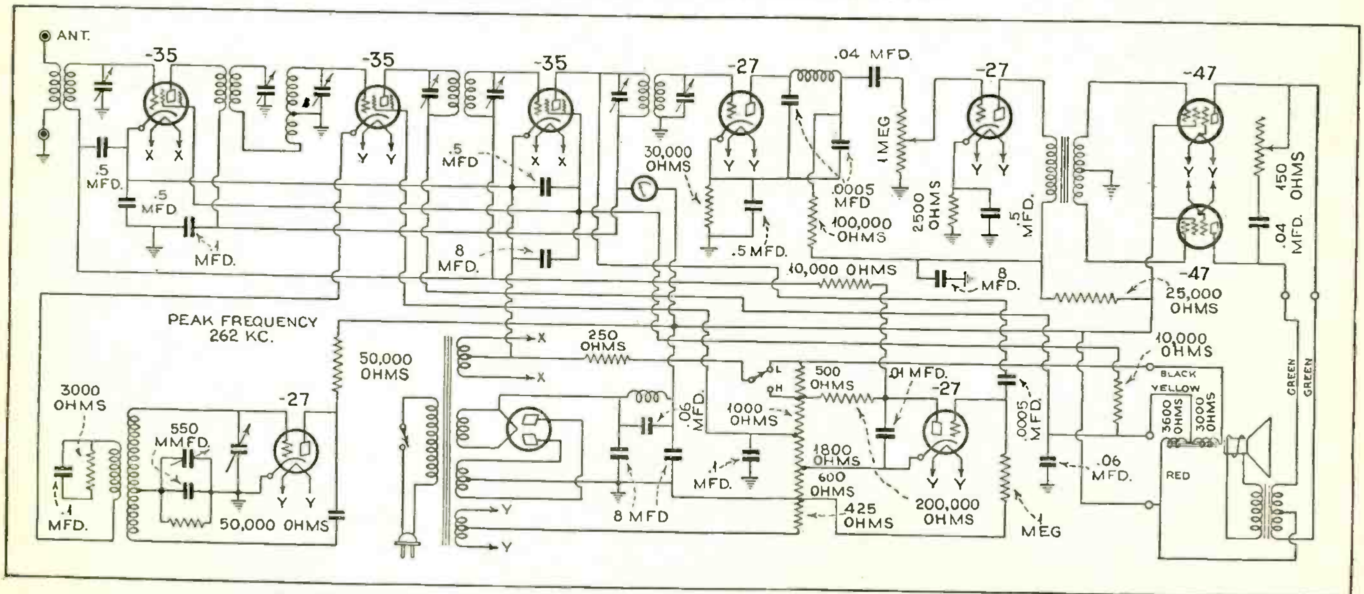
SERVICE DATA FOR SERVICEMEN



CROSLEY, MODEL 163, SUPERHETERODYNE



MAJESTIC, MODEL 200, SUPERHETERODYNE



MONTGOMERY WARD (AIRLINE "MINSTREL," SERIES 1355 AND 1955)

Compiled from J. F. Rider's Perpetual Trouble Shooter's Manual.

S. W. TIME SCHEDULE

RECEPTION REPORTS

IN this eleventh installment of the DX Corner we have listed a time schedule of Short-Wave Best Bets, a list of stations logged during the past month at the RADIO NEWS Short-Wave Listening Post in Westchester County, New York, and at other Official R. N. Listening Posts throughout the world. The schedule includes only the best received stations, hourly, from 5 o'clock in the morning to 12 midnight, E.S.T. Space has been left for filling in local time. Space has also been left opposite the call letters for your own dial settings for each station you pick up. Unless otherwise noted, stations are heard daily.

Short-Wave "Best Bets"

Wavelengths in Meters	*Call Letters*	*Dial Settings*
10 G.M.T. 5 A.M. E.S.T.		**Local Time**
19.8+	HVJ	
30.5	JIAA	
31.2+ Sun.	VK2ME	
31.5 Wed., Sat.	VK3ME	
70.2	RV15	
11 G.M.T. 6 A.M. E.S.T.		**Local Time**
19.7	DJB	
25.5	DJD	
30.5	JIAA	
31.2+ Sun.	VK2ME	
31.3+	W1XAZ	
31.5 Wed., Sat.	VK3ME	
49.4+ Irregular	W8XAL	
70.2	RV15	
12 G.M.T. 7 A.M. E.S.T.		**Local Time**
16.9+	W8XK	
16.9	GSG	
19.6	FYA	
19.7	DJB	
23.3+ Sun.	CNR	
25.3	GSE	
25.5	DJD	
25.5+ Ex. Tues., Wed	PHI	
31.2+ Sun.	VK2ME	
31.3+	W1XAZ	
31.8	PLV	
49.4+ Irregular	W8XAL	
70.2	RV15	
13 G.M.T. 8 A.M. E.S.T.		**Local Time**
16.9+	W8XK	
16.9	GSG	
19.6	FYA	
19.7	DJB	
23.3+ Sun.	CNR	
25.3	GSE	
25.5	DJD	
25.5+ Ex. Tues., Wed	PHI	
31.2+ Sun.	VK2ME	
31.3+	W1XAZ	
31.8+	PLV	
35.5 Irregular	PRAG	
49.2	VE9GW	
49.4+ Irregular	W8XAL	
49.5 Sun.	OXY	
49.9+	VE9DR	
70.2	RV15	
14 G.M.T. 9 A.M. E.S.T.		**Local Time**
16.9+	W8XK	
19.6	FYA	
19.7	DJB	
25.3	GSE	
25.5	DJD	
25.5+ Sat., Sun.	PHI	
25.6 Except Sun.	VE9JR	
31.2+ Sun.	VK2ME	
31.3+	W1XAZ	
31.5+	GSB	
31.8+	PLV	
35.5 Irregular	PRAG	
49.0 Except Sat. Sun.	VE9HX	
49.2	VE9GW	
49.4+ Irregular	W8XAL	
49.5 Sun.	UOR2	
49.9+	VE9DR	
15 G.M.T. 10 A.M. E.S.T.		**Local Time**
13.9+	W8XK	
16.8+	W3XAL	
19.6	FYA	
19.6+	W2XE	
19.7	W8XK	
19.7	DJB	
25.3	GSE	
25.5	DJD	
26.8+ Sun.	CT3AQ	
31.2+ Sun.	VK2ME	
31.3+	W1XAZ	
31.5+	GSB	
31.8+	PLV	
45.3	RV72	
49.0+ Ex. Sat., Sun.	VE9HX	
49.2	VE9GW	
49.4+ Irregular	W8XAL	
49.5 Sun.	UOR2	
49.9+	VE9DR	
16 G.M.T. 11 A.M. E.S.T.		**Local Time**
13.9+	W8XK	
16.8	W3XAL	
19.6+	W2XE	
19.7	W8XK	
19.7	DJB	
23.3	HJ1ABB	
25.2	FYA	
25.4	I2RO	
25.5 Irregular	DJD	
25.6 Except Sun	VE9JR	
26.8+ Sun.	CT3AQ	
31.2+ Sun.	VK2ME	
31.3+	W1XAZ	
31.5+	GSB	
40.5 Except Sun.	HJ3ABD	
45.3	RV72	
49.0+ Ex.Sat.,Sun.	VE9HX	
49.2	VE9GW	
49.3+ Sun.	W9XAA	
49.4+ Irregular	W8XAL	
49.5 Sun.	UOR2	
49.6	GSA	
49.9	VE9BJ	
49.9+ Except Sun.	VE9DR	
17 G.M.T. 12 Noon E.S.T.		**Local Time**
13.9+	W8XK	
16.8	W3XAL	
19.6+	W2XE	
19.7	W8XK	
19.7	DJB	
23.3	HJ1ABB	
25.2	FYA	
25.4	I2RO	
25.5 Irregular	DJD	
25.6 Sat.	VE9JR	
31.2+	W3XAU	
31.2+Sun.	VK2ME	
31.3+	W1XAZ	
31.5+	GSB	
40.5 Ex. Sun.	HJ3ABD	
45.3	RV72	
49.0+ Ex. Sat., Sun.	VE9HX	
49.2	VE9GW	
49.3+ Sun.	W9XAA	
49.4+ Irregular	W8XAL	
49.5 Sun.	UOR2	
49.6	GSA	
49.9	VE9BJ	
49.9+	VE9DR	
18 G.M.T. 1 P.M. E.S.T.		**Local Time**
13.9+	W8XK	
16.8	W3XAL	
19.7	W8XK	
19.7	DJB	
25.2	FYA	
25.5 Irregular	DJD	
25.5	GSD	
25.6 Sat.	VE9JR	
30.4 Sat.	EAQ	
31.2+	W3XAU	
31.3	GSC	
31.3+	W1XAZ	
45.3	RV72	
49.2	VE9GW	
49.3+ Sun.	W9XAA	
49.4+ Irregular	W8XAL	
49.5 Temporary	OXY	
49.9+	VE9DR	
19 G.M.T. 2 P.M. E.S.T.		**Local Time**
16.8	W3XAL	
19.5 Ex. Tu. Th. Sat.	W2XAD	
19.7	W8XK	
25.2	FYA	
25.3	I2RO	
25.3+	W2XE	
25.5 Irregular	DJD	
25.5	GSD	
25.6 Ex. Sat., Sun.	VE9JR	
30.4 Sat.	EAQ	
31.2+	W3XAU	
31.3	GSC	
31.3+	W1XAZ	
31.3+	DJA	
37.3+ Sun.	CNR	
45.3	RV72	
49.2	VE9GW	
49.3+ Sun.	W9XAA	
49.4+ Irregular	W8XAL	
49.5 Tues.	UOR2	
49.5 Temporary	OXY	
49.9+	VE9DR	
50.2+	HVJ	
20 G.M.T. 3 P.M. E.S.T.		**Local Time**
16.8 Except Sat.	W3XAL	
19.5+ Ex. Tu. Th. Sat	X2XAD	
19.7	W8XK	
25.3+	W2XE	
25.4	I2RO	
25.5 Irregular	DJD	
25.5	GSD	
25.6	FYA	
25.6 Ex. Sat., Sun.	VE9JR	
30.4 Sat.	EAQ	
31.2+	W3XAU	
31.3	GSC	
31.3+	W1XAZ	
31.3+	DJA	
37.3 Sun.	CNR	
45.3+ (chimes)	RV72	
49.1+ Sat.	W3XAL	
49.2	VE9GW	
49.3+ Sun.	W9XAA	
49.4+ Irregular	W8XAL	
49.5 Tues.	UOR2	
49.5 Temporary	OXY	
49.6+ Sun.	W1XAL	
49.9	VE9DR	
50.0	RV59	
21 G.M.T. 4 P.M. E.S.T.		**Local Time**
19.7	W8XK	
25.2	W8XK	
25.3+	W2XE	
25.4	I2RO	
25.5	DJD	
25.6	FYA	
31.2+	W3XAU	
31.3	GSC	
31.3+	W1XAZ	
31.3	DJA	
31.5+	PRBA	
37.3 Sun.	CNR	
46.6 Fri.	W3XL	
48.8+	W8XK	
49.1 Except Sat.	W9XF	
49.2	VE9GW	
49.3+ Sun.	W9XAA	
49.4+ Irregular	W8XAL	
49.5 Temporary	OXY	
49.6	GSA	
49.9+	VE9DR	
50.0	RV59	
22 G.M.T. 5 P.M. E.S.T.		**Local Time**
16.8 Except Sat.	W3XAL	
25.2	W8XK	
25.4	I2RO	
25.5	DJD	
26.8+ Tues., Thurs.	CT3AQ	
30.4	EAQ	
31.2+ Tues., Fri.	CT1AA	
31.2+	W3XAU	
31.3	GSC	
31.3 Sat.	HBL	
31.3+	W1XAZ	
31.3+	DJA	
31.5+	PRBA	
35.5	PRAG	
36.6	PSK	
38.4+ Sat.	HBP	
45.0+ Sun.	HC2RL	
46.6+ Fri.	W3XL	
48.7	YV3BC	
48.8+	W8XK	
49.0	W2XE	
49.0+ Sat., Sun.	VE9HX	
49.1+ Sat.	W3XAL	
49.1+ Except Sat.	W9XF	
49.2	VE9GW	
49.3+ Sun.	W9XAA	
49.4+	W8XAL	
49.5 Temporary	OXY	
49.6	GSA	
49.9	VE9DR	
50.0	RV59	
50.6 Irregular	HJ4ABE	
23 G.M.T. 6 P.M. E.S.T.		**Local Time**
25.2	W8XK	
25.6	FYA	

26.8+ Tues., Thurs.	CT3AQ	
30.4	EAQ	
31.2+ Tues., Fri.	CT1AA	
31.3 Sat.	HBL	
31.3	GSC	
31.3+	W1XAZ	
31.3+ Irregular	DJA	
31.4+	W2XAF	
31.5+	PRBA	
35.5	PRAG	
36.6+	PSK	
38.4+ Sat.	HBP	
45.0+ Sun.	HC2RL	
46.5	HJ1ABB	
46.6+ Fri.	W3XL	
48.7	YV3BC	
48.8+	W8XK	
49.0	W2XE	
49.0+ Sat., Sun.	VE9HX	
49.1+ Sat.	W3XAL	
49.1+ Except Sat.	W9XF	
49.2	VE9GW	
49.3	CP5	
49.3+	W9XAA	
49.4+ Sun.	W8XAL	
49.5+	GSA	
49.5 Temporary	OXY	
49.9+	VE9DR	
50.6 Tu., Th., Sat.	HJ4ABE	
00 G.M.T. 7 P.M. E.S.T.		**Local Time**
25.2	W8XK	
25.6 Except Sun.	VE9JR	
25.6	FYA	
30.4 Sat.	EAQ	
31.3	GSC	
31.3+	W1XAZ	
31.3+	DJA	
31.4+	W2XAF	
31.5+	PRBA	
35.5	PRAG	
36.6+	PSK	
42.0	YV2AM	
45.0+ Sun.	HC2RL	
46.5	HJ1ABB	
46.6+ Fri.	W3XL	
47.0	HJ5ABB	
48.0+	HJ3ABF	
48.5	TGW	
48.7	YV3BC	
48.8+	W8XK	
49.0	W2XE	
49.0+ Sat., Sun.	VE9HX	
49.1+ Sat.	W3XAL	
49.1+ Ex. Sat., Sun.	W9XF	
49.2	VE9GW	
49.3	CP5	
49.3+ Sun.	W9XAA	
49.4+	W8XAL	
49.5	W3XAU	
49.5+	GSA	
49.8	DJC	
49.9	VE9DR	
50.4 Irregular	HJ2ABA	
50.6 Ex. Wed., Sun.	HJ4ABE	
69.4	G6XR	
01 G.M.T. 8 P.M. E.S.T.		**Local Time**
25.2	W8XK	
25.6	FYA	
25.6 Except Sun.	VE9JR	
31.3+	W1XAZ	
31.3+	DJA	
31.4+	W2XAF	
37.0	HC2JSB	
40.5+ Except Sun.	HJ3ABD	
42.0	YV2AM	
45.0+ Sun.	HC2RL	
46.5	HJ1ABB	
46.6+ Fri.	W3XL	
47.0	HJ5ABB	
48.0+	HJ3ABF	
48.5+	TGW	
48.7	YV3BC	
48.8+	W8XK	
49.0	W2XE	
49.0+ Sat., Sun.	VE9HX	
49.1+ Sat.	W3XAL	
49.1 Ecept Mon.	HCJB	
49.2	VE9GW	
49.3+ Sun.	W9XAA	
49.4+	W8XAL	
49.4+	W3XAU	
49.8	DJC	
49.9+	HIX	
49.9+	VE9DR	
50.4 Irregular	HJ2ABA	
50.6 Mon.Wed.Fri.	HJ4ABE	
69.4	G6XR	
73.0+ Except Mon.	HCJB	
02 G.M.T. 9 P.M. E.S.T.		**Local Time**
25.2	W8XK	
25.6	FYA	
25.6 Except Sun.	VE9JR	
31.3+ Irregular	DJA	
31.3+	W1XAZ	
31.4+	W2XAF	
40.5+ Except Sun.	HJ3ABD	
42.0	YV2AM	
45.0+ Tues.	HC2RL	
45.3 Thurs.	PRADO	
46.5	HJ1ABB	
46.6+ Fri.	W3XL	
47.0	HJ5ABB	
48.5+	TGW	
48.7	YV3BC	
48.8+	W8XK	
49.0	W2XE	
49.0+ Sat., Sun.	VE9HX	
49.1+ Sat.	W3XAL	
49.1+ Except Sat.	W9XF	
49.2 Except Sun.	VE9GW	
49.3	CP5	
49.3+ Sun.	W9XAA	
49.4+	W8XAL	
49.4+	W3XAU	
49.8 Irregular	DJC	
49.9+	HIX	
49.9+	VE9DR	
50.4 Irregular	HJ2ABA	
50.6 Mon. Wed. Fri.	HJ4ABE	
73.0+ Except Mon.	HCJB	
03 G.M.T. 10 P.M. E.S.T.		**Local Time**
25.6	FYA	
25.6 Sat.	VE9JR	
31.0	T14NRH	
31.3+	W1XAZ	
31.4+	W2XAF	
40.5+ Except Sun.	HJ3ABD	
45.0+ Tues.	HC2RL	
45.3 Thurs.	PRADO	
46.6+ Fri.	W3XL	
48.5	TGW	
48.8+	W8XK	
49.0	W2XE	
49.0+ Sat., Sun.	VE9HX	
49.1+ Sat.	W3XAL	
49.1+ Except Sat.	W9XF	
49.2 Except Sun.	VE9GW	
49.3	CP5	
49.4+	W8XAL	
49.4+	W3XAU	
49.9+	HIX	
49.9+	VE9DR	
50.6 Mon. Wed. Fri.	HJ4ABE	
04 G.M.T. 11 P.M. E.S.T.		**Local Time**
25.6	FYA	
25.6 Sat.	VE9JR	
31.3+	W1XAZ	
45.0 Fri.	TGW	
45.0+ Tues.	HC2RL	
46.6+ Fri.	W3XL	
48.8+	W8XK	
49.1+ Sat.	W3XAL	
49.1+ Except Sat.	W9XF	
49.2 Except Sun.	VE9GW	
49.4+	W8XAL	
49.4+	W3XAU	
49.9+	VE9DR	

Station Locations

Wave-length	*Call Letters*	*Location*
13.9+	W8XK	Pittsburgh, Pa.
16.8+	W3XAL	Bound Brook, N. J.
16.8+	PHI	Huizen, Holland
16.9	GSG	Daventry, England
19.5	W2XAD	Schenectady, N. Y.
19.6	FYA	Pontoise, France
19.6+	W2XE	New York, N. Y.
19.7	W8XK	Pittsburgh, Pa.
19.7	DJB	Zeesen, Germany
19.8	GSF	Daventry, England
19.8	HVJ	Vatican City
23.3	CNR	Rabat, Morocco
25.2	FYA	Pontoise, France
24.2	W8XK	Pittsburgh, Pa.
25.3	GSE	Daventry, England
25.3+	W2XE	New York, N. Y.
25.4	I2RO	Rome, Italy
25.5	GSD	Daventry, England
25.5	DJD	Zeesen, Germany
25.6	FYA	Pontoise, France
25.6	VE9JR	Winnipeg, Canada
26.8+	CT3AQ	Funchal, Madeira
30.4	EAQ	Madrid, Spain
31.0	T14NRH	Heredia, Costa Rica
31.2+	XETE	Mexico City
31.2+	W3XAU	Philadelphia, Pa.
31.2+	VK2ME	Sydney, Australia
31.2+	CT1AA	Lisbon, Portugal
31.3	HBL	Geneva, Switzerland
31.3	GSC	Daventry, England
31.3+	W1XAZ	Springfield, Mass.
31.3+	DJA	Zeesen, Germany
31.3+	W2XAF	Schenectady, N. Y.
31.5	VK3ME	Melbourne, Australia
31.5+	YV3BC	Caracas, Venezuela
31.5+	GSB	Daventry, England
31.5+	PRBA	Rio de Janeiro, Brazil
31.8+	PLV	Bandoeng, Java
35.5	PRAG	Porto Alegre, Brazil
36.6+	PSK	Rio de Janeiro, Brazil
37.0	HC2JSB	Guayaquil, Ecuador
37.3	CNR	Rabat, Morocco
38.4+	HBP	Geneva, Switzerland
39.4	X26A	Nuevo Laredo, Mexico
40.5+	HJ3ABD	Bogota, Colombia
42.0	YV2AM	Maracaibo, Venezuela
45.0+	HC2RL	Guayaquil, Ecuador
45.3	RV72	Moscow, Russia
45.3	PRADO	Riobamba, Ecuador
45.3+	REN	Moscow, U. S. S. R.
46.5	HJ1ABB	Barranquilla, Colombia
46.6	W3XL	Bound Brook, N. J.
47.0	HJ5ABB	Cali, Colombia
48.5	TGW	Guatemala
48.7	YV3BC	Caracas, Venezuela
48.8+	W8XK	Pittsburgh, Pa.
49.0	W2XE	New York, N. Y.
49.0+	VE9HX	Halifax, N. S.
49.1+	YV1BC	Caracas, Venezuela
49.1+	W3XAL	Bound Brook, N. J.
49.1+	W9XF	Chicago, Ill.
49.2	VE9GW	Bowmanville, Can.
49.3+	W9XAA	Chicago, Ill.
49.4	CP5	La Paz, Bolivia
49.4+	W8XAL	Cincinnati, Ohio
49.5	UOR2	Vienna, Austria
49.5	W3XAU	Philadelphia, Pa.
49.5	OXY	Skamleback, Denmark
49.6	GSA	Daventry, England
49.6+	W1XAL	Boston, Mass.
49.8	DJC	Zeesen, Germany
49.9	VE9BJ	New Brunswick, Can.
49.9+	HIX	San Domingo
49.9+	VE9DR	Montreal, Can.
50.0	RV59	Moscow, U. S. S. R.
50.0+	HVJ	Vatican City
50.4	HJ2ABA	Tunja, Colombia
50.6+	HJ4ABE	Medellin, Colombia
69.4+	G6XR	Rugby, England
70.2	RV15	Khabarovsk, Siberia
73.0	HCJB	Quito, Ecuador

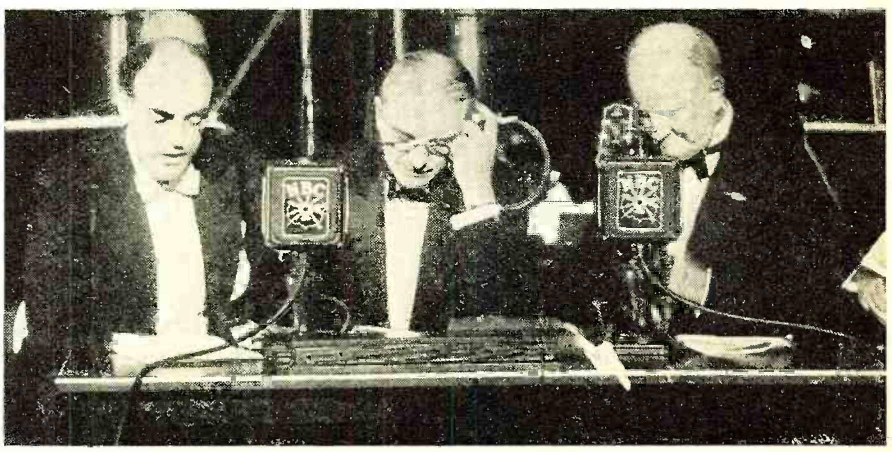
Official RADIO NEWS Listening Post Observer Appointments

Listed below by states and countries are the Official RADIO NEWS Short-Wave Listening Post Observers who are serving conscientiously in logging stations for the DX Corner.

Alabama, J. E. Brooks; California, C. H. Canning; Florida, E. M. Law, James F. Dechert; Georgia, C. H. Armstrong; Illinois, Robert L. Weber; Indiana, Freeman C. Balph, J. R. Flanagan; Maine, R. I. Keeler; Maryland, Howard Adams, Jr., James W. Smith; Massachusetts, Elmer F. Orne, Arthur Hamilton, Roy Sanders; Mississippi, Dr. J. P. Watson; Missouri, C. H. Long; New Jersey, William Dixon, R. H. Schiller, William F. Buhl; New York, I. H. Kattell, Donald E. Bame; North Carolina, H. O. Murdoch, Jr., W. C. Couch; Ohio, R. W. Evans, C. H. Skatzes; Pennsylvania, K. A. Staats, C. T. Sheaks, George

AN INTERNATIONAL BROADCAST EVENT

During the opening ceremonies of Radio City in New York, three famous men on this side of the Atlantic talked with another notable in London via a short-wave relay, the whole conversation being put on the regular broadcast station channels. The picture below shows, from left to right, Sir John Reith, managing director of the British Broadcasting Corporation, seated with Owen D. Young and General James G. Harbord, as they talked across the Atlantic to David Sarnoff, President of the Radio Corporation of America



Lilley, John A. Leininger, F. L. Stitzinger; Tennessee, Adrian Smith; Texas, Heinie Johnson; Virginia, D. W. Parsons; Washington, Glenn E. Dubbe, Chas. G. Payne; Wisconsin, Willard M. Hardell, Walter A. Jasiorkowski; Canada, Jack Bews, A. G. Taggart, W. H. Fraser, Douglas Wood; Cuba, Frank H. Kydd; England, Alan Barber, Donald Burns; South Africa, Mike Kruger, O. McCormick; New Zealand, Dr. G. Campbell.

Applications for Official Observers in the remaining states should be sent in immediately to the DX Corner. Listeners outside of the United States who feel that they would like to serve in this capacity are also requested to file their applications as soon as possible before final appointments are made.

Reception Conditions This Month

The outstanding improvement in reception conditions in America have been noted on the higher wavelengths, and especially is this true of short-wave stations operating in South America. The 49-meter band has also greatly improved in strength, and static conditions are almost at a minimum. During the afternoon the 31-meter band has been very strong and clear and in the early morning up to 10 or 11 o'clock. The 19-meter band has come through very well for this time of year. This month will probably find us at the peak of reception conditions for the 49-meter band in general.

The Portugal Transmissions

An official communication from station CT1AA (Radio Colonial) at Lisbon, Portugal, states that they will be on the air on 9600 kc. or 31.25 meters on Tuesdays and Fridays from 4:30 to 7 p.m. They can be recognized by a series of three cuckoo calls between selections.

PHI Transmissions

An official communication from PHI at Huizen, Holland, states that PHI broadcasts on a wavelength of 25.57 meters or a frequency of 11,730 kc. on Mondays, Thursdays and Fridays from 7 to 9 a.m., E.S.T., Saturdays and Sundays from 7 to 9:30 a.m. The announcer has added one more to his various languages. Announcements will now be made in Dutch, Malay, German, French, English, Spanish and Portuguese. Station PHI is owned by N. V. Philips' Radio at Eindhoven, the transmitter is located at Huizen and the studio is located at Hilversum.

British Empire Transmissions

An official communication from the British Broadcasting Corporation states that their programs for the coming month will be as shown in Best Bets. Substitutions of stations may be made at any time as follows: GSE may be substituted for GSD, GSC may be substituted for GSB or vice versa.

CP5 Transmissions

An official communication from station CP5 at La Paz, Bolivia, states that they will be on the air on a wavelength of 49.3 meters or 6080 kc. daily from 6:30 to 8 p.m. and from 9 to 11:30 p.m., E.S.T. The name of the station is "Illimani."

A Verification

Mr. Joe E. Jacobs of San Juan, Puerto Rico, informs Mr. Donald E. Bame as to the call letters of the Spanish-speaking station coming in just below W8XK. The station is YV3BC of Caracas, Venezuela. Mr. Jacobs reports the following stations as best bets: GSA, EAQ, LSX, YV2AM, FYA, WCAU, on his Midwest superheterodyne.

A Report from British Guiana

Mr. E. S. Christiani, Jr., our Official RADIO NEWS Short-Wave Listening Post Observer in British Guiana, sends us in a note that he is the first person in British Guiana who was able to pick up TI4NRH at Costa Rica. He is putting in a higher and longer antenna with a double lead-in at the present time and plans to send us in regular reports in the future.

A Report from Spokane, Washington

Mr. William D. Tullis, owner and operator of radio station W7BKH, reports that station HC2RL has been heard by him, as previously reported in the DX Corner. He states that they have an American announcer by the name of Willis Murray. He also states that the DX Corner is just the right thing and the Best Bets for all short-wave listeners.

Report from Pittsburgh

Mr. E. C. Lips of Pittsburgh, Pennsylvania, reports the following best bets at his official listening post for the month of November: DJB, DJC, DJD, EAQ, GSA, GSC, GSE, HC2RL, HJ4ABE, HJ1ABB, PRCA, VE9GW, VE9JR, YV3BC, I2RO, VK2ME, VK3ME, TI4NRH, VE2BG, VE5EH, XIG. He does not mention any of the American stations, as they all come in well.

DX Clubs Take Notice!

Morris Davidson, Secretary of the Sunset DX Club, announces that the club is now open again and that members wishing to join may do so. (The Editors invite all clubs specializing in DX work to associate themselves with the Short-Wave DX Corner of RADIO NEWS so that we may be able to publish data of interest to members and readers such as that above.)

A Report from Hobbs, New Mexico

Mr. G. K. Harrison, using a Midwest receiver, applies for appointment as an Official RADIO NEWS Listening Post Observer and sends us in the following hastily prepared list of best bets: W8XK, W3XAL, KKQ, KES, W2XAF, VE9JR, EAQ, LSX, YV3BC, W2XE, VE9GW. He has just received his new set and will have a larger log next month.

O. R. N. S. W. L. P. O.

What do these letters mean? On receiving a recent letter from Mr. C. W. Couch, we noticed, as we do on many other of the short-wave letters from our readers, they come in signed as above. It gave the Editors, themselves, rather a shock when they found it that it actually read Official RADIO NEWS Short-Wave Listening Post Observer. Mr. Couch, using a TravLer superheterodyne and a Stewart Warner converter, sends us in an excellent log of reception for October and November. It has been of more than considerable help in compiling and checking the DX Best Bets for this month. Congratulations O. R. N. S. W. L. P. O. Couch (for North Carolina.)

"Little Rhody" Speaking

Mr. Wm. A. Ayotte of Providence, Rhode Island, heads his report as per the above title, using a Silver Masterpiece 15-tube all-wave super. He gives us a short list of stations that come in absolutely like locals: GSE, GSA, DJD, YV1BC, LSX, PSK, W8XK, W2XAF, W9XF, VE9DR.

A Report from New Jersey

William Dixon of Plainfield, New Jersey, an Official Observer, sends us in an excellent log of stations, wavelengths and time on the air as well as the following schedules received from the stations themselves: VE9GW, Mondays, Tuesdays, Wednesdays and Thursdays, 3 p.m. to 12 p.m.; Friday and Saturday, 8 to 12 p.m.; Sunday, 12 noon to 9 p.m., E.S.T. EAQ will be on the air from 7 to 7:30 p.m. nightly under the auspices of the International Broadcasting Company of London. HC2RL announces in English as well as Spanish. Their characteristic announcement is "Hello, America." W3XL is on the air Fridays from 5 p.m. to 1 a.m.

An Official Report from Massachusetts

Mr. Arthur Hamilton of Somerville, Massachusetts, reports the following best bets: GSG, GSE, GSD, GSB, GSA, GSC, DJB, DJD, DJC, DJA, VK2ME, VK3ME. He states that XETE has not been heard for some time and that HBL is not as good as formerly. RV59 is fair. He has heard station G6RX in Rugby, England, a number of times on about 69.4 meters.

Is This a New Station?

Mr. J. F. Fritsch of Baltimore, Maryland, reports hearing HCJB of Quito, Ecuador, on a 5-tube Philco with a short-wave hookup. Can any of our readers give further dope on this station?

An Official Report from Cuba

Official Observer Frank H. Kydd reports the following best bets in his location: YV3BC, W8XK, FYA, W2XE, DJB, GSA, W3XAL, W2XAF. He states that there are a great many stations listed in best bets that he can locate easily enough but cannot receive with what might be called "good reception" and thinks it would be advisable to obtain a better receiver. He asks our opinion of the new General Electric, National, Midwest, Scott and other receivers.

A Note from Canada

Mr. R. Edkins of Transcona, Manitoba, Canada, states that radio station PSK of Rio de Janeiro, Brazil, naming themselves the Radio Club of the World, is coming in fine Tuesdays, Thursdays and Fridays from 5 to 7:30 p.m., E.S.T., the wavelength being 36.65 meters.

Reception in Schenectady

Arthur J. Conroy of Schenectady, New York, using a Silver Masterpiece II, reports the following list as best bets: All of the British Empire transmissions, all of the German transmissions, YV1BC, YV3BC, HJ1ABB, PRADO, HBL, CT1AA, EAQ, FYA, VK2ME, VK3ME, LSL, PRAG.

Another English Station

James W. Smith of Baltimore, Maryland, states he has been listening to a new station, G6XR, London, calling Canada at about 8 p.m. to 11 p.m., E.S.T. Their program consists of reading radio information and playing records. They come in slightly above 69 meters. He states the transmission as a whole is very enjoyable. This reception was done on a CT16 Midwest receiver.

A Report from Oregon

Mr. G. E. Dubbe, an Official Observer who has recently moved from Freewater, Oregon, to Walla Walla, Washington, sends in the following Best Bets for his new location: J1AA, VK2ME, VK3ME, RV15, DJB, FYA, W8XK, GSF, W2XE, GSE, GSD, DJD, I2RO, VE9JR, CT3AQ, W2XE, GSB, W2XAF, YV1BC, W3XAL, W9XL, W9XAA, W3XAU, VE9DR, VE9GW. He uses a home-built receiver employing seven tubes with a 170-foot aerial and a balanced lead-in.

An Appointment in South Africa

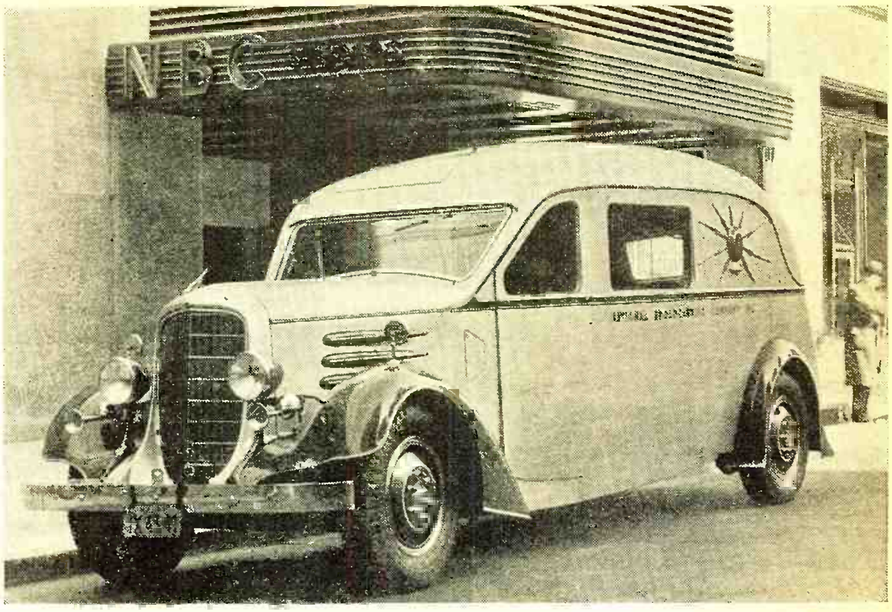
We have just appointed Mr. C. McCormick of Johannesburg, South Africa, Official Observer for his location. He is the

(*Continued on page* 484)

A New MOBILE X'MITTER

Frederic Siemens

HAVING completed the elaborate broadcasting layout in Radio City, New York, the National Broadcasting Company is diverting its technical endeavors towards additional advances in the radio world. The latest achievement of the network's engineers is a mobile transmitter. The motor unit is actually a complete broadcasting station on wheels and includes certain technical improvements that even many standard broadcasting stations lack. Mounted on a 10-ton General Motor chassis of special underslung body construction, the vehicle contains a "studio" and a combination control and transmitter "room".



A SHORT-WAVE BROADCASTER ON WHEELS

The N. B. C.'s new transmitter car standing at the entrance to Radio City. It carries a 150-watt ultra-short-wave broadcast relay transmitter with a stationary range of 100 miles and a 50-mile range while in motion

Two transmitters are operated aboard the vehicle. One of them with call letters WMEF, is used on the intermediate frequencies of 2,390 and 1,566 kilocycles, while the second W1OXS, functions on the ultra-short bands of 34,600, 27,100 and 25,700 kilocycles. The intermediate-band transmitter is used when the car is stationary; the ultra-short-wave transmitter operates when the vehicle is in motion.

The mobile transmitter was built at the suggestion of William Burke Miller, director of NBC news programs, for the broadcasting of "spot" news events from points where telephone lines are not available. It is planned to have the broadcasts from the mobile unit received at the associate NBC station nearest the point of program origin, for distribution to the entire chain. If the ultra-short-wave transmitter is utilized at a considerable distance from any NBC station, the network engineers will erect a temporary receiving base within the transmitter's range and relay the program to the chain through telephone lines.

NBC engineers and executives are reluctant to call the new mobile unit a "truck." The body was especially constructed in a stream-lined sedan effect to take it out of the class of a commercial vehicle. The reason behind this move, Mr. Miller explained, is that trucks are not permitted into certain public parks and restricted residential areas.

The front part of the mobile station is the "studio." This section is separated from the transmitter compartment by a thick plate glass window. The entire truck is soundproofed along similar lines used for standard broadcasting studios. A perforated copper-sheet shields the entire body. Special treatment was essential to keep out noises of gear-shifting and motor-humming. A 2½ kilowatt, gasoline-driven, 3-phase A.C. generator is aboard the truck as the main power supply source. This, too, was especially designed to operate silently.

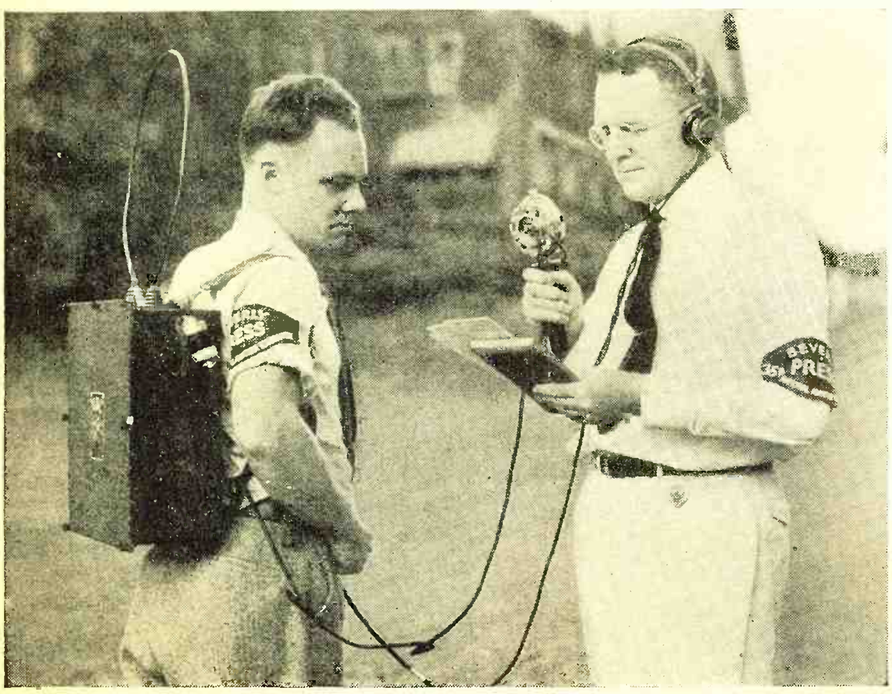
Storage batteries and dynamos are carried for emergency power supply. A set of A.C. and D.C. battery chargers is also aboard so that the accumulators can be reconditioned at any place the car is garaged.

The ultra-short-wave transmitter is unique in the fact that it is crystal-controlled. George O. Milne, NBC's New York Division engineer who supervised the vehicle's construction, told the writer he believed it to be the first ultra-short-wave unit of its type.

A crew of four men is assigned to the mobile transmitter. This group includes two engineers, one announcer and a chauffeur.

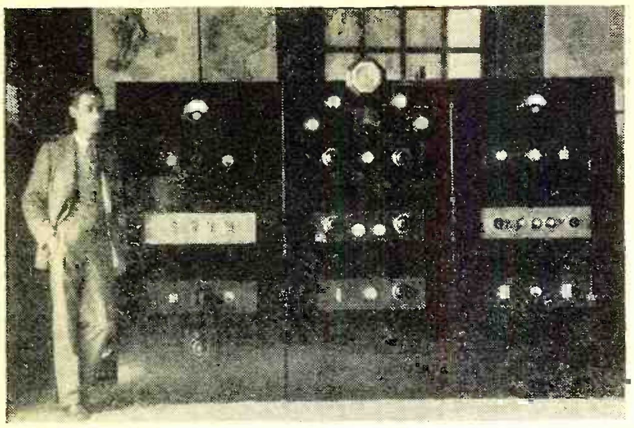
The front "studio" section can accommodate four persons at the window seat. The announcer's position at the windshield has a small desk to support a microphone and a typewriter. When it is essential to obtain a view from a higher point, the announcer stands on his seat and opens a trap door in the roof of the car and speaks into the microphone with his head protruding through the roof opening. When the door is opened a windshield on the roof swings upward to protect the announcer from the elements.

Five receiv- (*Continued on page* 510)



THE PACK TRANSMITTER

This device, which can be worn on the back, enables the announcer to move to locations where the mobile unit cannot go. It transmits the waves to the mobile unit, which in turn relays it to the regular broadcasting station



SHORT-WAVE STATION HJ4ABB
A popular South American short-wave station heard regularly in America. It is located at Manizales, Colombia, South America

GETTING ACQUAINTED *with* SHORT WAVES

The author in his opening article last month considered what the short waves are—their characteristics and usages. A quantitative investigation into the reasons for their increasing importance was then made. This installment is qualitative in nature—an inquiry directed toward ascertaining just what there is below 200 meters to interest us as listeners

James Millen

IT is essential that our initiation into the short-wave field be anticipated with an intelligent appreciation of what we shall find there. The broadcast enthusiast who dives rashly without some study into short waves—experience in the broadcast bands his sole criterion—is likely to find the water unpleasantly cool, and in his disappointment probably will blame his equipment, or the short waves themselves. The chances are his receiver is a good one. And there is nothing the matter with the short waves!

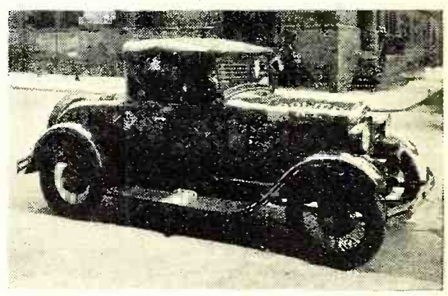
"The fault, dear Brutus, is in ourselves——" It would be as unfair to judge short-wave results solely by one's long-wave experience as it would be to reverse the wrong and measure long-wave results by what can be done on the high frequencies in the way of long-distance, daytime reception. Hence the pertinent question so often asked by the broadcast fan—"Is it worth while for me to get a short-wave receiver? Will I find enough down there to interest me and justify the expense?"

The answer, in the great majority of cases, is an unequivocal "Yes." And you, yourself, are best able to answer the question. Only by consideration of all the factors involved can a comparison be made on the basis of broadcast-band results. If this is done, it is possible to estimate the pleasurable possibilities of short-wave reception by computing what Zeh Bouck calls the "entertainment values" of the various short-wave services. Giving the familiar broadcast-band programs an entertainment value of 100%, we shall now attempt to evaluate the percentages of short-wave fare.

By far the greater part of the short-wave spectrum—from 200 meters (1500 kc.) to 10 meters (30 mc.)—is occupied by stations transmitting in *code*. This transmission will be absolutely unintelligible to practically every broadcast fan, and its entertainment value, for the time being, can be estimated at zero. However, experience has shown that many short-wave broadcast fans become intrigued by the dots and dashes they find all over the dial—intrigued to the extent of learning the code and becoming proficient in copying. Such enthusiasts generally enter the ranks of amateur operators, and, to them, code reception has a very high entertainment value—often 100 percent.

Limiting ourselves to radio-telephonic communication and broadcasts, let us consider such services—as we go down in wavelength and up in frequency. The allocations, as we give them, can only be approximate, because each service often employs several bands. We merely select the spectra in which they are most consistently received.

Police calls predominate between 200 and 100 meters—1500 and 3000 kc. These terse orders to squad cars are often very interesting, garnished as they are with elements of true-life drama. There is no play acting in the statement that a man is "beating his wife at 46 Main Street," and harassed husbands can derive a vicarious satisfaction while leaning back in their easy chairs. Nero and his amphitheater are gone, but the few generations that span the years between the heyday of ancient Rome and the present time are insufficient to eradicate our interest in blood and gore! Those of us who impaled butterflies in our youth will find high entertainment value in police broadcasts. Unfortunately, the pleasurable possibilities inherent in police-call reception have been somewhat curtailed by the use of codes. For instance, the stentorian voice of the announcer will describe a filling station proprietor being murdered as "Code eight-one—code eight-one!"—which is no fun at all. However, there are still plenty of honest, outright and frank police broadcasting stations that still call a slit throat by its right name. (Entertainment value—about 25%.)



HOT AFTER CRIME
In these two photographs is shown the reason for the success of short-wave radio for apprehending criminals while the crime is being committed. The police dispatcher is shown handing the telephone message to the radio man, who will repeat the address and the form of crime into the microphone and thus transmit it over the air. A police car nearest the scene of the crime will then speed to that point. Criminals are often caught red handed before they can escape

Airplane stations, both ground and aircraft, will be found between 100 and 75 meters (3000 kc. and 4500 kc.). An element of the romantic and hazardous still clings to the idea of flying, but even that can hardly compensate the prosaic quality of these "programs." The stations flash "on and off" the air on no particular schedule, and the traffic for the greater part consists of routine messages between the various ground stations. The modulation is not of a particularly high quality and sometimes unfavorably impresses the broadcast fan, used to the perfect articulation of ribbon and condenser mikes. The plane transmitters are even worse. Occasionally, useful weather reports can be received and once in a while an exciting or interesting item—but that's about all. (Entertainment value—5 percent.)

In the neighborhood of 75 meters (4.5 mc.) will be found a flock of amateur 'phone stations, raising an eternal bedlam that would shame the witches in Macbeth. To the uninitiated, these conversations are about as interesting as an advertising plug on the long waves. Amateurs talk a gibberish punctuated every second word with their only intelligent phrase, "Old man," and the balderdash suffers from a repetition that reminds one of a phonograph record with a crossed groove. To the amateur himself, it is *mother tongue* and all highly vital—to the newcomer on short waves it is like the muling prattle of someone else's brat. (Entertainment value—about on a par with that of the old near beer.)

However, as we have already intimated, the short-wave broadcast fan often succumbs to the allure of amateur operating, and as the fascination grows, so does the percentage of pleasure in listening to amateur radio-telephone stations. For such, recourse must be made to entirely different criteria, and the operation of a broadcast receiver suffers miserably in the comparison.

To the short-wave neophyte, broadcasting is both the bait and the *pièce de résistance* and the majority of reliable night-time stations will be found between 60 and 30 meters—5 and 10 megacycles. Many excellent programs will be received in this band *over great distances!* Though many of the American programs are identical with those broadcast on the lower frequencies and are transmitted simultaneously, from the point of view of perfect reception, they cannot be accorded the 100% entertainment figure of long-wave operation. The signals are sometimes erratic and fading sometimes becomes annoying. This is due partially to the inherent characteristics of the high frequencies and partly because relatively few short-wave listeners are located within the local service area of the broadcasting station—or if so located they spurn the nearby fare and reach out for the more illusive signal.

Noise is also more predominant on the short waves. This may be attributed to the fact that most of the noise-producing contrivances—such as automobile ignition systems, motors, fans, X-ray machines, traffic lights, vacuum cleaners, etc.—generate interfering waves within the high-frequency spectrum.

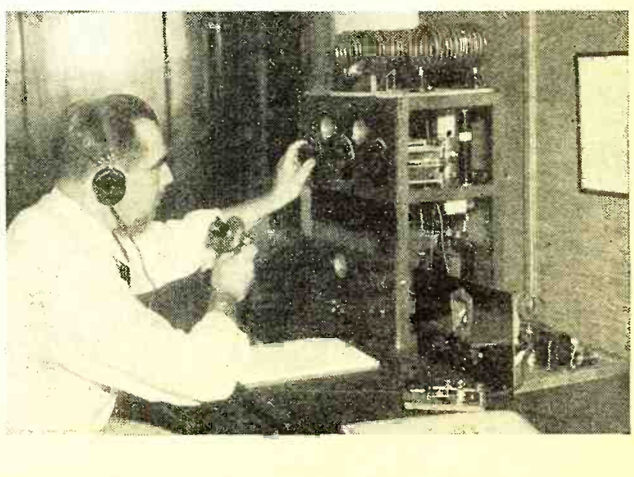
However, excellent quality reception from several stations thousands of miles away can always be consistently expected on the short waves—day and night. We only desire to emphasize that in our ten years of short-wave experience we have never heard a program that was quite as good as the same program broadcast from a local station on the more conventional and longer waves. (Entertainment value—75 per cent.)

So far we have evaluated short-wave broadcasting on more or less of a quality basis—*which is not altogether fair!* To many, the main consideration is not *how well* can a program be received, but rather *from how great a distance!* A weak and feeble flutter from across the seas and half around the world is a plume, whereas perfect reception from a local transmitter is but a pin-feather! To the twister of the midnight dial—and it may as well be a *mid-day* dial on the short waves—high-frequency reception holds a fascination and lure *that can never be approached* on the longer waves. Here, we shall have to reverse our computation, giving the short-wave receiver 100 percent, with the broadcast set tagging along far down the line.

Manufacturers of short-wave and all-wave receivers have dangled before prospective customers the delectable bait of listening in to private transoceanic telephone conversations—on the psychological reasoning that we are all potential keyhole squinters and party-line addicts. The psychology is sound, but the argument is somewhat fallacious. Practically all over-ocean telephone conversations are "inverted"—so scrambled that they sound like Chinese on a phonograph record being run backwards. They are usually completely unintelligible without the aid of elaborate unscrambling apparatus. Some ship-to-shore communication remains undistorted, and occasionally uninverted speech spans the ocean channels—usually on off-traffic periods and during tests. Outside of the allure of distance —for commercial (*Cont'd on page* 493)

SHORT-WAVE RECEPTION AT THE CENTURY OF PROGRESS

Chief Operator Stitters, of amateur station W9USA at the Century of Progress, listening in on a new short-wave receiver. At left an officer in Uncle Sam's Air Army controlling maneuvers of his fleet of planes by radio



AMATEUR COMMUNICATION

More than 25,000 licensed amateur radio stations in the United States talk back and forth with their home-built transmitters and receivers

A CRYSTAL-CONTROLLED
SHORT-WAVE SUPER

With this installment the series covering a highly novel and effective short-wave receiver is concluded. While the complete outfit as described may be beyond the means and requirements of the average fan, nevertheless almost every experimenter can apply some of the author's ideas in working out his own pet design

Frank H. Jones

Part Five

BEFORE we turn on current to the whole set, let's study the a.v.c. and grid circuits so you will have a clear idea of how the thing should function.

Figure 15 is a voltage distribution diagram, without any of the inductances, to more simply show the various grid potential relationships as they are controlled by an incoming signal through the operation of the a.v.c. tube.

Note first that the grids of the r.f. tubes are at ground potential through the grid resistors, decoupling resistors and the a.v.c. plate resistor.

The cathode of the a.v.c. tube is at about 75 volts negative with respect to ground. This gives the a.v.c. plate a plus or positive potential of 75 volts with respect to the cathode. A 3000-ohm potentiometer at P1 with slider "S" makes it possible to vary the grid potential of the a.v.c. tube from zero bias to about 35 volts negative with respect to the cathode. With high bias on the a.v.c. tube, the plate resistor carries no current, as the high bias gives plate current cut-off. If you reduce this bias, a current will flow in the plate resistor and there will be a proportional voltage drop across this resistor, and this varies the bias on all the r.f. tubes, thus cutting down the signal strength delivered to the i.f. amplifier and so to the second detector of the receiver, and precisely, it was the increased signal arriving at the a.v.c. tube grid, through its .0005 mfd. coupling condenser, from the grid of the second detector, that changed the bias on the a.v.c. tube. Thus the d.c. component of the rectified signal current changes the bias on the grid of the a.v.c. tube. The net result is that signals of appreciable strength will be automatically controlled at a predetermined level which may be varied by changing the setting of the potentiometer slider "S."

Inasmuch as the first input t.r.f. tube is excited from two different antennas, it is obvious that whichever antenna has the stronger signal will operate the set, and the weaker signal which is usually noise-ridden and somewhat distorted, will not even get past the grid of the first t.r.f. tubes. As atmospheric conditions change, the other antenna may then have the strong, clear signal, and it then takes control immediately. This switching action is smooth, very rapid and completely automatic, so that even quite rapid types of short-wave fading are very largely smoothed out and much higher average signal quality results.

If all signals are very strong, the whole level of reception may be reduced by lowering the bias on the grid of the a.v.c. tube by manual operation of slider "S" on potentiometer P1. This causes the a.v.c. tube to take a larger steady plate current, which in turn puts a higher steady bias on all the t.r.f. tubes. Also note that the cathode resistors for these tubes keep a permanent negative bias of never less than 3 volts on each grid regardless of the functioning of the a.v.c. circuit. One-thousand-ohm variable resistors have been substituted for the original 500-ohm resistors in the cathode circuits in the i.r.f. amplier. By varying the resistance here, the overall sensitivity of the complete receiver may be decreased to a point that is always definitely above the local noise level.

If you use the output of the type -50 audio tube for a loudspeaker, adjustment of the ½-megohm variable grid resistor will set the audio volume at any strength desired.

Also note that, naturally, the output transformers AT1 and AT2 may have other ratios in case you want to feed into speakers or lines having input impedances other than 600 ohms.

You are now ready to test the complete combination.

Turn on the master switch, which should be in the main 110-volt line.

Allow about half a minute for the heater tubes to warm up, paying attention to the tuning meter, MA3. With potentiometer P1 set for lowest t.r.f. grid biases, this meter should show about 25 milliamperes if there is no signal tuned in. Turning the potentiometer the other way will reduce the current through this meter. If this works okay, it shows that the a.v.c. circuit is working normally.

Now set dials of the t.r.f. section to one of the waves you previously tuned in when testing that amplifier alone; for instance, W2XAF on 9530 kc. (provided it is their time to be on the air). Then set the oscillator harmonic amplifier on its fourth harmonic as previously explained, and the oscillator section will then deliver a 7884 kc. signal to the cathode circuit of the first detector. Due to the mixing or modulating action which now takes place in this tube, one beat frequency which will appear in the plate circuit of this tube will be 1646 kc.

Tune your i.r.f. amplifier to 1646 kc. dial calibration, and if you have previously made this calibration exactly, when you tune C4 to approximately this same 1646 kc. frequency, you should hear W2XAF.

Readjust all condenser dials for maximum drop in current (as shown by meter MA3) and record all settings.

If a crystal is used at the frequency suggested, and the tuned i.r.f. amplifier has been adjusted to cover the range from 1087 kc. (*Continued on page* 507)

I.F. DIAL SETTINGS

Here is the approximate calibration of the tuning control of the i.f. amplifier, if the crystal frequency and i.f. range are as suggested

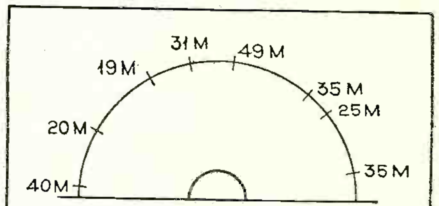


FIG. 16

DETAIL OF A.V.C. CIRCUIT

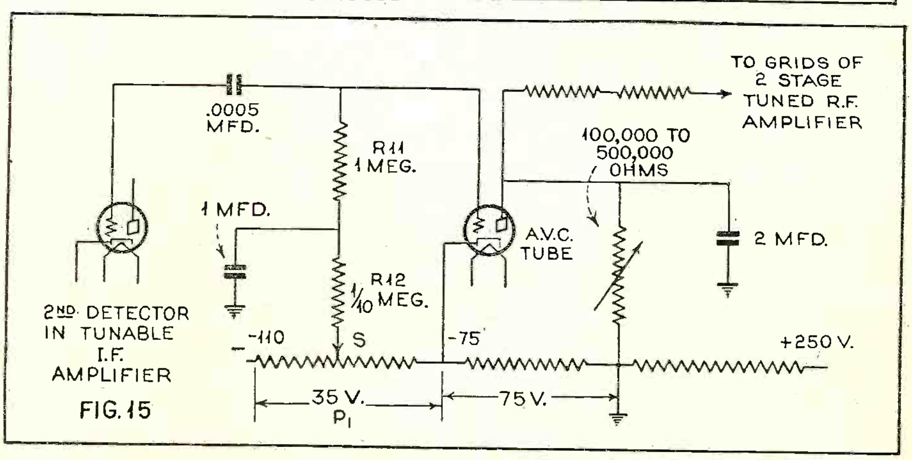
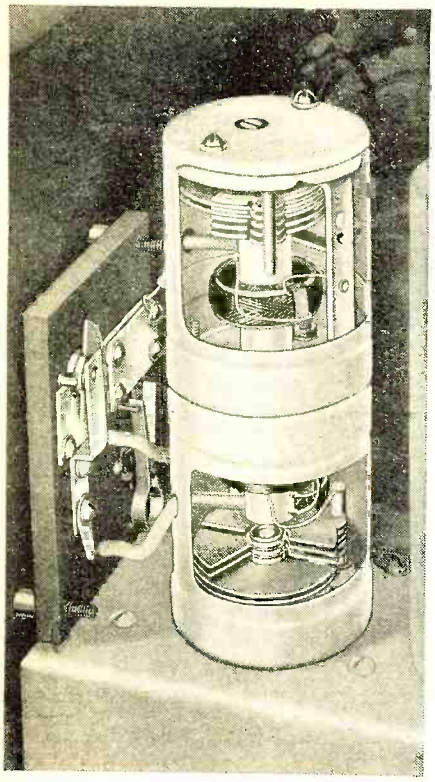


FIG. 15



ULTRA SELECTIVITY WITH CRYSTAL FILTERS

WHEN the Stenode circuit, employing a crystal filter to provide a previously unheard of degree of selectivity in the broadcast range, was introduced in RADIO NEWS several years ago, it was the "talk of the town" for months. Subsequently, the activities of the Radio Commission in forcing strict adherence to assigned frequencies and in carefully planning allocations of frequencies for broadcast use, plus the development of highly selective receiver circuits, made the super-selectivity of the Stenode unnecessary. During the past year or so, however, much independent experimental work has been done using crystal filters in receivers designed for operation on the short-wave ranges, some of which are so congested as to make dependable reception next to impossible. As a result several commercial receivers have now been made available with crystal filter circuits and are being found intensely practical, particularly for use in the "ham" ranges.

For one who has never had an opportunity to listen in with a receiver having a well-designed crystal circuit, a surprise is in store. During the past week one of the latest Hammarlund Comet "Pro" receivers which includes this improvement, has been under test by our laboratory staff—with selectivity little short of amazing. During a short period of operation on the 80-meter "ham" band one evening, for instance, both ends of a number of 'phone conversations between "hams" were tuned in. Four of them had to be terminated by the participants due to interference from other stations which made it impossible to continue. Yet in these four instances the "crystal" receiver brought in every word said by all eight stations without difficulty. In three of the cases, if the crystal filter of the receiver was switched out of the circuit the powerful heterodynes from interfering stations ruined reception.

To facilitate matters, some of the tests were conducted using a local modulated oscillator to serve as interference so that the interference could be regulated both in intensity and frequency. As a further convenience, the broadcast-band coils were plugged into the receiver and WEAF was tuned in. Thus a constant and powerful modulated signal was taken advantage of, to serve as the "desired signal."

The local oscillator was first tuned to 661 kc. to provide a thousand-cycle heterodyne beat. The oscillator intensity was then increased until the heterodyne was so powerful as to make WEAF's program unintelligible when the crystal was out of the circuit. Then the crystal was switched in and the crystal control knob (anti-resonance selector, or interference elimination control) adjusted for minimum interference. Not only did the program then become intelligible, but the heterodyne was reduced to such an extent as to be barely perceptible.

Repetition of this test with the oscillator adjusted to a frequency only 200 cycles off 660 kc. brought substantially the same result except that the heterodyne was not so completely eliminated. It was, however, reduced to a point that made the program understandable.

It might be said here, to avoid misunderstanding, that the extreme degree of selectivity provided by a properly designed crystal filter results in extensive reduction of sidebands. This alters speech, but not to the extent of making it unintelligible. "Crystal" receivers as now available are therefore applicable only to the reception of c.w. telegraphy and speech—not to pleasurable reception of short-wave broadcasting.

The method of employing the crystal in the "Pro" is shown in Figure 1, and in the accompanying photograph. In place of the normal transformer employed to couple the first detector and the first i.f. tubes of the standard "Pro" receiver, the primary, L1, and secondary, L2, windings have been isolated from one another and placed in separate cans. In the can with the primary winding and (Continued on page 505)

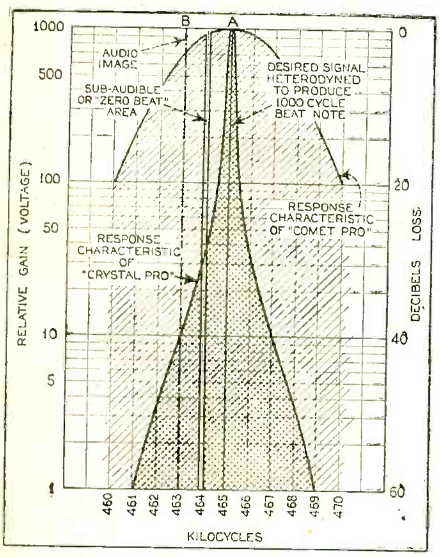


FIGURE 2. ULTRA SELECTIVITY—

FIGURE 3. —PLUS REJECTIVITY

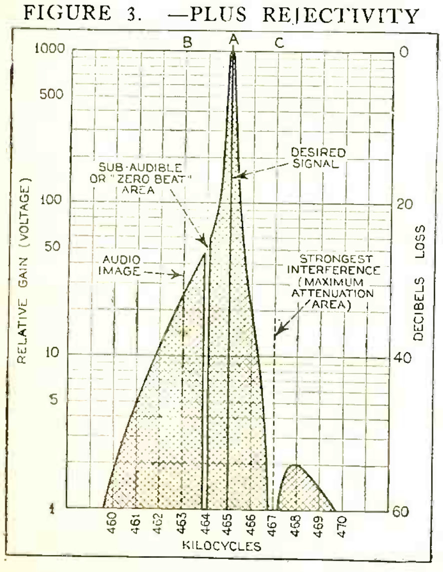
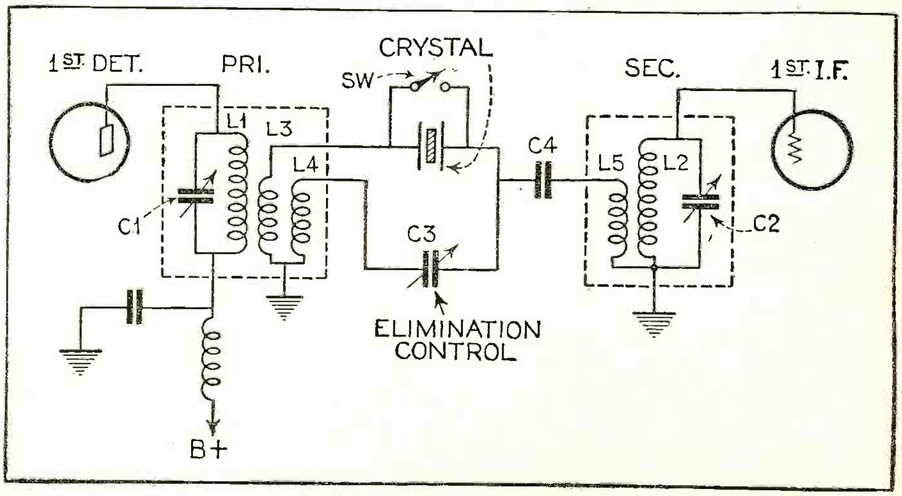


FIGURE 1. THE CRYSTAL CIRCUIT



PHENOMENA UNDERLYING RADIO

In preceding sections the elements of the structure of matter, the electron theory and the mechanics of heat production have been given in enough detail so that we may now turn to the examination of the electrical results of mechanical and thermal action

E. B. Kirk

Part Six

OUR next consideration is the effects produced by a strain or deformation of a body. A solid may be stretched, compressed, twisted, bent, and sheared by the application of a stress (deforming force). Obviously a liquid or a gas cannot be stretched, twisted, bent or sheared in the ordinary meaning of these terms, and further, a part of a gas or a liquid cannot be compressed without the action being transmitted to the other parts. We are therefore limited in this section to the consideration of the thermal effects arising in solids as a result of strains caused by forces acting in various ways.

Compression or tension when applied to a solid conductor causes a change in the arrangement and in the motion of the particles. This is evidenced by an increase or decrease in temperature in the part of the body under the influence of the stress, and therefore currents are set up as we have just previously seen. Ordinarily the currents so produced are very minute and quickly subside, but it is possible to detect them, particularly if the mechanical change is an alternating one. Sound waves, since they are a series of rarefactions and compressions, will produce minute electric currents in a plate or wire.

If conditions are further complicated by having not only pressure applied to a metal but also heat in such a way that one junction or transition from the compressed to the uncompressed metal is maintained at a uniform temperature and the other junction is maintained at a different but constant temperature, an electric current is set up. The compressed and the uncompressed metal functions as the two different metals of a thermo-couple (Seeback Effect). As we have seen, the Thomson Effect gives a current between the parts of a conductor which are at different temperature; here we have the superimposition of the action of pressure, which, if we consider the compressed and the uncompressed parts of the conductor as two different metals, is a pure Seeback action. A still further complication can be added, namely, if while the above condition be maintained an external potential is applied and a current passed through the conductor. The result is that the Peltier or converse Seeback Effect enters the picture. The Peltier Effect (which will be examined under the division dealing with dissimilar materials in contact) gives at the junctions (compressed with uncompressed metal) either an absorption or a liberation of heat which is quite distinct from the Joule Effect (which is the general liberation of heat by an electric current, that is, the I^2R loss).

The electrical differences of potential produced by pressure are extremely small, amounting to only a few microvolts even when pressures as great as 12,000 kilograms per square cm. are exerted. Under ordinary conditions these actions are negligible, but in certain circuits used for exact measurement or detection of minute electrical phenomena they enter as factors of prime importance. Rapidly fluctuating currents may produce or absorb heat with associated changes of pressure that may be enormous in minute areas and conversely, rapid fluctuations of pressure give rise to great though very local temperature changes. The importance of these in crystal rectification has been elaborated by Eccles. With the growing importance of sound recording some of these complicating phenomena are coming under the scrutiny of research in that field.

Both bending and twisting can be considered as combination of compression and tension. Tension, of course, is negative pressure, but the application of tension practically never results in an even distribution of stress (experiments with tension have not been as consistent as those with compression).

The converse of the electrostrictive effect has been observed, that is, when a current flows through a conductor a change in its dimensions results. Of course, heat is liberated by a dissipation of a part of the current in the resistance of the circuit and it is difficult to separate the change actually due to the flow of current from the changes in dimensions which are the results of thermal expansion. This constrictive effect has been attributed to the mutual attractions of all current-carrying elements of the conductor; that is, it is supposed to be electromagnetic, the electrons moving in parallel paths in the current flow set up mutually attractive fields which tends to bring the lines of flow closer together. When the conductor has a circular cross-section, the pressure is directed toward the axis with a maximum value at the axis and a minimum at the surface. Its direction of action is opposed to that of thermal expansion.

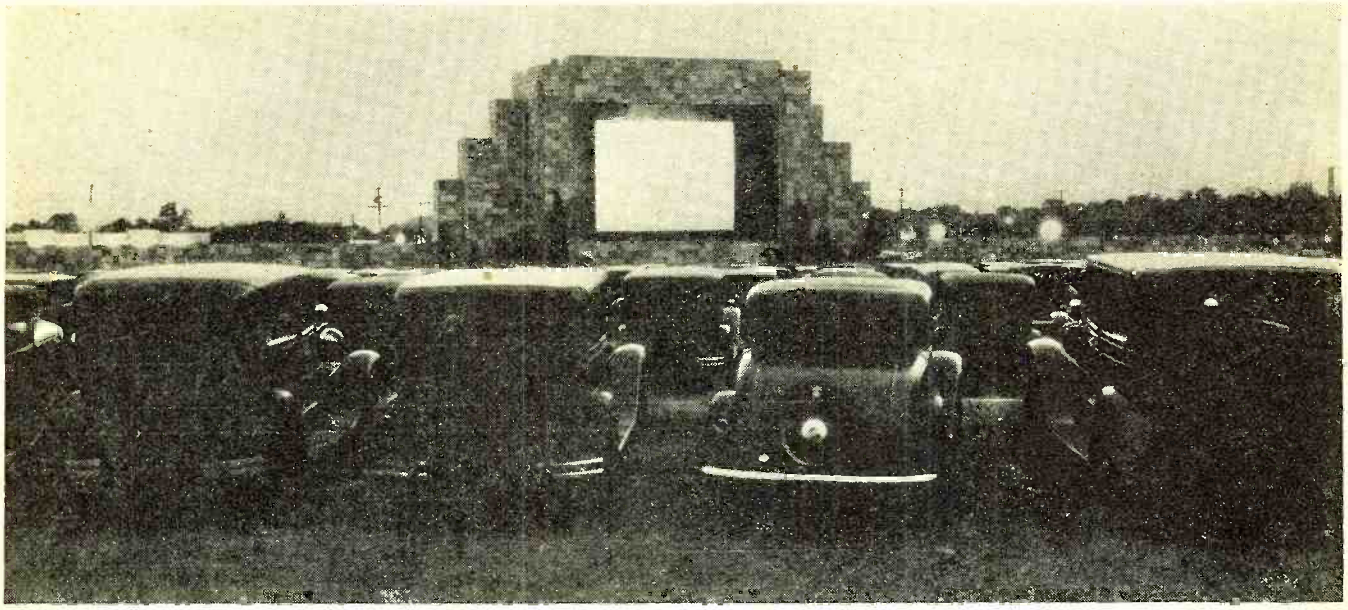
This same phenomena occurs in liquids and has been termed the Pinch Effect from the pinching-off action observed in small streams of liquid. The contracting force is small for relatively low current densities, but increases to values sufficient to rupture a liquid filament when the current density becomes greater. The contraction usually forms locally at the point of smallest cross-section and, once started, tends to break the filament completely as though it were being pinched by an invisible external force. This action, although on a minute scale, no doubt enters in the action of certain electrolytic detectors and liquid coherers.

These actions, although not of wide commercial importance, have been used in the laboratory as measuring devices and for the production of sound. The Thermophone of Alexander Graham Bell with which he succeeded in transmitting speech over a modulated heat beam was capable of converting either sound into a varying current or a varying current into sound. The present-day thermophone used for sound standards converts varying amounts of heat produced by an alternating current into sound of the same frequency.

Several types of hot-wire receivers were employed in the early days of radio. Preece in 1880 described a thermo-telephone receiver. In consisted of a fine platinum wire, attached to the center of a metal diaphragm, the tension of the wire being adjusted by means of an adjusting screw. If the wire was connected in a circuit carrying a varying current, every variation of the current altered the temperature of the wire, thereby altering its length and causing corresponding movements of the diaphragm. Such an arrangement was used by Swinton and by Blake for the reception of radio signals without the employment of any rectifying detector. The action can be compared with that of a hot-wire ammeter: the wire, though not responding rapidly enough to give a detectable sound response for each individual oscillation of the incoming high frequency, does respond to the lower frequency of the modulation.

Another type of hot-wire receiver was that of Eccles. It consisted of a platinum filament mounted in a tube, one end of which was open. Variation of the current sent through the wire resulted in alternate heating and cooling and set up sound waves, directly, without the use of a diaphragm. In 1887 Forbes reversed the process, thereby using a hot wire as a transmitter. He found that when words were spoken toward an incandescent filament in direct contact with the air, the current through the wire was modulated by the compression and rarefaction of the sound waves. This transmitter was quite insensitive to mechanical shock or vibration.

Next month's installment will deal with some of the phenomena underlying the use of quartz crystals in radio.—EDITOR.)



Outdoor Auto Movies

In the open air moving picture field described in this article one simply drives in, parks his car, and looks and listens to a movie thriller from a comfortable seat in his own car

Merle S. Cummings

THROUGH the application of new high-fidelity sound-reproducing apparatus, one of the most unique talkie theatres has been erected in Camden, New Jersey. The Driv-In Theatre, as the venture is called, is an open automobile parking area of 250,000 square feet. The grounds are laid out in seven graded tiers so that each motor car literally becomes a private theatre box when it is driven onto one of the inclined ramps. The tiers are graded so that a clear-vision line permits perfect visibility of the 60-foot screen from any part of the field. Three directional loudspeakers concealed behind the screen permit the even distribution of sound throughout the outdoor theatre.

It is possible to hear and see the programs with all of the car windows closed. In case of rain, the windshield wiper of the cars can be set in operation to permit visibility, while the special directional sound projection is powerful enough to penetrate the windows and doors of the average sedan. The powerful amplification system consists of the new Photophone high-fidelity reproducing equipment. This apparatus was chosen for the unusual purpose after a careful study of the peculiar outdoor acoustic requirements with regard to volume and frequency range and sound perspective. The engineering problem was not only designed to convey the sound to all portions of the parking area, but also to give an illusion of natural sound coming from the screen. It was also essential to make the sound clearly heard above the general outdoor noise level created by motor traffic and other extraneous sources.

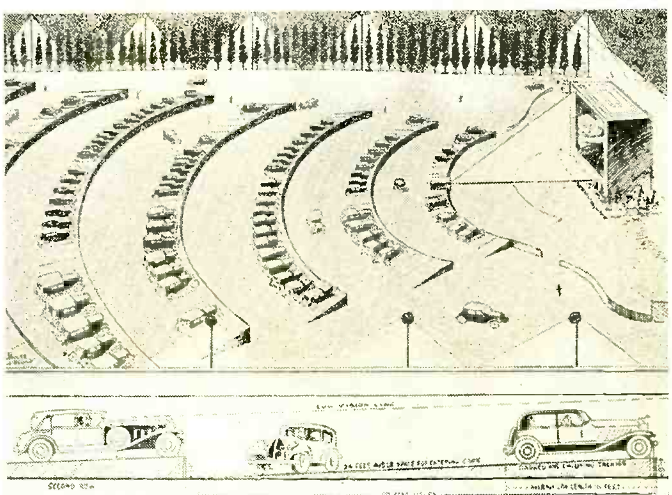
Because the reverberation which usually builds up the indoor low-frequency response is entirely absent, it was important to provide increased low-frequency response for the special requirements of the outdoor theatre. For the purpose, a directional baffle loudspeaker with a narrow distribution angle (33° arc) was selected. Three loudspeakers were needed to give full sound coverage in the horizontal plane, because the parking space, when viewed from the screen, subtends a 90° arc.

When viewed in the vertical plane from a point two-thirds up the screen, the parking area subtends an arc which is sufficiently within the distribution angle limits of the loudspeaker. Thus, the three loudspeakers are set at that height for the purpose of presenting the best illusion. The speakers are mounted side by side with axes spread apart 30° in the horizontal plane and tilted down 10° in the vertical plane. In the horizontal plane, uniform sound distribution is obtained from the three loudspeakers, because in passing across the field of sound from one loudspeaker axis to the next the increasing intensity of one compensates for the decreasing intensity of the other. In the vertical plane, a fairly uniform sound distribution is obtained.

The loudspeakers' narrow distribution angles are of especial outdoor benefit in reducing the amount of power lost by radiation into the open air. Through knowledge of distribution characteristics and efficiency of a loudspeaker and the sound pressure or acoustic power required at any point in the sound field, it was possible to determine the electrical power needed at (*Continued on page* 505)

LAYOUT OF THE MOVIE FIELD

The scheme by which automobiles may be driven on slanting ramps to provide a clear view for all



NEEDED RADIO INVENTIONS

Irving J. Saxl, Ph.D.

Part Two

ANOTHER problem that is near to the heart of the radio inventor is the question of secret communication. Various methods of attacking this problem have been tried, but thus far this has proved most difficult and could be achieved only partially and with expensive equipment, thus limiting its use to special commercial and military installations such as speech scrambling equipment and coding machines. The introduction of centimeter waves may perhaps be another step toward the goal of secret communication, because these waves can be thrown from a parabolic mirror like the rays of a searchlight—in one direction only. Furthermore, if they are short enough, they do not travel much beyond the horizon.

While Marconi stated, in a recent paper, that he was able to receive signals on 60 centimeter wavelengths (500 megacycles) below the curvature of the earth, centimeter waves of the order of 15 centimeters or less have not been received as yet at distances beyond the optical limits.[1]

It seems that the further down the wavelength goes, the closer do these waves follow the laws of optics. It is natural therefore to think in terms of shorter and still shorter wavelengths of the electro-magnetic spectrum, for secrecy. While the use of heat waves (infra red) for communication purposes does not seem to be a practical idea, although there are many "infra-red transmitters" in nature (every smokestack of a house or ship and every surface that is warmer than its surroundings is a transmitter) there still remains open a wide band of waves, slightly longer than heat waves, but shorter than any waves used at the present time.

While it is true that many short-wave stations work at several meters wavelength and while Marconi uses waves of the dimension of decimeters, and other experimenters have gone down to centimeter wavelengths the field of millimeter waves has not as yet been successfully approached commercially.

Research on these wavelengths goes back to the beginning of this century. Almost thirty years ago, waves in the order of millimeters were produced by Nichols, Tear and Blair in America and by others in Europe. While these experiments were extremely interesting, the output energy of the tiny spark transmitters used at that time was too small and the general behavior of small electrodes that burned off rather quickly did not seem to lend itself readily to the commercial generation of carrier waves for speech modulation. These experiments were in the realms of pure research. Figure 1 shows the physical principle used at that time for the production of millimeter waves.

By reasoning that the wavelength in spark transmitters is dependent upon the electrical capacity (among other things) of the electrodes between which the spark jumps, the natural inference was to reduce the size of these electrodes as much as possible. This method immediately increased the difficulty of cooling these electrodes effectively so as to give them a reasonable lifetime despite the heat of the sparks.

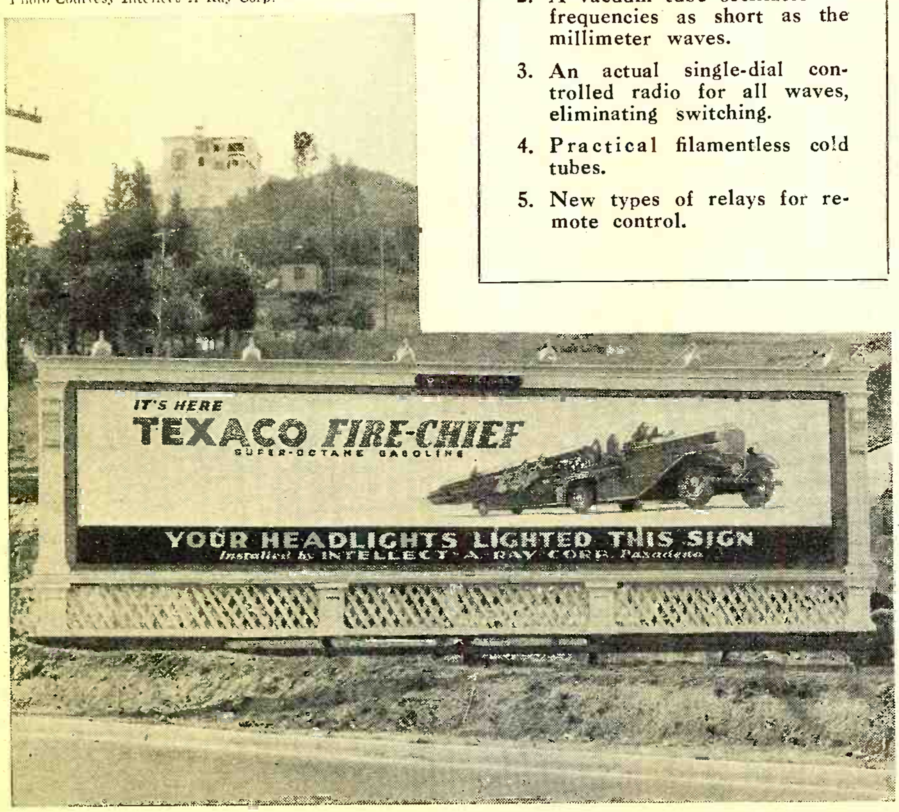
The influence of the electrical capacity was reduced by subdividing the spark-length, the actual millimeter oscillations being generated between two balls of silver held near each other in the narrow part of a double funnel. These oscillators were fed by copper electrodes of larger diameter and some distance apart from the small electrodes. The entire system was cooled and insulated in petrolatum. Despite the cooling precautions of all kinds, the lifetime of the micro electrodes was rather limited. To overcome this, a system whereby the micro electrodes were continuously exchanged was used by Glagoliewa Arkadiewna. But this also, while it provided a means for an interesting physical experiment, was not the industrial solution of the problem.

Millimeter waves, therefore, have been generated under laboratory condi-

A REMOTE CONTROLLED SIGN

The signboard pictured below is turned on and off by the headlights of approaching automobiles coming round a bend in the road. This is an example of remote control by electronic means

Photo Courtesy Intellect-A-Ray Corp.

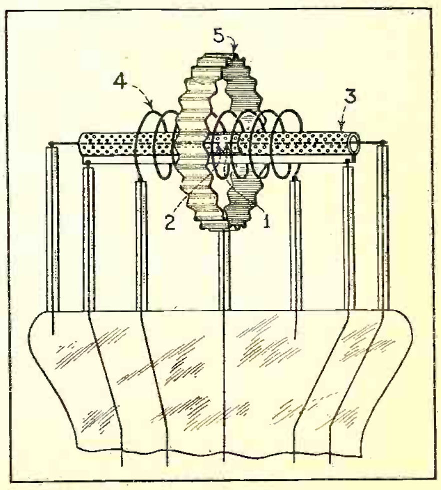


Can You Invent These?

1. A secret but simple communication system that no one else could listen in on.
2. A vacuum tube oscillator for frequencies as short as the millimeter waves.
3. An actual single-dial controlled radio for all waves, eliminating switching.
4. Practical filamentless cold tubes.
5. New types of relays for remote control.

FILAMENTLESS TUBE

Figure 2. The general arrangement of a "cold" tube working without a filament is shown in the sketch below. This is described in the text

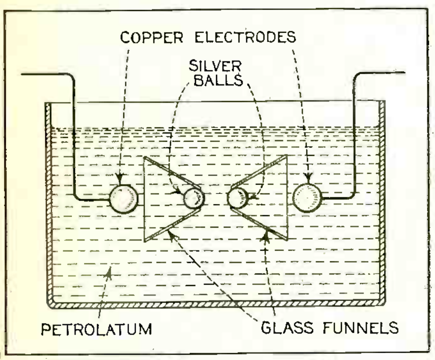


tions. They offer enormous possibilities for directional transmitters and many other purposes once they can be generated and received on a commercial scale. Who will transfer this scientific principle into practical usage? Will it be a new principle used in conventional tubes, like the Barkhausen-Kurz system that makes possible the generation of centimeter waves in regular triodes, or will a new tube be invented? Will entirely new and independent methods be invented for the generation of these waves at the borderline between radio and heat?

An invention for which there would be an immediate market would be an actual one-dial controlled radio apparatus taking in all wavelengths, from the ultra-short waves to the longest waves—a one-dial control that would work with short waves as well as with the longest ones, and on which the various wavelengths would be accurately calibrated on the circumference of a dial, without switching, etc.

There are controls now on the market which use a number of subdivided circles attached to the same dial, and in which condensers with straight-line characteristics are used. But the selection of the various frequency signals is still done by a separate knob or switch. The difficulties of avoiding this extra knob are enormous, as the circuit constants for operating on very short and very long wavelengths are so fundamentally different that the use of the same equipment does not seem feasible at present.

Although switching procedures have been reduced substantially, although plug-in coils have been eliminated, althought straight-line radio condensers have been introduced, the problem of an actual one-dial control for short and long waves has not been solved as yet. What inventor will do it?

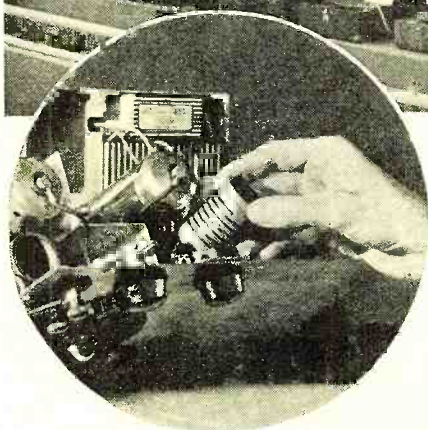


CAN YOU IMPROVE ON THIS?

Figure 1. This is the fundamental idea of the spark oscillator for millimeter waves. Can any of our readers perfect a tube device that will generate continuous waves at these tiny frequencies?

Thus far the electronic relay has been most promising. It consists, essentially, of an electron emitter, a plate toward which the electrons move and are perceived, and an electrically operated relay for closing control switches, etc.

Amplifiers are usually needed for this work and amplifiers need tubes.



ELIMINATING PLUG-INS

Plug-in coils have been largely done away with in modern receivers. They have been replaced with a switching arrangement. Can you invent a radio dial which will also eliminate the switching devices?

INVENTIONS ON EXHIBIT

At the recent radio and phonograph show in Paris there were on exhibit the many hundreds of inventions of talking machines that have brought this development from the early stages in 1907 to the perfected product of 1933

However, considerable filament current is necessary to operate these tubes and this necessitates either heavy transformers or disagreeable storage batteries. Furthermore, B eliminators or B batteries are both disagreeable necessities for the supply of the plate voltages of such tubes.

Experiments have already been made to eliminate the filament current by the introduction of powerful photo-active surfaces. Instead of using the B supply, the inherent energy of radio-active preparations has been experimented with. Thus far both these possibilities are nothing but laboratory curiosities. Furthermore, tubes have been constructed which use ionization currents in gas-filled tubes as the generator of electrically charged bodies. This immediately eliminates the filament supply, but still necessitates means for generating and handling the large voltage in connection with this set-up. Figure 2 shows the basic idea underlying filamentless tubes as constructed in a number of laboratories here and abroad. Instead of using a heated body as the source of electrons, they are produced by a discharge between two electrodes, 1 and 2, which are surrounded by a gas of low pressure, such as Argon. This produces negatively charged electrons and positively charged ions. To restrain the ions from acting as carriers of electric charges, they are repelled by a strongly charged grid, 3, usually a cylinder with a number of small holes in it.

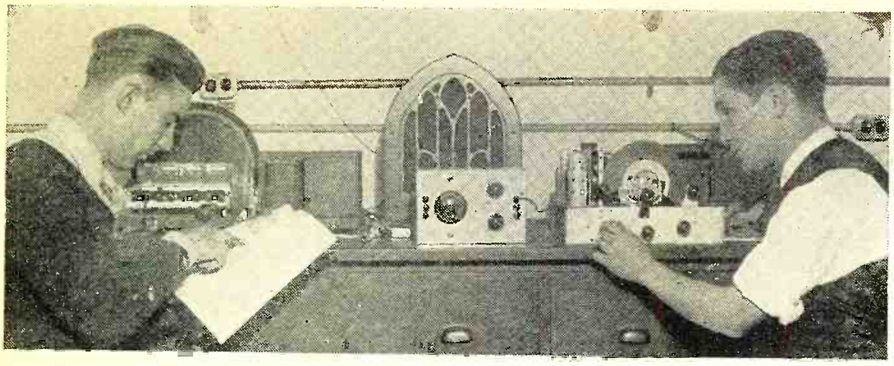
Therefore any particles passing through this cylinder are negatively charged, as the cylinder acts in a general way similar to a cathode in one of the regular amplifier tubes. A grid, 4, controls the flow of the electrons towards a plate, 5. To avoid the plate becoming warm under the impact of the electrons and thus becoming a secondary emitter, the radiating surface of the plate is made as large as possible, and the plate therefore remains relatively cool.

All the lead wires are covered with glass insulator tubes to avoid any discharge taking place at other places within the tube than the desired ones. Although the principle of these gaseous discharge devices sounds simple and the experiments made thus far seem promising, gas filled tubes have not been introduced commercially for a number of reasons.

What will the real inertialess amplifier of the future be? Will it be a highly improved type? Will it be a tube at all? Or will other means be used for the generating and detecting of alternating currents and for amplifying them? Will a high vacuum be used?

We already have chemical, magnetic and a great number of other relays for specific purposes. Will the amplifier of the future develop from them or will it be from a better self-powered tube?

Techniques have their modes and fashions like (*Continued on page* 510)



THE DX CORNER

FOR BROADCAST WAVES

THIS month the DX Corner for the Broadcast Band is presented for the third consecutive time. Whether it will be adopted as a permanent feature rests entirely with our readers. If you want it, write and say so, because its continuance will depend entirely upon your response. If enough readers evidence interest in this department, it will not only be continued permanently, but will be enlarged beyond the space now allotted to it. Address your letters to the DX Editor, RADIO NEWS.

QUITE a number of letters have been received from readers expressing their desire to have this new section continued, and many of these have contained information of interest to DX'ers. Let's have more of it. Later, if it is decided to continue this section, it is planned to appoint Official Broadcast Band Listening Posts. These appointments will go to the DX'ers whose letters during the next two or three months indicate the best qualifications. Eventually it is hoped that one Official Listening Post will be selected for each state and for foreign countries as well.

In submitting reports on reception, coming DX programs, etc., there are a few suggestions which may be helpful. It is desirable, for instance, to give the frequency (and power, if known) of all stations mentioned. This will aid us in learning of changes which may have been made, but which have not been officially announced. Also, bear in mind that RADIO NEWS is prepared considerably in advance of the date upon which it reaches readers. Thus, November 18th is the deadline for the February issue (which reaches readers early in January). Usable material received before the 18th of any given month does not therefore reach readers until almost 60 days later, and for that reason notice of special DX programs must be at least this far in advance to be of any use to readers. In reporting reception of DX stations it will be helpful if you give dates and hours of such reception.

This emphasis on reports of reception, announcements of DX programs, etc., should not be taken to mean that material of this type is the only kind that will be of interest to other DX fans. Almost every DX'er has some kink or another which he has used to improve the distance-getting ability of his receiving equipment. An interchange of such ideas in this department will be helpful all around. In practically every case improved sensitivity can be obtained by tuning the antenna, for instance. If you have tried this and have found it practical, others will undoubtedly be interested in knowing just what arrangement you used, etc. You in turn will be just as much interested in having such information based on experiments of others.

By pulling together in this way this department can be made of tremendous worth to all DX'ers.

Broadcast Band "Best Bets"

To avoid constant repetition of location, frequency, power, etc., in the following reports, stations will for the most part be mentioned by call letters only. These details on each station mentioned will, however, be given in the following list which constitutes a "Best Bets" list for the month inasmuch as it includes only the foreign stations actually reported by readers.

Best Bets (*Australia*)

Call	Location	Kc.	Watts
2BL	Sydney, New South Wales	855	5000
2CH	Sydney, New South Wales	1210	1000
2CO	Corowa, New South Wales	560	7500
2FC	Sydney, New South Wales	665	5000
2GB	Sydney, New South Wales	950	3000
2UE	Sydney, New South Wales	1025	1000
3AR	Melbourne, Victoria	610	5000
3LO	Melbourne, Victoria	800	5000
4BC	Brisbane, Queensland	1145	600
4QG	Brisbane, Queensland	760	5000
4RQ	Rockhampton, Queensland	910	2000
5CK	Crystal Brook, South Austr.	635	7500

Best Bets (*China*)

XGOA	Nanking	681.8	75.0

Best Bets (*Japan*)

JFAK	Taihoku	670	10,000
JOAK1	Tokio	590	10,000
JOAK2	Tokio	870	10,000
JOBK	Osaka	750	10,000
JOCK	Nagoya	810	10,000
JODK1	Keijo	900	10,000
JODK2	Keijo	610	10,000
JOFK	Hiroshima	850	10,000
JOGK	Kumamoto	790	10,000
JOHK	Sendai	770	10,000
JOIK	Sapporo	830	10,000

Best Bets (*New Zealand*)

2YA	Wellington	720	5000
3YA	Christchurch	980	500
4YA	Dunedin	650	500

Best Bets (*South America*)

LR4	Buenos Aires	990	20,000

Special Foreign Broadcasts

Following are several special DX broadcasts from foreign stations. This list is furnished through the courtesy of the International DX'ers Alliance (C.S.T.):

Jan. 6—2-3 a.m.—LS9, 1270 kc.—Buenos Aires, Argentina—5000 watts.

Jan. 7—12:01-2 a.m.—YV1BC, 960 kc.—Caracas, Venezuela—5000 watts.

Jan. 6 and 7—11 p.m.-1 a.m.—NN, 995 kc.—North National, Great Britain—50,000 watts.

Jan. 8—12:01-2 a.m.—1328 kc.—Fecamp, France—10,000 watts

Jan. 8—12:01-1:30 a.m.—563 kc.—Munich, Germany—60,000 watts.

Jan. 7 and 8—11:30 p.m.-1:30 a.m.—985 kc.—Bordeaux, France—13,000 watts.

Jan. 8—3-4 a.m.—PRC5, 1364 kc.—Rio de Janeiro, Brazil—1000 watts.

Jan. 9—12:01-2 a.m.—MR, 752 kc.—Midland Regional, Great Britain, 25,000 watts.

Jan. 8 and 9—11:30 p.m.-1:30 a.m.—779 kc.—Toulouse, France (Radio Toulouse)—8000 watts.

Jan. 10—1-2 a.m.—EAJ1, 860 kc.—Barcelona, Spain—8000 watts.

Jan. 10—12:01-2 a.m.—725 kc.—Athlone, Irish Free State—60,000 watts.

Jan. 10 and 11—11 p.m.-1 a.m.—1157 kc.—Frankfurt-am-Main, Germany—17,000 watts.

Jan. 13—12:01-2 a.m.—PP, 914 kc.—Poste Parisien, Paris, France—60,000 watts.

Jan. 13—12:01-2 a.m.—WR, 968 kc.—West Regional, Great Britain—60,000 watts.

Jan. 13 and 14—11 p.m.-1 a.m.—WN, 1147 kc.—West National, Great Britain, 50,000 watts.

Jan. 20—2-3 a.m.—LR3, 950 kc.—Buenos Aires, Argentina—12,500 watts.

These broadcasts are tentative, as definite confirmation has not been received at the time of going to press.

DX Tips

Each Sunday morning at 12:25 a.m., C.S.T., station WDAF, 610 kc., broadcasts DX tips. This broadcast is arranged by the International DX'ers Alliance and will be found useful by all DX fans.

Midwest DX

C. H. Skatzes of Delaware, Ohio, expresses the opinion that up to the middle of November he had not seen any indication that the present one is to be an exceptional season for DX, although he qualified this by saying that he has received 2YA quite well and 4OG has also been heard.

This opinion coincides with the experience of the RADIO NEWS staff—that DX reception this year in the eastern part of the U. S. is not up to that of the same period last year. It would be interesting to have comments from other readers located in the East and Middle West, concerning their findings in this respect.

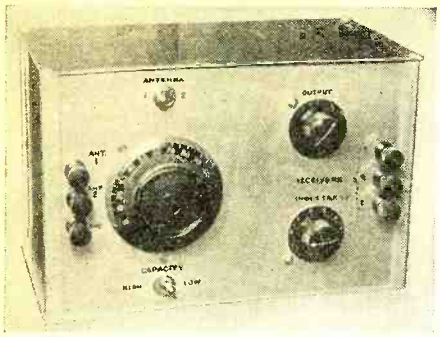
Further tips in Mr. Skatzes' letter are: "10BQ, a 5-watter operating on 1200 kc. and located at Brantford, Ontario, Canada, broadcasts a special DX program every Saturday morning from 2:30 a.m. to 4 a.m., E.S.T.

"KSUN, 1200 kc., 100 watts, of Lowell, Arizona, has been added to the list of frequency test stations listed in RADIO NEWS last month. It is on the air from 6:10 a.m. to 6:30 a.m., E.S.T., the first Tuesday of each month."

From Missouri

The following data on reception in the Middle West is quoted from a report submitted by C. H. Long of Winston, Missouri: "Reception conditions were good here the latter part of October. The Japanese and Chinese signals were received with more than usual strength, and in addition the static level was quite low on a number of occasions. As a result it was possible to log successfully a number of new stations: JOCG, XGOA, JFAK, JORK, JOBK No. 2 and JOCK. Other Japanese stations well received include: JOLK, JOJK, JOBK, JOHK, JOGK, JOCK, JOIK, JOFK, JOAK and JOQK. The Australian and New Zealand stations were also well received during this period. Those best received include: 2CO, 3AR, 5CK, 4QG, 3LO, 2BL, 4RK, 2GB, 2UE, 4BC, 2CH and 2YA. At present the best hours for the reception of the above stations are from 4 to 6:30 a.m. Signals from the Australian and New Zealand stations are now beginning to weaken slightly, especially those from the more inland stations. This is to be expected, inasmuch as summer

(*Continued on page* 484)



KICKING UP DX!!!

(The R. N. Tenatuner)

The unit described here offers a simple means for markedly improving the DX ability of broadcast-band receivers. It is easy to build and is installed by simply connecting it in the antenna lead circuit

S. Gordon Taylor

MUCH is heard about the advantages to be obtained through tuning the antenna used for DX reception but there seems to be very little definite information available as to the extent of the improvement thus obtainable or on suitable equipment for tuning the antenna. A study of this subject has been made in the RADIO NEWS Laboratory and the antenna tuning unit developed from this study is described herewith for the benefit of DX fans who may be interested—and let it be said here that every DX fan can profitably take advantage of the improved DX reception provided by such a unit.

To illustrate the value of the unit, Table 1 is made up from actual measurements made in the Laboratory. These measurements were made using a standard commercial receiver and an ordinary outdoor antenna approximately ninety feet long. The voltage measurements were obtained from a meter connected across the speaker. The signal was obtained from a completely shielded, modulated oscillator which was coupled to the antenna, and the output of which was completely independent of changes in antenna tuning. At each frequency the oscillator and receiver were tuned exactly and then the oscillator output cut down until the receiver output meter showed a reading of one volt with the receiver connected directly to the antenna in the normal manner. Then without changing any of the adjustments the antenna tuner was inserted between the antenna and the receiver and was tuned to resonance. The output meter was again read and gave a definite measure of improvement brought by the antenna tuner circuit. Thus it is seen that at 600 kilocycles the receiver output was multiplied 7.25 times or the equivalent of 17.2 decibels. At the other frequencies in the broadcast band, the gain was smaller, being only 1.8 times at 1500 kilocycles or the equivalent of 5.1 decibels. The average improvement for the entire broadcast band is seen to be slightly less than five times or the equivalent of fourteen decibels. Briefly, what this all means is that very weak DX signals which ordinarily could not be brought up to audibility with the receiver alone can be increased to a point far above the threshold of audibility through the simple expedient of tuning the antenna.

Nor is this the only advantageous feature offered by antenna tuning. It is a known fact that internal noise in a receiver originates almost entirely in the first tube. Therefore, if a signal can be picked up, as it is when the antenna is tuned, before going into this first tube the ratio of signal-to-noise will be more favorable and in effect the noise level of the receiver will be materially reduced.

Where a short antenna is used the gain provided by tuning it is tremendous. In the above tests, for instance, a gain ratio of 24 was obtained at 600 kilocycles and 4.6 at 1500 kilocycles, or an average gain of approximately 14 (23 decibles) for the broadcast band. These measurements were obtained when the 90 foot outdoor antenna was replaced with a 20 foot indoor antenna. Thus where conditions necessitate the use of a short antenna, the unit described here will result in a degree of effectiveness approximating that of a much longer untuned antenna.

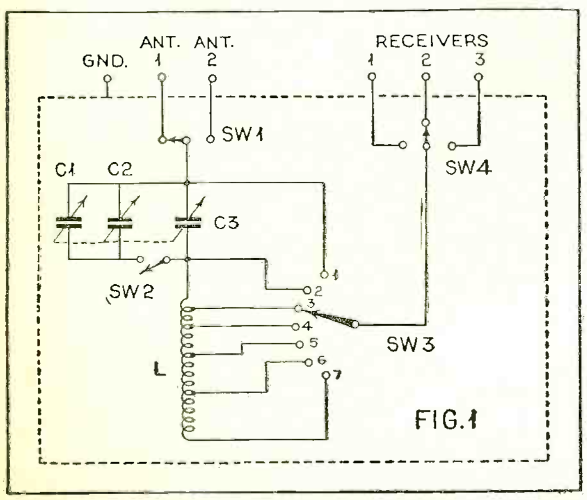
The "Tenatuner" consists basically of a tapped coil and a variable condenser in series between the antenna and the receiver. It is desirable to have a variable condenser with a maximum capacity of approximately 1000 mmfd. for this purpose but such good condensers are (*Continued on page* 504)

TEST MEASUREMENTS

Table 1. This table shows the actual gain obtained by connecting the Tenatuner ahead of standard broadcast receiver. The 3rd column shows the voltage gain and the 4th column the gain in decibels

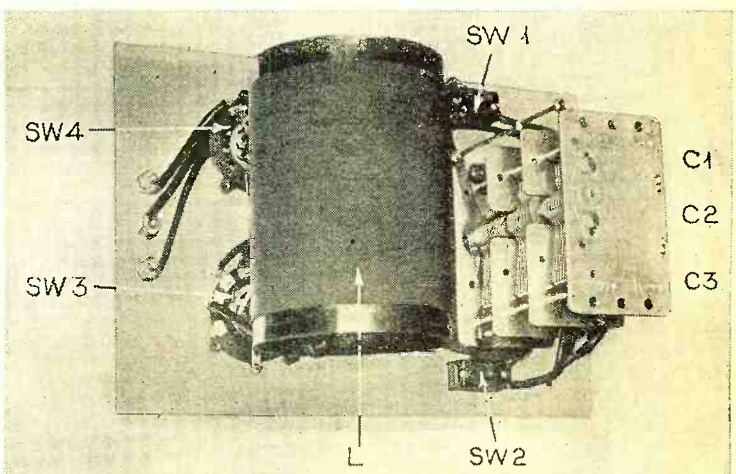
Freq. KC.	Ant. Direct	Ant. Tuned	Improvement in Output, Decibels
600	1 v.	7.25 v.	17.2
800	1 v.	5.5 v.	14.8
1000	1 v.	4.3 v.	12.7
1200	1 v.	4.5 v.	13.1
1500	1 v.	1.8 v.	5.1

THE TENATUNER CIRCUIT



THE ASSEMBLY

Figure 2. All parts are assembled on one of the side panels of the aluminum box shield, but are insulated therefrom. The gang condenser is mounted on insulating pillars and washers, as are the binding posts. The switches are of insulated construction and therefore may be mounted directly on the panel



BROADCASTING STATIONS IN AFRICA & OCEANIA

ALGERIA

Call	Location	Kc.	Kw.
	Algiers (Will increase power to 100KW)	824	15.0

CANARY ISLANDS

Call	Location	Kc.	Kw.
EAR5	Las Palmas	1071	05.

EGYPT

Call	Location	Kc.	Kw.
	Cairo	710	0.5
	Cairo	780	0.3
	Alexandria	780	0.2
	Alexandria	1080	0.5
	Alexandria	1080	0.5

MOROCCO

Call	Location	Kc.	Kw.
	Rabat	721	5.0
	Meknes (under construction)	869	
CNO	Casablanca	983	0.025

TUNISIA

Call	Location	Kc.	Kw.
TUA	Tunis	235	0.5

UNION OF SOUTH AFRICA

Call	Location	Kc.	Kw.
	Bloemfontein	588	0.75
ZTJ	Johannesburg	667	15.0
ZTD	Durban	731	1.0
ZTC	Cape Town	810	1.0
	Pretoria	1000	0.05

AUSTRALIA

Call	Location	Kc.	Kw.
2CO	Corowa, N. S. W.	560	7.5
7ZL	Hobart, Tasm.	580	3.0
3AR	Melbourne, Vict.	610	5.0
5CK	Crystal Brook, S. Austr.	635	7.5
2FC	Sydney, N. S. W.	665	5.0
6WF	Perth, W. Austr.	690	5.0
7HO	Hobart, Tasm.	690	0.05
5CL	Adelaide, S. Austr.	730	5.0
4QG	Brisbane, Qnsld.	760	5.0
3LO	Melbourne, Vict.	800	5.0
2BL	Sydney, N. S. W.	855	5.0
6PR	Perth, W. Austr.	880	0.5
4RK	Rockhampton, Qnsld.	910	2.0
3UZ	Melbourne, Vict.	930	0.3
2GB	Sydney, N. S. W.	950	3.0
5DN	Adelaide, S. Austr.	960	0.3
3BO	Kangaroo Flat (near Bendigo, Vict.)	970	0.2
4GR	Toowoomba, Qnsld.	1000	0.05
3HA	Hamilton, Vict.	1010	0.2
2UE	Sydney, N. S. W.	1025	1.0
5PI	Port Pirie, S. Austr.	1040	0.05
2CA	Kingston, Canberra	1050	0.05
4MB	Maryborough, Qnsld.	1060	0.05
2KY	Sydney, N. S. W.	1070	1.5
3SH	Swan Hill, Vict.	1080	0.05
7LA	Launceston, Tasm.	1100	0.2
2HD	Newcastle, N. S. W.	1110	0.2
2UW	Sydney, N. S. W.	1125	1.5
6ML	Perth, W. Austr.	1135	0.3
3YB	Mobile station used in Victoria	1145	0.025
4BC	Brisbane, Qnsld.	1145	0.6
2WG	Wagga, N. S. W.	1155	0.05
4TO	Townsville, Qnsld.	1170	0.2
3DB	Melbourne, Vict.	1180	0.3
4MK	Mackay, Qnsld.	1190	0.1
5KA	Adelaide, S. Austr.	1200	1.0
2CH	Sydney, N. S. W.	1210	1.0
6KG	Kalgoorlie, W. Austr.	1220	0.1
2NC	New Castle, N. S. W.	1245	2.0
3WR	Wangaratta, Vict.	1260	0.05
2SM	Sydney, N. S. W.	1270	1.0
3TR	Sale, Vict.	1280	0.05
4BK	Brisbane, Qnsld.	1290	0.2
3BA	Ballarat, Vict.	1300	0.05
5AD	Adelaide, S. Austr.	1310	0.3
2MO	Gunnedah, N. S. W.	1320	0.05
4RO	Rockhampton, Qnslad	1330	0.05
2XN	Lismore, N. S. W.	1340	0.05
3KZ	Carlton, Vict.	1350	0.3
4BH	Brisbane, Qnsld.	1380	0.6
2GN	Goulburn, N. S. W.	1390	0.1
3GL	Geelong, Vict.	1400	0.05
2KO	Newcastle, N. S. W.	1415	0.2
3AW	Melbourne, Vict.	1425	0.3
2WL	Wollongong, N. S. W.	1435	0.05
7UV	Ulverstone, Tasm.	1460	0.2
2AY	Albury, N. S. W.	1480	0.05
3AK	Melbourne, Vict.	1500	0.05

NEW ZEALAND

Call	Location	Kc.	Kw.
2ZK	Wanganui	600	0.12
1ZH	Hamilton	630	0.05
4YA	Dunedin	648	0.5
2YA	Wellington	720	5.0
1YA	Auckland	820	0.02
2ZP	Wairoa	900	0.105
3YA	Christchurch	980	2.5
2ZF	Palmerston North	1050	0.15
2ZO	Palmerston North	1050	0.2
4ZF	Dunedin	1080	0.01
4ZM	Dunedin	1080	0.045
4ZO	Dunedin	1080	0.04
4ZB	Dunedin	1080	0.02
4ZW	Dunedin	1080	0.05
1ZR	Auckland	1090	0.08
2ZW	Wellington	1120	0.4
2ZM	Gisborne	1147	0.11
2ZJ	Gisborne	1150	0.075
4ZI	Invercargill	1160	0.008
4ZP	N. Invercargill	1160	0.125
1ZQ	Auckland	1190	0.025
3ZC	Christchurch	1200	0.25
2ZE	Ekatehuna	1210	0.01
4ZL	Dunedin	1220	0.1
2YB	New Plymouth	1230	0.1
1ZM	Auckland	1260	0.01
4ZC	Otago	1280	0.02
2ZB	Napier	1290	0.0075
2ZH	Napier	1290	0.065
3ZR	Greymouth	1300	0.08
3ZE	Greymouth	1300	0.045
1ZJ	Auckland	1320	0.026
2ZI	Hastings	1330	0.015
2ZL	Hastings	1330	0.02
4ZR	Otago	1340	0.005
2ZR	Nelson	1360	0.05
1ZB	Auckland	1420	0.02
1ZS	Auckland	1420	0.005
3ZM	Christchurch	1450	0.1

The DX Corner (Broadcast)

(*Continued from page* 482)

is beginning in Australia. With the approach of Spring more suitable conditions will again obtain for the reception of these stations. Signals from South America are now reaching the United States with good strength. LR4 was received here quite well November 7th from 8:30 to 9:30 p.m., when for some cause WBZ happened to be off the air."

A Report from California

From San Jose, California, comes the following interesting information submitted by T. William Kelly: "Since July last I have logged every one of the 10-kilowatt stations in Japan and to date have received verifications from five. This a.m. (November 10th) and yesterday I listened to the following Japanese stations, all with good loudspeaker volume: JOAK, JOBK, JOCK, JOFK, JOGK, JOHK, and JOIK.

"My greatest catch among the United States occurred at 4 o'clock this morning when I heard WGY, Schenectady, New York (790 kc.—50 kw.). Previous to that my greatest distance was WJAX, Jacksonville, Florida (900 kc.—1 kw.).

"It may be of interest to some of your readers to know that CKLW of Windsor, Ontario, Canada, shifted from 540 kc. to 800. Also that CJOR of Vancouver, can now be heard on 600 kc.

"Every morning at 3 o'clock, P.C.T., I pick up a station on about 610 kc. but cannot get his call or very much of what he says. It seems that he is describing a motor of some sort, then at 3:15 he goes on with a program that sounds like Spanish. I wonder if anyone can tell me who this is? A harmonic from a code station makes it impossible for me to get him, although I have been trying for about a month."

From Washington

A report from Glenn E. Dubbe of Walla Walla, Washington, states that all of the 10 kw. Japanese stations are coming in at his location with fair regularity and that in addition he has heard six of the low-powered Japanese stations. XGOA, China, has recently been heard quite frequently. He finds that although he has heard seven Australian stations this Fall, they have not been dependable.

DX in Nevada

Don H. Townsend, Jr., of Fallon, Nevada, believes that this winter is going to offer an unusually successful season for DX work, basing his opinion on his reception up to the middle of November. He further says: "2CO, Australia, came in with remarkable volume. JOAK was received fairly well. 3AR, Australia, and JOTK, Japan, came in strong at times. 4YA was picked up through much interference from KPCB, Seattle, Washington. 2FC, JFAK, XGOA and JOLK came in well with very little fading. 2YA was fair but weaker than usual. JOSK, JOBK, JOFK, JOCK and JOAK were all received with fair volume, while JOHK had more volume than ever before. 3YA and a Japanese station on 760 kc. (call not heard) were picked up with very good volume. Previous to this reception I had never succeeded in logging JOSK, JOTK or 4YA."

The DX Corner (Short Waves)

(*Continued from page* 472)

owner and operator of the experimental station ZU6G and also ZU6GP, and he is to send us reports of reception, monthly.

Best Bets in Detroit

Mr. Fred Helmer of Detroit, Michigan, sends in the following Best Bets: DJB, DJC, GSA, PHI, I2RO, CT1AA, FYA, VK6AG, DENNE, EAQ. These he receives exceptionally strong, using a Silver 15-tube all-wave set.

A Report from Kentucky

Mr. William A. McAlister of Hopkinsville, Kentucky, reports that he has been picking up VK3ME every Wednesday and Saturday and VK2ME each Sunday. His other Best Bets are: EAQ, VE9GW, W1XAZ, W1XAL, YV1BC, W8XK, YV3BC and DJA. He has made this new log while listening in on his new Midwest all-wave 16-tube set.

A Correction

Mr. Donald E. Bame, whom we listed a month ago as Barne, wished to call attention to the fact of the proper spelling of his name. He also reports that the Spanish-speaking station mentioned by him in his report he has found to be YV3BC. He also states the following stations as well received: DJB, GSE, DJD, GSB, EAQ, FYA, GSG, GSF, GSD, W8XK, VE9GW, GSA, DJC, G6RX, YV3BC, HJ4ABE, VE9HX, W2XAF, VK2ME, GSC, NR, W3XAL, VE9DJ, HC2RL, YV1BC.

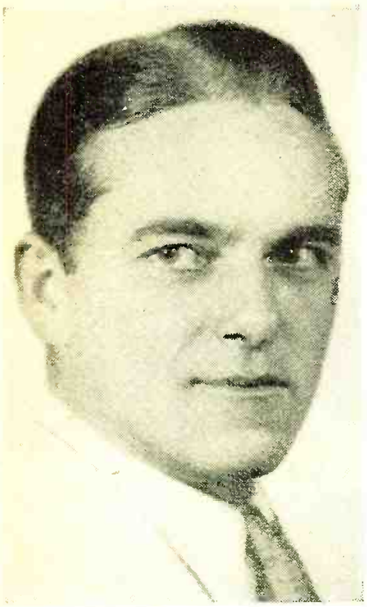
A Report from New Zealand

Mr. R. H. Moffatt of the New Zealand DX Club reports the following Best Bets for his location: RV15, HVJ, VK7LO, RV59, W8XAL, W9XF, W8XK, W3XL, VK3ME, W3XAF, VK2ME, J1AA, FYA, GSD, EAW, I2RO.

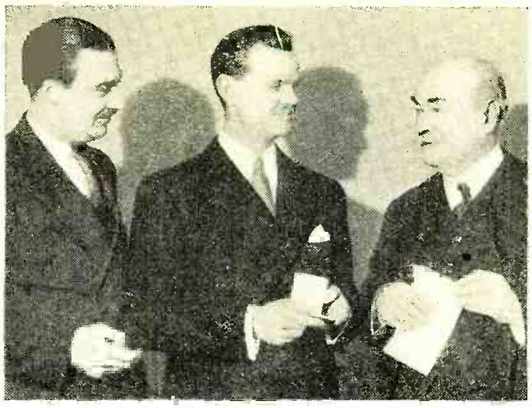
Readers Who Helped Log Stations for This Month's Report

We are indebted to following readers of RADIO NEWS who sent in reports of recep-

(*Continued on page* 508)



ALEXANDER GRAY



JAMES WALLINGTON LAWRENCE TIBBETT NICHOLAS M. BUTLER

GEORGE BEATTY

BACKSTAGE *in* BROADCASTING

Samuel Kaufman

PROFESSOR William Lyon Phelps, whose pedagogical endeavors won him much fame at Yale University, has taken up a broadcasting career as narrator and master of ceremonies on the CBS "Voice of America" series sponsored by the Underwood Typewriter Company. As may be guessed, the idea behind the series is a scholarly one. In the words of a CBS spokesman, the plan is "to dramatize the various cultural elements of present-day and past America." The permanent roster of the program's personnel includes Nat Shilkret and his orchestra, Alexander Gray, baritone, and Cal Tinney, comedian. Various guest artists of all types are presented on each of the Saturday night broadcasts.

MADAME FRANCES ALDA, noted soprano of the Metropolitan Opera Company, has launched a new series of Tuesday concerts over the NBC. Her programs from the Waldorf-Astoria Hotel, New York, also feature Xavier Cugat's Orchestra. Madame Alda, a native of New Zealand, gained operatic fame in Europe and America and retired from the Metropolitan at the peak of her career in 1930. Her successful radio series of the previous year prompted this season's return to the air via the same network and program spot.

ALBERT SPALDING, one of America's best-known concert violinists, is now a regular weekly feature of the CBS, being presented Wednesday nights over a nation-wide hook-up. Both the NBC and CBS have recently assigned many program spots to stellar names in the concert and operatic worlds. Radio listeners, we are told, have shown much enthusiasm for the classical trend.

JAMES WALLINGTON, the NBC announcer who leaped to radio fame as straight man for Eddie Cantor, was the surprised winner of the 1933 radio diction medal of the American Academy of Arts and Letters. This is the fourth of the five annual awards to go to an NBC spokesman. The sole CBS announcer to win the academy's distinction is David Ross, who obtained the 1932 medal. The three previous winners were Milton Cross, Alwyn Bach and John Holbrook. Wallington has been an NBC anouncer for five years and was recruited from the staff of WGY, Schenectady. Another radio personality to figure in the 1933 academy awards is Lawrence Tibbett, the opera baritone, who won the medal for good stage diction.

HOME from a Hollywood talkie sojourn, Ed Wynn returned to his "Fire Chief" rôle on the NBC Texaco program and, during his first few broadcasts, seemed to win back all of the tremendous following he obtained the season before. Although his comedy style was essentially the same as the past year, his absurd conversations with Graham McNamee clicked in a big way. But while scoring as a comedian, Wynn did not have much success in his other radio venture—the Amalgamated Broadcasting System.

THE variety type of radio entertainment has been gaining considerable popularity and one of the newest programs of that category is the CBS "American Revue," presented Sunday evenings. George Beatty, the droll master of ceremonies of the program, scored quite favorably on his first few programs. Ethel Waters, prominent Broadway vocalist recently featured on NBC, has the featured vocal rôle. Joe Venuti, violinist, and the Dorsey Brothers Orchestra supply the instrumental background.

WENDELL HALL, popularly known as the "Red-headed Music Maker," is one of the few radio artists managing to keep a grasp on fame from year to year. One of broadcasting's pioneer entertainers, Hall, the author of the "It Ain't Gonna Rain No More" ditty, is now featured in a ukulele and song rôle on an NBC Sunday series sponsored by the F. W. Fitch Company.

SEEING a need for substantial encouragement of American composers of

(*Continued on page* 507)

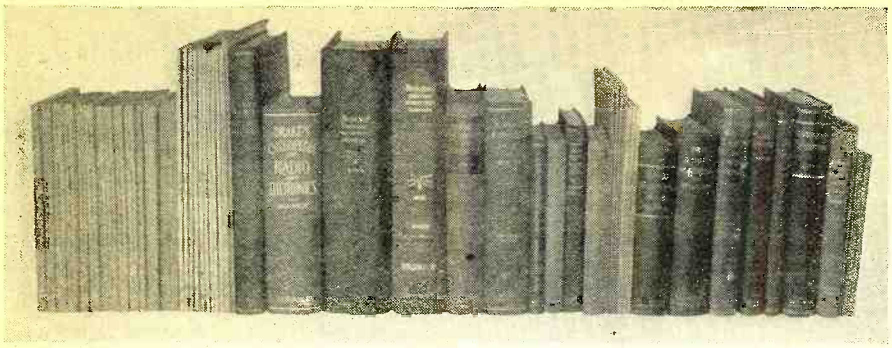
ALBERT SPALDING

MME. ALDA

AGAIN—THE FIRE CHIEF

PAUL WHITEMAN

WENDELL HALL



THE TECHNICAL REVIEW

JOSEPH CALCATERRA

Electron Tubes and Their Application, by J. H. Morecroft. John Wiley and Sons, 1933. A textbook on tubes of all kinds, including radio vacuum tubes, mercury-vapor rectifiers, thyratrons, grid-glow tubes and photo-cells. This book is therefore useful—not only to the radio engineer, experimenters, but also to engineers employed in other industries who may be called upon to use electron tubes for industrial purposes.

Since the text covers so many types of electron tubes, it is not as full of long mathematical analyses as the usual textbook on vacuum tubes. On the other hand, much of the material presented was not available in book form heretofore.

The opening chapters deal with the constitution of matter, the removal of electrons from matter and the effect of space charge.

Chapter IV discusses the vacuum tubes employed in the radio industry. It covers the fundamental principles and uses of all tubes from the diode to the pentagrid tube. A more detailed discussion of the circuits follows later

The gas-filled tubes, photoelectric cells and special electronic devices (grid-glow tube, magnetron, etc.) are next in order. Then follows the more detailed discussion of the circuits for the use of vacuum tubes when applied as amplifiers, oscillators, modulators or detectors. This part takes seven chapters (about 230 pages).

Finally, circuits for the use of special tubes are shown and discussed. Such applications as the inverter, telemeter, cathode-ray oscillograph, time-delay relays are found in this part.

The book was written by Prof. Morecroft; his works are too well known to need further comment.

The Modern Encyclopedia. Edited by A. H. McDannald. Wm. H. Wise & Co., 1933. An encyclopedia, complete in one volume of over 1300 pages. The articles and definitions have been compiled by the staff of the Encyclopedia Americana. There is a definite need for a book of this kind at a low price, especially for those who cannot avail themselves of a large encyclopedia. The various articles are of necessity much shorter than those found in the 24-volume type of encyclopedia, but they give the essential points and their brevity is often an asset. It is surprisingly complete and up to date, covering, in fact, every branch of human knowledge and nearly all points this reviewer could think up. There are several articles in it which cannot be found in other encyclopedias because they are new discoveries. As an example, we copy just one: "Neutron. In physics, a particle of an atom which has a unit mass and a zero charge. Discovered by bombarding beryllium with polonium rays, it has been defined as a proton and an electron in intimate combination and is said to have a mass approximately equal to that of a hydrogen atom. Work in search for a neutron was done by Joliot and Mme. Curie, but the actual discovery was made by J. Chadwick in 1932." The book has a buckram binding and is thumb-indexed, while the text is clarified by 1200 illustrations. A 32-page atlas is furnished separately to each purchaser.

Service Hints. Published by Hygrade Sylvania Corp. A 64-page booklet consisting of service information. The larger part is taken up by notes on different makes of receivers and ailments peculiar to them. Other hints of a more general nature are found in the latter part of the booklet. It closes with a list of all tubes, giving their number, their use and the type of Sylvania tube that can be employed to replace them.

Review of Articles in the November 1933, Issue of the Proceedings of the Institute of Radio Engineers

A New Field of Applications for Ultra-Short Waves, by Ernst Kramar. This paper describes the use of ultra-short waves in connection with radio beacons, especially in cases where poor visibility makes the use of visible light beacons impractical. The effect of the number and spacing of the reflectors on the guide ray is discussed in detail.

Vacuum Tube Electronics at Ultra-High Frequencies, by F. B. Llewellyn. An analysis of vacuum tube electronics which takes into account the time of flight of the electrons. Applications of the general analysis are made to the various types of tubes. A wavelength range extending from infinity down to only a few centimeters is considered, and it is shown that even in the low-frequency range certain slight modifications should be made in our usual analysis of the negative grid triode.

Some Aspects of Radio Law, by J. Warren Wright. This paper discusses some of the representative cases that have arisen and the decisions which have been made in such cases as a guide in interpreting radio law based on the Radio Act of 1927. It discusses the theory that radio transmission is interstate commerce; the tendency to regard public reception of broadcast materials as coming within the terms of the copyright act and the power of the states to regulate certain phases of radio.

Superregenerative Wavemeter for Ultra-Short Waves, by H. Ataka. A description of a simple generating wavemeter, based on super-regeneration, used to determine the wavelength of ultra-short-wave oscillators with insufficient output. Data is given on its construction, manipulation and accuracy.

A Projector Type Light Flux Generator for Testing Light-Sensitive Devices, by E. B. Kurtz and J. L. Potter. This paper describes a novel light-flux generator which is capable of giving a sinusoidal light flux for frequencies up to 100,000 cycles (or higher) per second, for use in the testing of television or other equipment using photoelectric cells.

A Note on the Simple Two-Element Low-Pass Filter of Two and Three Sections, by L. B. Hallman, Jr. An analytical study of the simple two-element, low-pass filter of two and three sections is presented in this paper.

Review of Contemporary Literature

Ultra-Short-Wave Transmission, by C. R. Englund. Bell Laboratories Record, November, 1933. A brief historical sketch of the development of radio, from Clerk Maxwell in 1865 to date, and a more detailed description of the problems and advantages in transmission with ultra-short waves.

Measuring Inductance with a Resistor, by T. Slonczewski. Bell Laboratories Record, November, 1933. This article describes a bridge method for measuring inductance in which a resistor is used to measure the value of an unknown inductance.

An Artificial Ear for Receiver Testing, by F. L. Crutchfield. Bell Laboratories Record, November, 1933. An interesting description of an artificial ear, constructed so as to apply to a telephone receiver, an acoustic load equivalent to the load applied by a typical human ear and to measure the output of the receiver as perceived by an average human observer.

An Artificial Voice for Transmission Studies, by E. W. Holman. Bell Laboratories Record, November, 1933. This article describes an artificial mouth designed to provide sound characteristics similar to those obtained from the human mouth, in making transmission studies.

A Multi-Range Direct-Reading Ohmmeter, by M. G. Scroggie. The Wireless Engineer and Experimental Wireless, November, 1933. This article contains a complete description of circuit, construction and operation of a simple ohmmeter which can be used to obtain accurate resistance measurements of an exceptionally wide range of resistances.

Simplifying Experimental Equipment Construction. The General Radio Experimenter, October, 1933. This article gives a complete description, with illustrations of a number of standardized experimental equipment construction panels developed to simplify the work of assembling test circuits.

Iron Core Intermediate-Frequency Transformers, by Alfred Crossley. Electronics, November, 1933. This article gives data on the factors entering into the design of iron-core radio-frequency transformers of the type developed by W. J. Polydoroff.

A New Regenerative Detector Circuit for Ultra-Short Waves, by Richard Hilferty. QST, November, 1933. This article contains a description of a regenerative (autodyne) detector circuit that is peculiarly adapted to ultra-high-frequency operation.

Servicemen's Code of Fair Competition. Service, November, 1933. A statement of the problems in the field of radio servicing and listing of the points covered in the Code submitted by the Institute of Radio

Service Men to the National Recovery Administration.

How to Get Copies of Articles Abstracted in This Department

The abstracts of articles featured in this department are intended to serve as a guide to the most interesting and instructive material appearing in contemporary magazines and reports. These publications may be consulted at most of the larger public libraries or copies may be ordered direct from the publishers of the magazines mentioned.

RADIO NEWS *cannot undertake to supply copies of these articles. They are NOT included in the* RADIO NEWS *Free Technical Booklet Service.*

Free Technical Booklet Service

THROUGH the courtesy of a group of manufacturers, RADIO NEWS offers to its readers this Free Technical Booklet Service. By means of this service, readers of RADIO NEWS are able to obtain quickly and absolutely free of charge many interesting, instructive and valuable booklets and other literature which formerly required considerable time, effort and postage to collect. To obtain any of the booklets listed in the following section, simply write the numbers of the books you desire on the coupon appearing at the end of this department. Be sure to print your name and address plainly, in pencil, and mail the coupon to the RADIO NEWS Free Technical Booklet Service. Stocks of these booklets are kept on hand and will be sent to you promptly as long as the supply lasts. To avoid delay, please use the coupon provided for the purpose and inclose it in an envelope, by itself, or paste it on the back of a penny postcard. The use of a letter asking for other information will delay the filling of your request for booklets and catalogs.

Technical Booklets Available

2. *1934 R.F. Parts Catalog.* Specifications on the line of Hammarlund variable and adjustable condensers, r.f. transformers, sockets, shields and miscellaneous parts for broadcast and short-wave receivers, complete short-wave receivers and transmitting variable condensers.

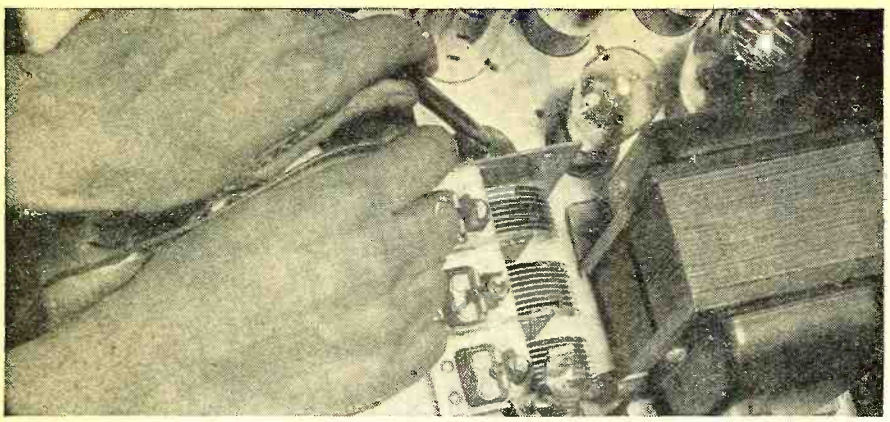
4. *A 15 to 200-Meter Superheterodyne.* A description of the outstanding features of the Hammarlund-Roberts high-frequency superheterodyne designed especially for commercial operators for laboratory, newspaper, police, airport and steamship use.

5. *1934 Volume Control, Fixed and Variable Resistor Catalog.* Data on standard and special replacement volume controls, Truvolt adjustable resistors, vitreous wire-wound fixed resistors, voltage dividers and other resistor specialties and public-address amplifiers (using new tubes) made by Electrad.

6. *Line Voltage Control.* Characteristics and uses of a voltage regulator and chart showing the correct Amperite recommended by set manufacturers for their receivers.

7. *Rich Rewards in Radio.* Information on the growth of radio and the opportunities existing in the field of radio manufacturing, radio servicing, broadcast-

(*Continued on page* 500)



THE SERVICE BENCH

ZEH BOUCK

DOOR to door solicitation is well established in the American merchandising scheme of things. It is a rare day in which the average householder is not called upon to inspect and buy anything from magazine subscriptions to kitchen brushes—"ships, shoes, sealing wax, cabbages and kings"! There is no reason why radio servicing should be eliminated from this economic picture.

Canvassing, however, requires certain temperamental qualifications on the part of the salesman—which may not always be found in the service man, who is already an expert in one line. The canvasser must be definitely imbued with a superiority complex. He *cannot be a timid soul.* He must not be discouraged by rebuff—which he may expect with lamentable consistency. The "Welcome" on the door-mat does not always apply to house-to-house sales folk. He's got to be able to "take it." Of course if a door slam in the face leaves one with a feeling of mingled humiliation and despair, recourse can always be made to a professional and tough-hided canvasser.

Walter J. Robertson, of Long Beach, California, is fortunately versatile. He is an efficient and experienced serviceman, and at the same time a canvasser par excellence. The following bears witness to his success: "This contribution is directed primarily to the attention of those servicemen who feel that there is no longer any money in radio servicing. If conditions in this town are any criterion of conditions existing elsewhere, then this article can perhaps be of some benefit to fellow servicemen.

"The city of Long Beach is probably more over-run with radio servicemen than any other city of its size in the country. With a population of around 150,000 we have over two hundred servicemen. Not all of them are operating out of retail stores or shops. A good many of them are independent, home servicemen. I am one of the latter. I arrived in this town about a month before the big earthquake. Business was pretty dull that first month and it seemed to me that every other person in town was in some way connected with radio sales and service. After the quake, the service game was pretty good. Scores of sets were knocked over, tubes were broken, and the sets generally shaken up. For a while, therefore, all of the boys reaped a little of the coin of the realm. However, that lasted for only about a month and then business resumed its former condition of deadness.

"Since business would not come to me, except to the tune of about one set a week, I decided to go out after it. Now much has been written pro and con regarding canvassing for radio service, but you can put me down as being 100% in favor of the idea. It has worked admirably for me and I am convinced that it will work for the rest of the boys.

"I had five thousand of my business cards (Figure 1) printed; and then set myself to the job of going out after business.

ROBERTSON'S RADIO SERVICE
2266 LOCUST AVENUE,
LONG BEACH, CALIF.

1. Free Inspection
2. No Labor Charge over $1.00
3. Work and Parts Guaranteed 6 months
4. Your Credit is Good

Telephone
439-30

W. J. ROBERTSON

FIGURE 1

I went from door to door, always asking the question, 'How's your radio working?' A lot of business men will probably say that this was no way to go about drumming-up business. Be that as it may, the idea WORKED. If the set was playing satisfactorily, I pointed out the advantages of doing business with me and asked the set owner to drop my card in the radio cabinet. However, if the set was ailing, I immediately went to work to convince the prospective customer that I was the man for the job. My records show that I have secured over 85% of these ailing sets and undoubtedly others will come from time to time. If one hasn't actually convassed his town, he can't realize just what a great proportion of the sets need attention. If you would find out, just grab a handful of your business cards one of these days and push a few door bells.

"A goodly amount of my business has probably been due to our unusual policy. As shown on the card, it consists of four major points. In the first place, I do not feel it right in these days and times to charge a service call. The question has two sides and the side I've selected *has a 100% customer support*. After all, that is important. As a general rule, after one is actually in the customer's house, he gets the job of servicing the set; so why 'sock' them a dollar merely for coming over? My second point is that I never charge more than a dollar for labor. The secret of this is speedy work due to efficient equipment. Some jobs are probably worth more than a dollar in labor; others undoubtedly are worth less. I believe that one dollar strikes a fair medium. Of course, full list price is charged for tubes and parts. My third point is an unconditional six-months guarantee on tubes, parts and labor. I handle a tube that has a manufacturer's guarantee of six months and that disposes of that responsibility very effectively. The use of the best parts, together with conscientious workmanship disposes of the rest of the guarantee problem. Try a liberal guarantee, fellows, and see how your customers will take to it!

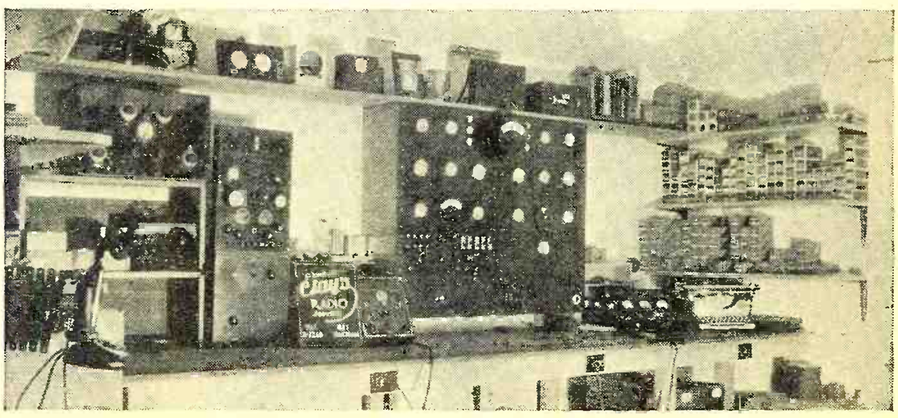
"Finally, I grant credit to practically anybody. Most servicemen will throw up their hands in horror. Why? Because they have charged exorbitant prices in many cases and folks feel reluctant to pay the high charges. But a fair price will enable practically any set owner to pay the bill. If a customer asks for credit, I grant him up to six months to pay the bill. Over forty percent of my work has been done on credit and practically all of it is paid within a month. I have yet to lose a single bill as a result of credit. The average man is honest and if the serviceman will trust him, that confidence will not be violated.

"When I am not servicing sets, I am out passing my cards from house to house. The average of a day's canvass is three sets and several 'red-hot' prospects. I believe it's worth the effort."

Another Service Sales Idea

Isidore Saltzman, of the Globe Radio Service, Jamaica, N. Y., contributes an excellent sales stunt borrowed from the photo finishing racket. Mr. Saltzman supplies local merchants—stationery stores, hardware stores, garages, etc.—with a display poster, stating that they take care of service work, as shown in Figure 2. This card measures eight by fourteen inches. It is in two colors—blue letters against black—printed on heavy cardboard, and is suitable for window display. All work secured is turned over to the Globe Radio

FIGURE 3



Service, and a commission of fifteen percent allowed the agent. These cards can be obtained from Leo Jacoby, 112-22 Sutphen Boulevard, Jamaica, N. Y., fifty for $2.50.

The Intermittent Reception Problem

Our SOS in the November *Service Bench* for field data on servicing receivers which operate intermittently has been fruitful. We select for present publication the fol-

FIGURE 2

lowing contributions: "Your appeal in the November issue is certainly a distress call from the serviceman! I suppose there are none of us who has been lucky enough to escape the problem of intermittent reception. As we all know, there have been numerous devices and methods suggested for the location of condensers and resistors causing operation of this character. Some of these are meritorious, such as the use of an r.f. oscillator and the high-resistance vacuum-tube voltmeter. Other systems, such as the 600-volt break-down test, are of dubious value. It is impossible to lay down consistent laws of procedure for so indefinite an ailment. One can only indicate a general method which may be suggestive in individual instances. The following points apply in every case: (1) Taking one's brains out of cold storage; (2) Obtain the circuit of the set in hand; (3) Tell the customer not to expect his set too soon; (4) Use a good analyzer.

"Much regarding the trouble can often be determined by listening closely to the speaker when the set cuts out. If a good number of stations can be heard including distant ones, but all very weak, the chances are that the difficulty lies between the last r.f. tube and the speaker. If, on the contrary, only local stations can be heard, with fair quality, a safe bet places the trouble in the r.f. section. Extremely erratic operation—the set cutting in and out by merely touching various parts, or the chassis, with a screwdriver—is symptomatic of a defective condenser in some grid circuit, or in the a.v.c., where currents are small. A defective coupling condenser may often be suspected. At this point, a glance at the circuit diagram will help localize the trouble. If further investigation is necessary, the following procedure is always effective: The set in question was a Majestic superheterodyne, without automatic volume control, and having eight or nine tubes, as I recall. This receiver would play okay for about one-half to three-quarters of an hour, then suddenly drop way down in volume. Any slight disturbance would bring it back to normal. Allowing the set to operate with an analyzer in the preselector stage and the tubes in the analyzer, it was discovered that the screen voltage dropped with the volume. A careful check of the screen circuits disclosed nothing more serious than a slightly unstable resistor. This was replaced without effecting a cure. It happens in this set that part of the oscillator plate resistor circuit and the screen-grid resistor circuit are common. It only remained therefore to suspect some degree of short in the oscillator circuit. It was found that the oscillator plate voltage also dropped with the signal and the trouble

(*Continued on page* 510)

WITH THE EXPERIMENTERS

S. GORDON TAYLOR

Suggestions for Operation and Maintenance of Carbon Microphones

Carbon microphones, because of their high output level and economy, have a wide field of application in all types of sound work. However, due to the inherent nature of the carbon device, care in handling and operation, as well as periodic overhauling, are essential factors in securing high quality reproduction at all times.

RADIO NEWS readers will be interested in the following suggestions, offered by the Shure Brothers Company, manufacturers of microphones, for obtaining maximum service and quality of reproduction.

1. Always turn down the current control before disconnecting the microphone. This minimizes inductive surges which are destructive to the carbon granules.
2. Never move the microphone with the current turned on.
3. Do not exceed the recommended button-current rating. While limits vary with different manufacturers, it is always true that low current results in maximum granule life.
4. Protect the microphone from mechanical shocks. If the granules become packed, tap the frame gently with a rubber-tipped pencil. Never use force.
5. Have the microphone completely overhauled by a reputable microphone manufacturer at least once every year.

If these rules are carefully observed, a carbon microphone may be expected to give many years of highly satisfactory service.

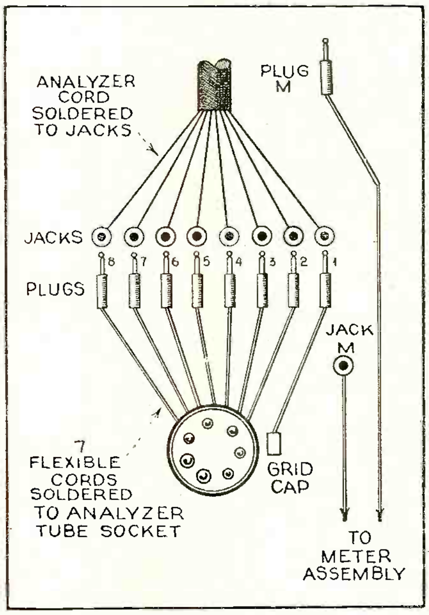
Location of Hum Sources

The experimenter as well as the serviceman and radio dealer will be interested in the following information disseminated by RCA-Radiotron Co., Inc., for tracking down sources of hum in standard radio receivers.

The first step in the elimination of hum is naturally the location of its source. By shorting first the input and then the output of each stage successively, hum originating in any one stage can be isolated. If hum persists after the input to the last audio stage has been shorted, the source of trouble probably lies in the power-supply system. To determine if hum is due to ripple voltage in the speaker field, short the output transformer or the speaker voice-coil and note the results. Any hum which continues is due to ripple voltages in the speaker field

Convenient Plug-In Meter Arrangement

Here is a simple and effective method employing inexpensive plugs and pup jacks for connecting a testing meter assembly in any one of the circuits of a tube under test. Normally the plugs are inserted in their respective jacks one to eight, as shown in the diagram. To connect the meter in series with any desired circuit, simply remove the plug from its normal jack and insert it in jack M. The connecting plug M from the meter is then placed into the vacant jack. I have a separate voltage source with plug-in arrangement for testing tubes. Using this method any tube can be tested by interchanging the pup plugs.



AUGUSTIN MAYER,
Akron, Ohio.

Experimenters—Extra!!!

The answer to the experimenters' devout prayer seems to have been found in the new line of General Radio "unit-panel" equipment. Modern multi-tube radio circuits do not lend themselves to breadboard layouts because comprehensive shielding is imperative. As a result the experimenter, unless equipped with the proper tools and mechanical equipment, has found his activities very much curtailed by the expense of experimental panel, shield and chassis components. The new line of unit parts overcomes this complication nicely by providing all required parts cut and drilled in such a manner as to be interchangeable and to allow one experimental set-up after another to be made, using the same chassis, panel, case, etc. Or these assemblies may be used for permanent set-ups, either rack or table mounting.

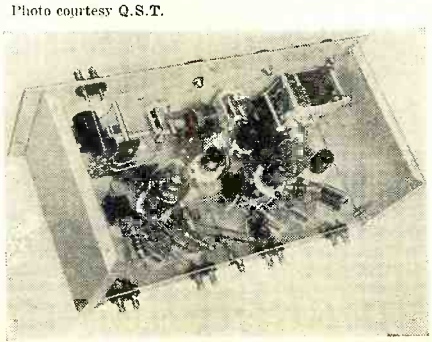
This line of parts consists of three different types of front panels and two types of base, end and dust cover assembly units. The photograph of the rack and panel assembly shows all types. The other photograph shows an interior view of an experimental set-up using one of the assemblies. A variety of large and small holes are provided on the panels, such as to take care of practically all requirements for equipment mounting. Any not used in a particular set-up are simply plugged with plates or snap buttons available for the purpose. These plates are also useful for mounting condensers, shielded plug-in coils, variable resistors, etc.

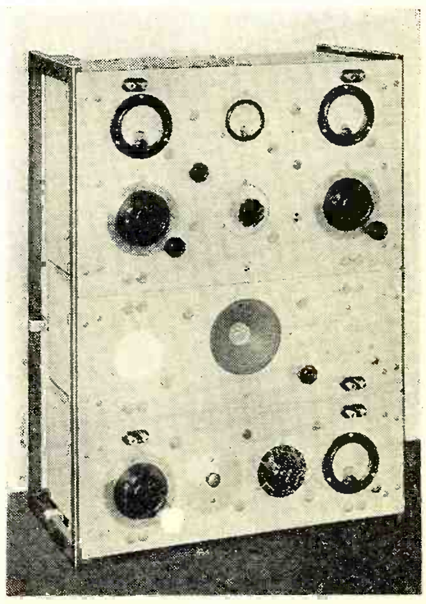
Baseplates are so designed as to permit their mounting at various elevations where the "chassis" or "deck" type construction is desired, or they may be attached directly to the bottom flanges of the end plates. Thus these units allow wide leeway in the variety of chassis and shielding designs possible.

The available accessories include a variety of disc plates for mounting in the large panel holes, ready drilled for the mounting of various types of parts and controls; snap buttons for plugging unused small holes on the panel; vernier dials, dial indicators, shielded and unshielded coil forms to be plugged through the panel; plugs, jacks, etc.

Space does not permit a more detailed description of this new line of equipment here but arrangements have been made by RADIO NEWS to provide copies of General Radio Bulletins Nos. 934 and 935, without charge, to readers who are interested. These bulletins provide 20 pages of detailed descriptive matter and prices of the assembly units and accessories. To obtain copies address your request to The Experimenters' Department, RADIO NEWS, 222 West 39th Street, New York City.

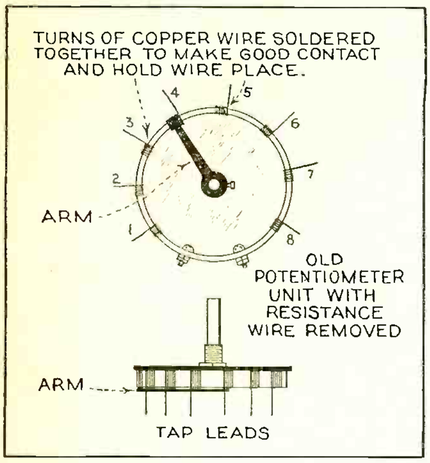
Photo courtesy Q.S.T.





Home-Made Tap Switch

Here is a tap switch that can be built by anyone. Any number of taps can be put on. The drawing is self-explanatory.



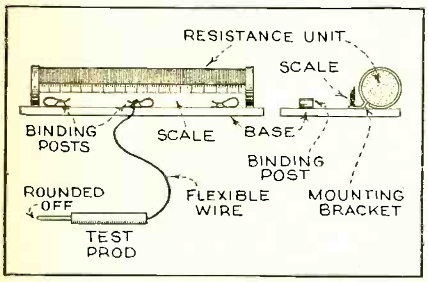
I used a Pacent 20-ohm potentiometer as the foundation of one I built for a multi-range volt-ammeter, and it sure does the trick.

J. S. NAPORA,
Uniontown, Pa.

Resistor Indicator

Resistor indicators which enable a serviceman to find the value of an uncoded or unmarked resistor that has given up the ghost are extremely useful.

Take a 100,000-ohm voltage divider resistance of the Electrad Truvolt type, which has the wire exposed. Mount it on a small bakelite or other insulating panel, together with three binding posts, as shown in the drawing. The two end binding posts go to the end terminals of the resistance unit and the center binding post goes to a short length of flexible wire which is connected to an ordinary test prod with the end filed or ground so that it forms a rounded point that will not cut the wire in the unit. In front of the resistance provide a third piece of bakelite to hold the scale, which is drawn on bristol board and fastened to the support. Divide the distance between the two end terminals of the resistance unit into ten equal parts on the scale. Each division will then represent 10,000 ohms. Further subdivide each



division into ten smaller divisions, each of which indicates 1,000 ohms.

In use, one end terminal and the test prod are connected in the circuit in place of the defective resistor and with the test prod at the 100,000-ohm mark on the scale the results are noted. Then gradually move the prod so that it cuts out resistance until the best results are obtained from the set or the readings on the set analyzer show that the resistance is correct. Then by noting the scale, the correct value of replacement resistor can be found.

If one of the new style Truvolt resistance units with a fiber guard is used, the scale can be drawn directly on the guard.

C. G. GROVER,
Nephi, Utah.

RADIO PHYSICS COURSE

ALFRED A. GHIRARDI*

Lesson 26
Transformers

THERE are three main forms of transformer core construction used, some being more efficient but more expensive to manufacture than others. The *open-core* type is shown at (B) of Figure 1. This is inexpensive to build, since the primary and secondary coils are wound on spools by machine, and are simply slipped over a rectangular steel core. Not much steel is used in this type, the magnetic field completing its path mainly through the surrounding air. Needless to say this type is not efficient and is used very little.

The type shown at (A) of Figure 1 is known as the *closed core* type because its core encompasses a certain area and forms a closed magnetic field. The portions of the core in which the primary and secondary are wound are referred to as the "core legs." The primary and secondary coils are usually wound with enameled or cotton-covered wire of adequate size to safely carry the currents the transformer is designed for—without too much rise in temperature. It is common practice in the design of transformer windings to allow from 1000 to 1500 circular mils of wire cross-section area per ampere of current.

In high-voltage transformers, each layer of the winding is usually insulated from the next by a paper insulation so that the voltage effective between layers will not be able to break down the insulation on the wire, and the coils are insulated from the core to prevent short circuits. Best design of this type of transformer results when the entire core forms approximately a square. Then the length of the magnetic path is a minimum. Under these conditions, the distance between the primary and secondary coils should be kept as small as possible consistent with adequate insulation and cooling facilities; that is, the outside dimensions of the core are kept small. This core construction is not used as much as the shell type to be described later, because it is impossible to entirely eliminate magnetic leakage in it, and the cross-section area of the core must be made quite large if much power is to be handled, in order to keep the flux density down below the saturation value for the core.

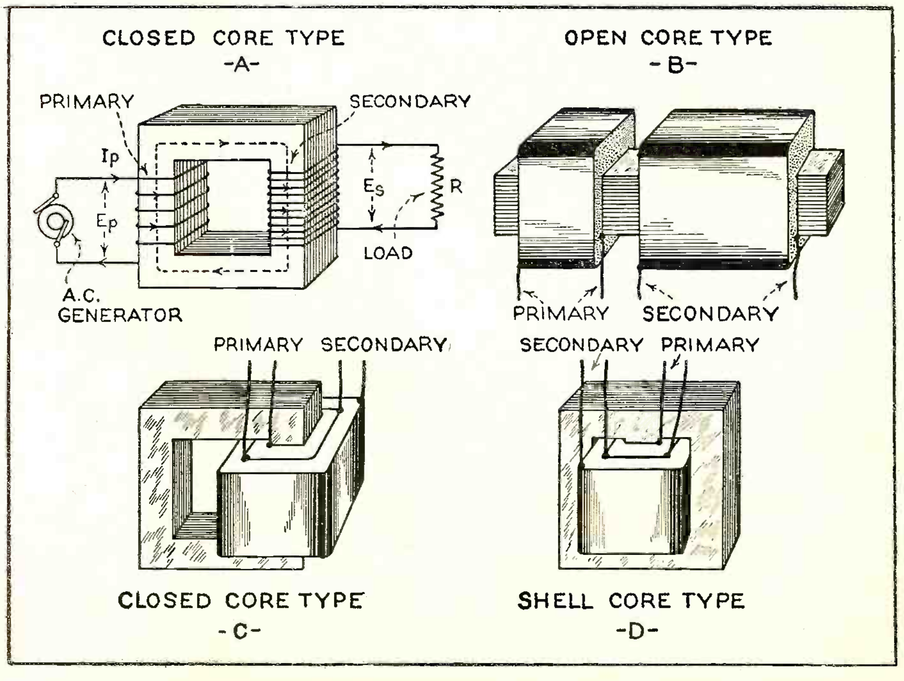
At (C) another form of core-type transformer is shown. This has both the primary and the secondary winding wound one over the other on a single leg of the core, to reduce magnetic leakage. This form of core is used more for inductor or choke coils in the filter systems of radio receiver power packs than it is used for transformers. It is also used extensively for audio transformers.

At (D) the shell-type transformer is shown. This has a completely closed core with a center leg and two outside legs. This forms two outside parallel paths for the magnetic lines of force. This construction provides very low magnetic leakage since the primary and secondary coils are wound directly over each other on the center core leg, or are sometimes wound with the winding interleaved. Also, since the total flux divides into two equal paths, each outside leg need only have half of the cross-section area required for the center leg, for the same flux density. This type of transformer is the most common one used for audio transformers and power transformers in radio, and for the large power transformers used in electrical power work.

The student may wonder why transformers should be used to *transfer* electrical energy from one circuit to another in this fashion. Why not simply leave out the coils and complete the circuit without them? If we desired to use the current in its original form, the transformer would be quite unnecessary (except in the case where it is used as an "impedance matching device"). It is when the *voltage* of a

* Radio Technical Pub. Co. Publishers, Radio Physics Course.

Figure 1—Various Types of Transformer Core and Winding Arrangements. The Shell Type is used most on account of its lower Magnetic Leakage



circuit is to be either *raised* or *lowered* that the transformers are used. Whether the transformer raises or lowers the voltage supplied to its primary depends entirely upon the ratio of the number of turns in the secondary to the number of turns in the primary winding.

Referring to (A) of Figure 1, it is evident that since the coils and magnetic circuit are all stationary with respect to one another, the e.m.f. is induced in the secondary by the change in *magnitude* and direction of flux with time, caused by the flow of alternating current through the primary winding. A transformer will also operate of course if a *pulsating* or changing direct current is sent through its primary. In this case an alternating e.m.f. is induced in the secondary, for when the primary current is increasing in value the e.m.f. is induced in one direction in the secondary. When the primary current decreases in value the e.m.f. is induced in the secondary in the opposite direction.

An alternator supplies current to the primary winding P having Np turns. The voltage is induced in the secondary having Ns turns. We will assume that there is no leakage of lines of force between the primary and secondary coils. As the primary winding is linked with the iron core, its magnetomotive force produces an alternating flux Φ in the core, which links with the secondary S, inducing e.m.f. Es of the same frequency as its own. Because of this induced e.m.f., the secondary winding S is capable of delivering current and energy, the energy being transferred from P to S by the mutual magnetic flux Φ. We will assume first for our purpose, that the secondary terminals are left open so no current is flowing in the secondary winding. The mutual flux Φ in passing through the magnetic circuit formed by the iron core, links not only the turns of the secondary winding S, but also the turns of the primary winding P. Therefore an e.m.f. is really induced in both the windings S and P. That in P is really a back or counter-e.m.f. of *self-induction* always opposite in direction to the applied e.m.f. If the transformer had no iron losses and no resistance losses in the copper primary winding (100 percent efficiency), this counter-e.m.f. of self-induction would equal the applied line e.m.f., and when once the magnetic field was set up, no further current would flow in the primary. Of course this condition is impossible, since energy is used up in sending current through the resistance of the primary winding, and electrical energy must also be taken from the line to make up for the losses in the magnetic material. Consequently, in a practical transformer when the secondary is on open circuit, a small current called the *no-load magnetizing current* is taken from the line by the primary. In efficient transformers this current is very small.

As this flux Φ is the same for each of the two windings, it must induce the *same e.m.f. per turn* in each winding. Since the e.m.f. per turn of the primary winding is $\frac{Ep}{Np}$ and the e.m.f. per turn of the secondary is $\frac{Es}{Ns}$, we must have the relation that:

$$\frac{Ep}{Np} = \frac{Es}{Ns} \text{ or } \frac{Ep}{Es} = \frac{Np}{Ns} \text{ or}$$

$$Es = Ep \times \frac{Ns}{Np}$$

In other words, the *induced* secondary voltage is proportional to the ratio of the number of secondary turns to the number of primary turns.

By using the proper number of turns, voltages either greater or less than the primary voltage may be obtained at the secondary terminals. The above relation is not absolutely true for a practical transformer delivering current from its secondary winding, for under these conditions there is some leakage, flux, etc., but for our purpose we may neglect this.

Short Waves

(*Continued from page 475*)

telephones in Buenos Aires, Madrid, Cairo and London can be received consistently all over the U. S. A.—there is little pleasure to be derived from eavesdropping on these conversations between 30 and 10 meters (10 and 30 megacycles). The average fan who tunes down here will probably check up an entertainment value of about 10 per cent.

It is obvious from the above, that no *single* short-wave telephone service—police, airplane, amateur, broadcast or commercial—equals long-wave broadcasting in entertainment value for the average fan. This is a truthful, impartial analysis, which can be taken at its face value.

However, if we add up the entertainment values computed for the individual services we find that the total entertainment value exceeds the 100 percent perfect mark for long-wave broadcasting. In other words, *many of us will actually derive more pleasure from the operation of a short-wave receiver than in twisting the dial on a conventional set!*

Aside from the all-important question as to the type and quality of short-wave fare, the broadcast fan is often dubious as to his ability to operate a short-wave receiver. Will a new technique have to be acquired? Are receivers and operation radically different, or more complicated, than those with which we are familiar? It is true that a few years back the efficient short-wave receiver presented an alarming array of controls, and considerable practice was required before attaining proficiency in operation. However, the same circumstances held for broadcast receivers in a similar stage of development.

It may be truthfully stated that with the design of modern control mechanisms and precision-ganged circuits, the short-wave receiver of today is practically as easy to operate as a broadcast set, and requires no new technique that cannot be assimilated in the first half hour of operation.

The remaining problem of how to receive short waves will be accorded detailed consideration in the articles that follow in this series. There are four ways by which high-frequency (short-wave) signals can be received: (1) by means of an adapter; (2) by means of a converter; (3) by means of a short-wave receiver; and (4) by means of an all-wave receiver. Assuming that the reader already possesses a high-grade broadcast set, we shall concentrate on the first three methods of reception. Next month we shall provide a complete constructional description of a simple, single-tube adapter that will make it possible for you to use your broadcast receiver on short waves. The adapter obtains all of its power from the broadcast set, utilizes part of its circuit, and the programs are heard on your regular loudspeaker. The broadcast receiver is in no way altered, and the combination is instantly ready for either long-wave or short-wave reception. *This adapter will be so simple that you can make it yourself—or your local serviceman can build it for you at a nominal cost. James Millen,* The National Company.

WHAT'S NEW IN RADIO

WILLIAM C. DORF

Pocket Radio

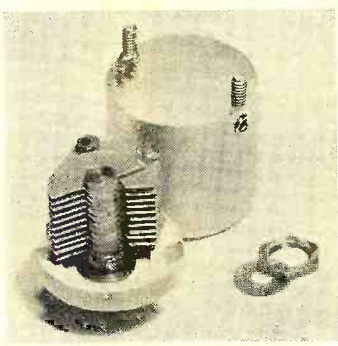
Description—The new International Kadette Junior a.c.-d.c. two-tube receiver measures only 2 inches thick by 4½ inches wide and is small enough to fit an overcoat pocket. It weighs only two pounds and the two tubes utilized are the 6F7 and the 12A7. The first tube functions as a radio-frequency

amplifier, detector and first audio amplifier. The second tube, 12A7, acts as an output pentode and at the same time rectifies the a.c. current. The circuit is a tuned radio-frequency hook-up employing reflexing.

Maker—International Radio Corp., Ann Arbor, Mich.

Air-Dielectric Padding Condenser

Description—The National Company recently announced a new shielded air-dielectric padding condenser with a maximum capacity of 100 mfd. and occupying a mounting space of only 1¼ inches diameter by 1¼ inches high. The condenser is



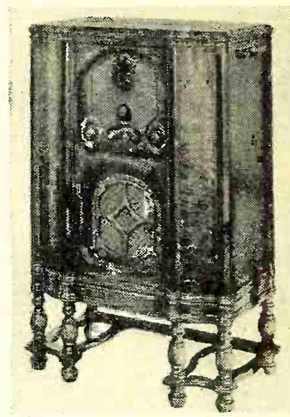
mounted on an Isolantite base and is designed to give complete freedom from capacity change with variations in temperature or humidity, or due to vibration. The plates are made from non-resonant aluminum material.

Maker—National Company, Inc., Malden, Mass.

All-Wave and Standard Broadcast Receivers

Description—The first illustration covers the new General Electric model K80, table type, eight-tube all-wave superheterodyne receiver which has a wavelength range from 16.7 to 555 meters. The set features full-size dynamic speaker, twin-push amplification, a variable tone control, automatic volume control and a new airplane type, four-band, illuminated dial. The following type tubes are utilized: three –58's, one 2A7, one 2B7, one –56, one –53 and one –80 type rectifier. The receiver and speaker are enclosed in an attractive Queen Anne style cabinet. The second photograph illustrates the model K107, a console superheterodyne receiver, with dual automatic

volume control, color tone control, color-radio noise silencer, visual tuning control and a new high-power dynamic speaker. The set covers the police and aircraft bands in addition to the regular broadcast wavelengths. The full line of General Electric sets includes short-wave, all-wave and

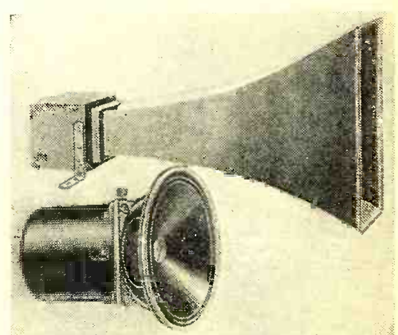


standard broadcast receivers in attractively designed midget and console cabinets.

Maker—General Electric Co., Bridgeport, Conn.

New Dynamic Unit and Exponential Horn for Sound Trucks

Description—The new Acratone 6-volt dynamic type reproducer combines the best features of the horn and cone type speaker



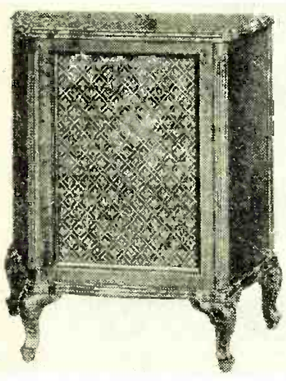
and is especially adapted to mobile sound systems. The speaker comprises a cone type driver unit, model 735, and an exponential horn, model 736, both of new design. The speaker unit is similar in appearance to large dynamic unit but makes use of a cone only 6 inches in diameter and an exceptionally large field. The cone is made of a special strong fibrous pulp material. The horn is a special type of sound projector for this dynamic unit. It measures 3½ feet long by 28½ inches square at the mouth. The speaker voice coil winding has an impedance of 15 ohms and is designed for continuous power of 15 watts and a peak power of 30 watts.

Maker—Federated Purchaser, Inc., 23 Park Place, New York City.

Remote Control Receiver

Description—The new line of Stromberg-Carlson receivers features the "Te-lek-tor-et" model 55, an eight-tube superheterodyne, remote-controlled set. The portable selector case, shown in the first illustration,

measures only 7⅝ inches wide by 6¾ inches deep by 6⅛ inches high and is connected to the amplifier-reproducer cabinet by a single ribbon cord. This speaker cabinet measures 27¾ inches high by 25½ inches wide by 11½ inches deep. The pre-selection tuning mechanism makes possible the accurate tuning of any pre-selected group of eight favorite stations. This list of eight stations can be changed at will. From this pre-selector case the operator can turn the receiver on or off, control volume or tune



for any station not set up on the pre-selector mechanism. The tubes employed are as follows: one 6A7, two 2A5's, one 2B7, one 5Z3, one -55, one -58 and one -78. The circuit features silent tuning between stations, automatic volume control and a thermostatic oscillator control. The new line is complete with striking-looking "Te-lek-tor" console models, radio phonograph combinations and a new six-tube automobile set.

Maker—Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.

Radio in the Canary Islands

Lisbon, Portugal.—The inhabitants of the Cape Verde Islands at present have no mode of communication with the mother country, during the winter months. The Portuguese government has, therefore, decided to install a radio transmitter on each of the twelve islands.

Rectifiers

(*Continued from page* 461)

tube is only 7500 volts, the tube giving, at this voltage, 0.6 amperes, while the voltages necessary for X-ray technique, dust precipitation, etc., are anywhere from 20,000 volts, upward, often as much as 100,000 volts.

At such tremendous pressures tubes whose constructions are physically sound at 400 volts, naturally have to be redesigned completely. Many factors that can be practically neglected in the commercial manufacture of rectifier tubes for our broadcast receivers are of the utmost importance when we enter the order of kilovolts.

Electrostatic deformation of the filament, changes in the emission, space charge[2] ionization of gas rests under this heavy bombardment of electrons sped up to a velocity of 100 kilovolts and more, are only a few of the problems that that must be solved before any practical application of such tubes can take place.

While the idea of using electron-tube rectifiers for high voltages was tried out many years ago, it was abandoned at that time because of the short life of the tubes. It is now a practical thing brought about by the development of new and better tubes. In some cases the tubes have lasted for more than 4,000 hours.

Figure 3 shows such rectifying equipment as manufactured by Westinghouse. It consists of a transformer and other electrical equipment which are of an unusual nature, because high-voltage vacuum tubes are used for rectification. Single-phase, full-wave rectification is employed, requiring four tubes which are mounted on the transformer. These tubes are two-element, high-vacuum tubes of sturdy construction, having heavy tungsten filaments. The glass cylinders surrounding the tubes protect them against hazard due to X-ray emanations, which tests have shown will accompany (although in a very slight degree) any high-voltage electronic rectification.

Figure 4 shows the wiring diagram for an outfit of this type.

The equipment is capable of delivering, from a 25-cycle source, a rectified output of 400 milliamperes average value, at a maximum r.m.s. potential on the transformer, of 100,000 volts. By means of an induction regulator this voltage can be reduced to 47,000 volts, so that a wide range of unidirectional output voltage is thus obtained. The filament transformers required are mounted in the same tank as the main transformer, and their secondaries are connected directly to the tubes mounted on the transformer cover. A small steel control panel, with contactors controlling the plate and filament circuits and other protective relays, complete the equipment.

Decided advantages are obtained by the use of this thermionic equipment over other earlier methods used for obtaining the unidirectional voltage required. The operation is extremely quiet and positive, the polarity is fixed and unvarying, the current is self-regulating, the equipment offers practically no radio interference, and a smooth and regular wave form can be obtained.

When connected to a suitably designed precipitating device (tube or plate type precipitators) the equipment described above could be used for any of the applications mentioned at the beginning of this article by reason of its wide range in voltage. In general, however, such equipments are designed with voltage output for the particular application, since the voltage used depends on the design of the precipitator and this in turn upon the gas-dust mixture.

As the emission of the filament increases with more than the fourth power of the absolute temperature at which it is used, and thus decreases its total lifetime very considerably, a regulating device to keep the filament voltage constant is of the utmost importance for reaching a long life of the filament and thus of the tube itself.

A static regulating device provides *practically constant voltage* on the filament of the tubes in this construction.

Figure 5 shows a rectifier tube of this character.

As the negative electrons are attracted by the positive plate at relatively low voltages, a *higher overall efficiency* of this type of tube can be maintained than with the use of mechanical rectifiers as far as current utilization is concerned. In addition, no "spark generators" are used and mechanically rotating equipment is completely eliminated.

In Figure 6 another interesting development is shown that reduces the size and increases the safety of this equipment. This other unit, made by the Waite and Bartlett X-Ray Manufacturing Company, Inc., is an *oil immersed* high-voltage tube unit, designed for precipitation work. It has a capacity of 50 K.V. at 75 m.a. for continuous duty.

In still other systems the high voltage is built up in several steps, as shown in Figure 7—a so-called cascade arrangement. In this way it is possible to avoid building up dangerous potentials between the transformer windings, which, after all, should not be spaced too far apart for obvious reasons. Instead of transforming the current immediately to the highest voltage, an intermediate potential is first produced. From this a second or third transformer is actuated which finally delivers the maximum available voltage without danger to the original current source. The type shown is that of the Victor X-ray Corp. and it utilizes Kentron tubes to produce a potential of 300,000 volts d.c.

Another interesting improvement has been introduced recently into high-voltage rectifier technique by the application of Thyratron tubes. These tubes operate with considerable current at relatively lower voltages, however, and use Mercury vapor. A third electrode is introduced, similar to the grid of a radio tube, which facilitates the control of the current flow. Figure 8 shows such a General Electric Thyratron rectifier as used for cable testing. Under these conditions, the rectifier is capable of delivering 5 to 10 amperes at from 2,500 to 5,000 volts.

If higher potentials are desired, straight high-vacuum equipment is necessary, such as that shown in Figure 9, which is capable of delivering 250,000 volts with 250 m.a.

With such equipment now made available by the advanced electronic rectifier technique, a number of important industrial applications have come to light. To mention a few, we have: The cleaning of flue gases from smelters yields valuable returns, cement dust is collected in large quantities from the flues of cement kilns; tar is removed from natural gas and water gas, the flue gases from central stations using pulverized fuel are "washed," and blast furnace gases in steel mills may be purified, so that they may be used for power purposes.

[1] Speight and Rydberg. Electrical Equipment for Precipitation Service. A. I. E. E., Cleveland, Ohio, June, 1932.

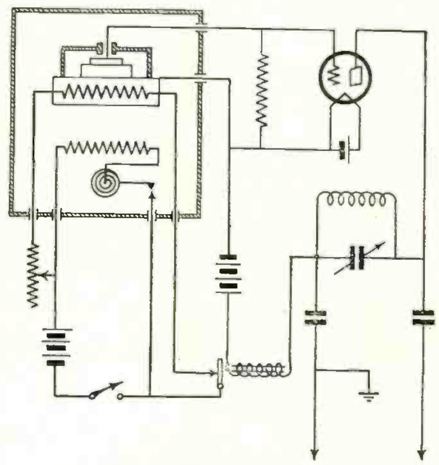
[2] Effect of Space Charge and Residual Gases on Thermionic Currents in High Vacuum. Dr. Irving Langmuir, Physical Review, Vol. 2, p. 450, December, 1913.

LATEST RADIO PATENTS

BEN J. CHROMY*

1,894,687. PIEZO-ELECTRIC CRYSTAL TEMPERATURE CONTROL. LAWRENCE A. HYLAND, Washington, D. C., assignor to Eclipse Aviation Corporation, East Orange, N. J., a Corporation of New Jersey. Filed Dec. 8, 1930. Serial No. 500,838. 18 Claims. (Granted under the act of Mar. 3, 1883, as amended Apr. 30, 1928; 370 O. G. 757.)

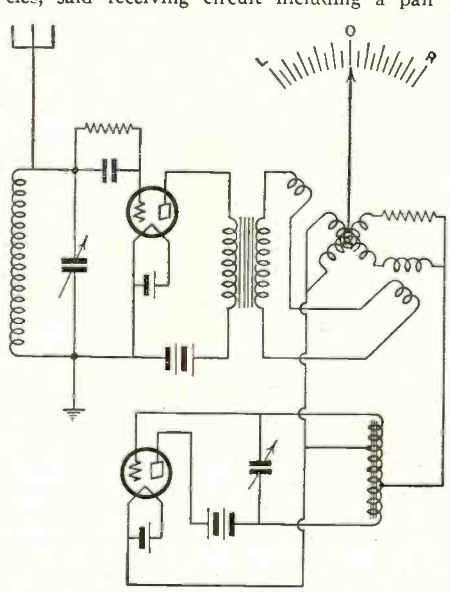
1. In a temperature-regulating system for frequency control or stabilizing devices,



means for mounting a frequency control or stabilizing device, and means for supplying heat to said device when the latter is not operating, in the same amount as the heat generated thereby when it is operating.

1,884,707. BEACON SYSTEM, LAWRENCE A. HYLAND, Washington, D. C., assignor to Wired Radio, Inc., New York, N. Y., a Corporation of Delaware. Filed Dec. 30, 1929. Serial No. 417,520. 10 Claims.

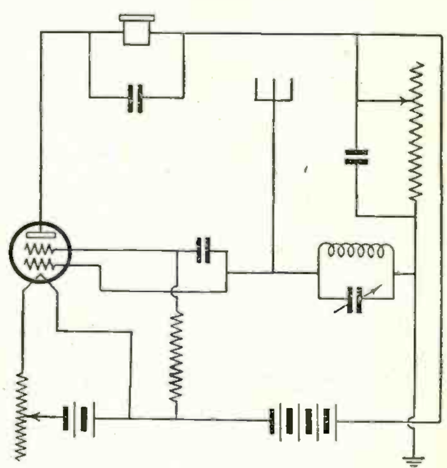
1. In a beacon system for aircraft navigation, a receiving circuit responsive to audio-frequency modulations of selected frequencies, said receiving circuit including a pair



of diametrically disposed energizing windings each subjected to the incoming signal modulations, an indicating scale, an indicator movable from a central position on said scale toward either end thereof, a pair of movable coils connected to said indicator and positioned between said energizing windings, and a local oscillator connected to said movable coils for establishing an electromagnetic field for normally maintaining said indicator in a central position on indicating scale and operating differentially with respect to the field established by said windings for correspondingly controlling the movement of said indicator toward either end of said indicating scale.

1,886,990. RECEIVING SYSTEM. BALTHASAR VAN DER POL, Eindhoven, the Netherlands, assignor to N. V. Philips' Gloeilampenfabrieken, Eindhoven, the Netherlands. Filed Jan. 15, 1925, Serial No. 2,512, and in the Netherlands Feb. 29, 1924. 16 Claims.

4. In combination in a circuit including a space discharge tube provided with a cathode, anode, grid and auxiliary electrode, means for maintaining the electrode positive with respect to the cathode whereby a negative resistance characteristic is imparted to the output circuit of the tube, a source of modulated high-frequency energy coupled to the grid, an oscillatory circuit connected to the auxiliary electrode and resonant to said high frequency and an impedance connected to said oscillatory circuit of such a magni-



tude that the total resistance of said output circuit is substantially zero both for said high frequency and the modulation frequency.

1,898,477. FADING ELIMINATION. OTTO BÖHM, Berlin, Germany, assignor to Telefunken Gesellschaft für Drahtlose Telephie m. b. H., Berlin, Germany, a Corporation of Germany. Filed Dec. 16, 1929, Serial No. 414,277, and in Germany Dec. 17, 1928. 1 Claim.

In a transmission system for eliminating fading of electromagnetic waves, in combination, a master oscillation generator, a variable condenser for changing the frequency of said oscillation generator, and motor driving means connected to said condenser, an amplifier associated with said oscillation generator for amplifying the currents generated thereby, an antenna connected to the output of said amplifier, a signal modulating element connected to said amplifier for modulating the energy received by said amplifier from said oscillation generator, a rotary commutator having unequal insulating length segments around its periphery, additional motor driving means for said commutator, connections from said commutator to said amplifier including a source of direct current potential, said commutator being ar-

* Patent Attorney, Washington, D. C.

ranged to bias said amplifier through said connections so as to interrupt the transmitted output energy to said antenna, said interruptions being of unequal time duration in accordance with the length of said unequal insulating segments on said rotary commutator.

Remote-Control Transmissions

(*Continued from page* 459)

was constructed permitting of two audibly modulated frequencies, 600 cycles for keying and 1500 for control. A super-regenerative receiver separates these frequencies by its filter network into the prearranged channels conveying the keying circuit directly to the keying relay of the transmitter while directing the control signals to a connector switch which in response to the coded signal, closes or opens the desired transmitter power circuits. The schematic pictorial sketch in Figure 2 illustrates in general the network by means of which all four transmitters are operated and keyed, without the necessity for manual assistance.

The operation is parallel to that of an ordinary dial-operated telephone system except that the connecting link between the dialing operator and the central switching mechanism is accomplished by a 55-megacycle carrier wave instead of a cable or other metallic conductor.

In Figure 3 is shown the control turret upon the face of which a dial is mounted. The operator first starts the short-wave transmitter shown in Figure 4, then throws the dial switch and dials the prearranged coded number for the connections to be set up. The release of the dial after the number has been dialed opens the transmitter circuit the same number of times as the number dialed. This permits the line finder of the connector switch located at C to rise to the indicated bank level when the first number of the series of two has been dialed. The second dialing directs its movement to the desired line in that level, hence by the step-by-step method the appropriate connection has been made. In this way the power of the transmitter may be turned "on" and then by keying on the 600-cycle modulated frequency the set-keying relay at C may be made to follow that of the operator at A (see Figure 2). The four transmitters, namely, a De Forest 2 kw. long-wave; a 200-watt short-wave, type 127; a 300-watt long-wave and a crystal-controlled 500-watt short-wave amateur set, are operated from the control dial in accordance with a prearranged decimal code, as follows:

Dial Codes for Remote Control Operation

22	Start	2 k.w.
43	Stop	2 k.w.
23	Start	200 watt
44	Stop	200 watt
24	Start	127 set
45	Stop	127 set
25	Start	Amateur
46	Stop	Amateur
26	Start	2 k.w. and 200 watt sets
47	Stop	2 k.w. and 200 watt sets
27	Start	2 k.w. (mcw.)
48	Stop	2 k.w. (mcw.)
28	Start	Amateur (mcw.)
49	Stop	Amateur (mcw.)

The connector switch and associated circuits are shown in schematic sketch in Figure 5.

In order to prevent reflections from the tall buildings found on lower Manhattan Island, a directional Bruce type or curtain array antenna was used for the control transmissions (see Figure 6). The sharpness of the beam was not the paramount consideration, as only a reasonably low elevation was provided for the antennas

(*Continued on page* 501)

Technical Review

(*Continued from page 487*)

ing, talking pictures, television, public-address systems and commercial station operation on land and sea, for men who are trained to fill the many jobs created by the radio and allied industries. Contains information on the home-study courses in radio and allied subjects offered by the National Radio Institute. Available only to the RADIO NEWS readers who are over 16 years of age and who are residents of the United States or Canada.

9. *Catalog of Fixed, Metallized and Precision Resistors.* Specifications of the International Resistance Co. 1934 line of metallized, wire-wound and precision wire-wound resistors, motor-radio suppressors, handy servicemen's kits, valuable technical data and list of free bulletins on the building of servicemen's test equipment.

16. *R.M.A. Standard Resistor Color-Code Chart.* A postcard-size color-code chart designed by the Lynch Mfg. Co. to simplify the job of identifying the resistance values of resistors used in most of the standard receivers. Contains a list of the most commonly used values of resistors with their corresponding color designations. A catalog of products is included.

18. *Volume Controls, Fixed Resistors, Motor-Radio Spark Suppressors and Power Rheostats.* Descriptions, specifications and prices of the line of Centralab standard, special and replacement volume controls for receivers, amplifiers, public-address systems and talkie installations, fixed resistors, motor-radio spark suppressors, wire-wound rheostats and potentiometers.

25. *Noise-Reducing Antenna Systems.* Describes the two types of noise-reducing systems perfected by the Lynch Mfg. Co. for both broadcast and short-wave reception.

34. *Serviceman's Replacement Volume Control Guide.* A revised list, in alphabetical order, of all old and new receivers showing model number, value of control in ohms and a recommended Electrad control for replacement purposes. Contains specifications and volume control circuits for over 2000 different receiver models.

41. *How to Build the "Economy Eight."* A folder prepared by Wholesale Radio Service Co. giving constructional information, diagrams, list of parts, etc., of an efficient 8-tube receiver which can be built from a kit which sells for $13.75.

42. *How to Build Useful Servicing and Testing Instruments with Simple, Standard Meters.* This bulletin gives data showing how any meter—preferably a low-range milliammeter—can be used to measure amperes, volts and ohms over any desired range through the use of proper shunt and series resistors. The bulletin was prepared by the Lynch Mfg. Co.

43. *How to Modernize Old Set Analyzers.* Describes in detail the new set analyzer remanufacture plan perfected by the Supreme Instruments Corp. for the conversion of obsolete set analyzers into efficient, up-to-date testing equipment at low cost.

44. *How to Add a Remote Control and Station Selector Unit to Any Receiver.* A folder published by Wholesale Radio Service which shows how any single-tuning-control receiver can be converted into a remote-control and station-selector set at a total cost of only $12.50.

52. *The Servicer.* A monthly house organ published by the International Resistance Co. It contains information designed to help the serviceman do better work and make more money doing it.

53. *Practical Training for Radio Servicemen.* This book, prepared by the Radio Training Association of America, gives an outline of their course of instruction for radio servicemen—a course that is endorsed and recommended by more than thirty leading radio manufacturers and trade associations.

56. *Servicing and Testing Instruments.* Description of a new line of Supreme low-priced analyzers, set testers, tube testers, ohmmeters, capacity testers, oscillators and universal meters. Complete information is also given on the new Supreme model 55 tube tester and the new Supreme master diagnometer which employs the "free reference point system of analysis."

57. *How to Build a High-Quality Condenser or Ribbon Microphone.* Describes the Superior microphone kit and instruction sheets with which it is possible to build, quickly and easily, a high-quality condenser or ribbon microphone.

59. *The I.R.C. Volt-Ohmmeter.* Characteristics and uses of the International Resistance Co. volt-ohmmeter, a combination voltmeter and ohmmeter specially designed for the point-to-point method of trouble-shooting. The instrument contains the automatic vacuum relay feaure which gives protection against burn-outs.

60. *Audio and Power Transformers and Choke Coils for Use in Public-Address Amplifiers and Radio Receivers.* Information on the characteristics of a wide variety of AmerTran de luxe and Silcor (popular priced line) audio and power transformers and chokes.

61. *Replacement Parts for Dealers and Servicemen.* A book, prepared by Whole-

February, 1934
RADIO NEWS Free Technical Booklet Service
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New York, N. Y.

Gentlemen: Please send me, without charge, the booklets or folders I have filled in below:

Numbers..........................
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My occupation or connection in radio is checked off below.

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  - ☐ Dealer
  - ☐ Servicing Organization
- ☐ Dealer
- ☐ Jobber
- ☐ Radio Engineer
- ☐ Experimenter
- ☐ Laboratory Technician
- ☐ Professional or Amateur Set Builder
- ☐ Licensed Amateur
- ☐ Station Operator
- ☐ Public Address Work
- ☐ ....

I am a ☐ subscriber ☐ newsstand reader.

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

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sale Radio Service Co., listing manufacturer's name and model number of current model and old type receivers, with the recommended replacement power transformers, condenser blocks, volume controls, voltage dividers and audio transformers required for such sets. This catalog is a list-price catalog which servicemen can show their customers when quoting prices for replacement parts.

PLEASE NOTE: To avoid disappointment, please make your selection of booklets from the latest issue of RADIO NEWS since our supply of booklets not listed in the current issue is exhausted. The list and coupon contained in this (February) issue should not be used after February 28th, 1934.

Remote-Control Transmissions

(*Continued from page* 499)

and since the intervening channel was that most commonly used by most of the shipping entering the Port of New York, too sharp a beam experienced "breaks," causing false signals, hence a broader path was provided than ordinarily would have been anticipated, which simplified the antenna construction considerably, as it eliminated the need for more than four verticals in the array.

A wavelength change switch was not needed, as each of the transmitters worked upon but one set wavelength, but in the construction of any similar system where only one transmitter is desired and could be constructed to cover all wavelengths in the band on which it was desired to operate, such a switch, with its auxiliary motor, would be a necessity.

No visual or other indicating devices were installed to show the operator at A that the automatic devices had performed their work in response to his coded signal, for the reason that such an addition would only complicate the installation and was not considered necessary, as this operator could monitor his own transmissions which would at once demonstrate that the automatic devices had performed their work in response to the signal dialed.

Because the system in many respects was somewhat unique, temporary installations were first made and remained from December to April before permanent construction was undertaken, and now remains, so far as is known, the first radio transmitting station to be regularly remotely controlled, automatically, by ultra-high-frequency radio transmissions.

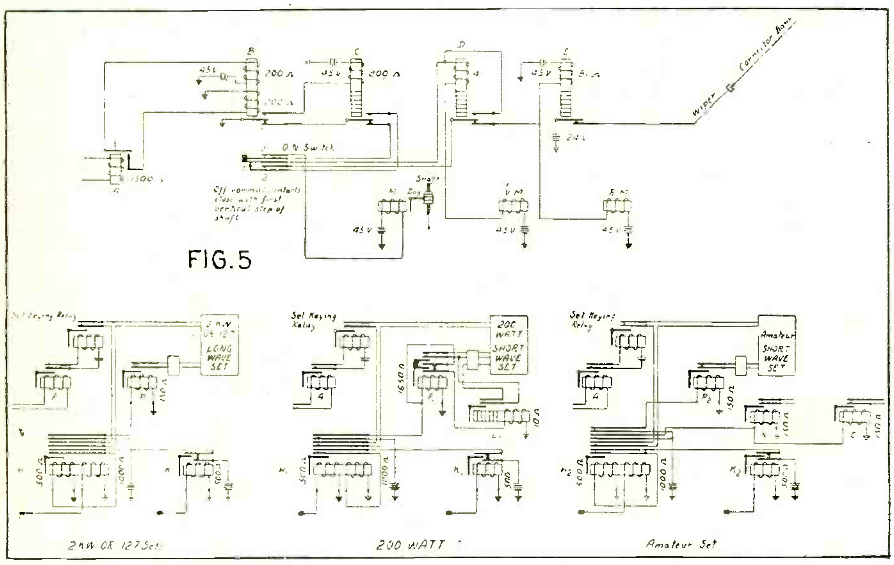


FIG. 5

Service Sidelines

(*Continued from page* 467)

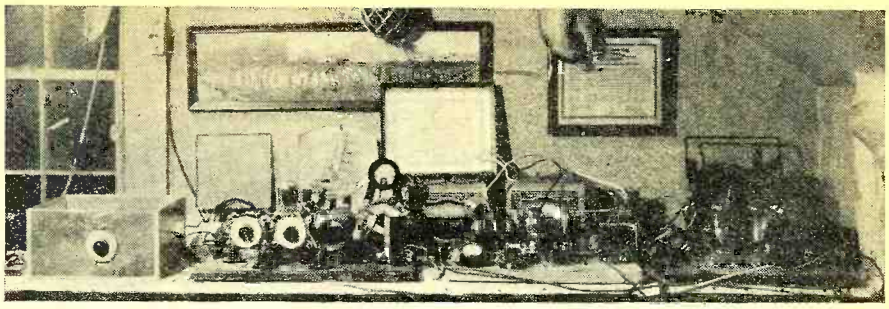
tan is generally associated with health, vitality and vigor. The mode of life in our civilized world has, of course, lessened the opportunities for exposure to the sun and consequently, to the health-giving rays. It is plain to see therefore, that an artificial source of ultra violet for the home is highly desirable in the interest of health maintenance and beauty culture.

The search for an ideal artificial source has been carried on persistently for many years and in many countries. An artificial source, to be ideal must measure up to requirements which until recently had seemed impossible to attain. The difficulties can be well appreciated when one considers the fundamental requirements:

1. It must be safe.
2. It must be easy to operate.
3. It must produce an adequate range of vital ultra violet.
4. This range must be constant and unvarying.
5. It must be low in original cost.
6. It must be economical in operation.

All these considerations had to be met before ultra violet could find its way into the great mass of American homes as a desirable and welcome electrical appliance. Fortunately, scientists have devised lamps which measure up to the ideal and thereby have opened a pathway to the serviceman, seeking additional income with a minimum of effort. An interesting illustration of this modern development is the new home equipment illustrated here. Produced by the National Vita Lite Corporation, this equipment operates from any 110 volt a.c. line, provides two degrees of radiation, known as "slow tanning" and "fast tanning," is light in weight, compact in size, and relatively inexpensive.

Has science again produced a device which will some day be considered universally as a necessity in every home and which today, while steadily growing in popularity can bring the serviceman profit with relatively little added effort on his part?



QRD? QRD? QRD?

CONDUCTED BY GY

ALMOST as bad as the cobwebs which absorbed the moisture and short-circuited the clacker arm on the telegraph circuit is the one that Morry Barton reports while on duty at WCSC. "During transmission there was a queer screechy whistling which I located as coming from the high voltage generators. I immediately thought it was a few bearings going haywire and was about to take the transmitter off the air when out of one of the openings of the generator jumped one of those singing crickets." Even if it weren't true, it wouldn't be bad, eh.

ONE of the ops recently returned from a trip in which he had the harrowing experience of almost getting knocked out of his bunk by his ship crashing into a large fishing smack during a heavy fog. Between the skipper and the First Mate writing up the messages, an impression was handed out that they weren't interested in locating the ship they struck or the survivors, if any. It was all straightened out after they had picked up a dory load of eleven of them who were sighted a distance of almost three miles from where the crash took place. What ho for the life of an op.

YE Ed went a-hoppin' to the World's Fair at Chi and came away with the same impression that Marconi had when he left. That it always rains on his holidays. But outside of that the Fair is a huge success from the standpoint of showing the tremendous progress that has been made in science since 1833. By past performance the next 100 years should be complete with color, radio, television, remote control of everything, and any wild ideas that may be simmering in the average op's brain. Every exhibit was complete with practical demonstrations and explanations which every layman could easily understand.

Radio Corporation of America had an exhibit of its huge Worldwide network and receivers and Xmtrs of latest types. Included in their exhibit was some of the old apparatus which was used by Marconi in his first experiments. These included the transmitting oscillator with the parabolic reflector which he used in 1895 at Bologna, Italy (and that isn't boloney), the revolving-disc, spark discharger, the receiving-coherer resonator, etc. B. F. Borsody, who is now operating engineer at New York, was there to explain television to the folks and explain it he did. Right from the photo on the plate through the transmitter to the air brush on the receiver end he had the passersby nodding their heads in understanding of his clear, explicit explanations. What a man! The American Airways exhibit was well displayed, with a complete installation of a ground station including apparatus of receivers and Xmtrs for plane work.

At the RCA exhibit Brother Cherne, who took his uniform out of the moth bags to act as major domo for the company, is operating at WGO and voicing the usual complaint of interference from ops who still think the air is a practicing school for bug artists. He sez that XDA and DFI blot out every one else on the 63-meter band for a full hour, with about an ordinary twenty minutes of traffic by continual repeats. They control this band usually around 2130 CST when he has plenty on hand. Whadyusay fellows, give the boys a break and use a sidewinder. It's lots more fun, y'know.

STATION W2XAF Schenectady will be the short-wave medium to be used for the Saturday night broadcasts to the Antarctica Expedition headed by Admiral Byrd. The first program was due over the air on 31.48 meters, November 11th, from 2300 to 2400 EST. Relatives and friends of those with the expedition were permitted to use this station to send any word to them. The CBS chain sent one of its engineers with the expedition to put on the air a complete broadcast from the expedition's base Little America via Buenos Aires. The Xmtr used at the base is a 1000-watt transmitter, using a directional antenna towards Buenos Aires, which re-broadcast it to the main studios in New York via short waves. By this method it is hoped to eliminate the fading, which was experienced on Admiral Byrd's last expedition, which usually existed between 0900 and 1630 EST.

ALTHOUGH the FRC has just granted permission to the Lorraine Tel and Tel Company to use a frequency for their installation of phone Xmtrs on Lake boats, Jimmie Spychalski and Freddy Alles, both on the S. S. "City of Cleveland," aren't worried. Freddy sez they'll still need an op to keep them in repairs and to show the skipper what buttons to push in-and-out. Yousah, me lads, and if these installations come up to expectations there will be many more of the boats equipped with this same apparatus. The type they will use has not come out for publication as yet but it is expected that they will use the regular GE type now employed on planes which have proven very efficient.

THE ARTA, due to its partly successful fight against the code wages which were presented to the NRA Board by the Airways, Broadcast and Marine companies, is now enthusiastically showing a roster which has almost tripled in membership since its fresh start under the guidance of Mr. Hoyt Haddock, its president. He believes that for the first time in the history of the profession in this country, a place in the Sun will be provided for them just as there now exists for operators in foreign countries. By statistical comparison with these foreign operators, the American op has barely existed and his working conditions have been such that almost fifty per cent of the profession have left this field to better themselves in other industries. It is to be hoped that new and better conditions will prevail for the future benefit of a morally and materially equipped American operator.

OPERATING on a frequency of 8.6 meters with about 25 watts power, the Bayonne, N. J., Police Department is now fully equipped to curb crimes in a big way with their new two-way communication installations. Not only is a car able to communicate with Headquarters, but it can also converse with another car which may be at the other end of the city. The ease with which this system operates was recently demonstrated, proving that with but 4½-watts power output for the cars, they are enabled to hear each other distinctly, without any interference from steel buildings or bridges or overhead lines. Other cities' police departments are falling right into line, which includes our good friend, Harry Chetham, who sends in a photo (Heading) of Somerville's first police radio, has been experimenting with this means of making his department more efficient for the past few years. The Fire department in his city also uses radio, especially for the purpose of communicating from inside burning buildings to outside departmental chiefs. He states that he is about ready to install two-way communication systems in his outfits and concludes with the remark that his station WPEH has the largest number of trained radiomen on its staff of any other city. That's sumpin', what.

WE hear that—Jimmie MacInnis and Jack Teggins have been appointed as permanent ops at WEAF. . . . Johnny Jeffords, W2WS, has just been awarded his EE degree and expects to show what an old op can do. Go to it, OM. . . . W. E. Gott, who got his ticket whilst overseas and still has it framed, is now the big RR man from up Milwaukee way and happy that Mr. Cockaday publishes RADIO NEWS. "Just keepin' up with the times," sez he. . . . Ben C. Fidler was stationed at the Airways exhibit at the Fair and he sez he saw plenty of the fair at the Fair. And how. . . . M. H. Griffith is now at the Fed. Airway Station at Donner Summit, Norden, Calif., and sez that 34 feet of snow has been recorded there. And some folks think that all of Calif. is Los Angeles. Enyho, we wish him luck and hope he doesn't get sunstroke from that height. . . .

We also understand that Herman Barrett is now on the Nantucket Lightship where he is traveling up and down and sometimes sideways. Just another reason for being dizzy. . . . J. Larsen, who just completed a course with Capitol Engineering School, has been promoted to Divisional Chief op by the Transcontinental and Western Air. That's something in this burning of the midnight oil and we don't mean banana oil. . . . So step on the button, OM, and let us hear some more from ye all. . . . 73 . . . ge . . . GY.

A Modern Tube Checker

(*Continued from page* 468)

We are interested in reading mutual conductance in terms of change in plate current for a given grid shift. When the tube is placed in the socket it heats up and draws a definite plate current, but we are not interested in the value of this current, as it has no direct bearing on the worth of the tube. The meter, which is connected directly in the plate circuit, is designed with a small knob on the front of the case to control the movement of the pointer by rotation of the instrument springs. Thus, the pointer is set to a given scale division, by rotating this knob, after the tube is heated up and is drawing plate current. In this manner all tubes of the same type are tested from the same initial scale division on the meter regardless of the plate current being drawn by the tube. The test button must then be pressed, shifting the grid potential a definite amount. If the change in plate current is normal for the tube under test, the instrument pointer will swing over the green section of the scale marked "Good Tube." The mutual conductance of the tube under test is indicated directly on the instrument which classes the tube as either good or bad depending upon whether the mutual is above or below the dividing line.

To ascertain whether or not all voltages in the tester are correct, a "Line Check" position is printed on the scale and a push-button is provided for connecting the instrument as an a.c. voltmeter. This is accomplished by inserting a copper-oxide rectifier into the meter circuit and connecting it across one of the transformer windings. A rheostat is provided in the line circuit to establish a means for adjusting the transformer voltages to their required values.

A test for cathode-to-heater leakage is provided and may be performed while the tube is heating up preparatory to testing. The push-button merely segregates the grid and cathode electrodes from the combined heater and plate-return circuit. If any current flows in the plate circuit while the push-button is depressed, it must flow through the cathode insulation to the heater and will, therefore, be indicated on the tester instrument. The importance of this test has become marked due to the increasing number of automatic volume control and superheterodyne high-impedance circuits between the cathode and ground.

The complete elimination of any tube numbers appearing on the device is a very strong point against obsolescence. The sockets are lettered "A" through "R" and the two selector switches have their positions numbered "1" to "11." A neat card holder finished in the same color as the tester supports the instruction card carrying all tube numbers, sockets and switch positions. When new tubes appear on the market there are 459 possible combinations, not including spare sockets, one of which ought to fit. All that is needed then is a new card, which can be quickly slipped into the holder and the tester brought up to date!

The model 674 tube checker shown in the picture is finished in fawn lacquer with trimmings in brown damascene. The sockets and switch handles are moulded of fawn bakelite. The complete tester has a snap to it that lends atmosphere to any dealer's counter.

Kicking Up DX!!!

(*Continued from page* 483)

hard to obtain and for that reason an inexpensive three-gang condenser is employed in this unit. When all three condensers are in the circuit, the total capacity is somewhat in excess of 1000 mmfd. but provision is made, by means of the switch SW2, for cutting out two of these sections.

The switches SW1 and SW4 are refinements inasmuch as they permit two antennas and up to three receivers to be used and interconnected in any combination desired simply by throwing switches. Many DX fans have two antennas and two or three receivers which they use interchangeably and the switching arrangement provided in the Tenatuner will permit all of these to be permanently connected, and switching from one to another accomplished instantaneously.

A study of the circuit, Figure 1, shows that when the main switch SW3 is set on point 1, the antenna is connected directly to the receiver. When set on point 2 the tuning condenser is connected in series with the antenna. When set on points 3 to 7 the amount of inductance required for any frequency is cut into the circuit and, with the tuning condenser, constitutes the antenna tuning circuit.

Shielding of the entire unit is of course important. Otherwise the inductance L would provide undesirable direct pick-up. Ordinarily it will not be necessary to ground this shield and in fact higher gain will usually be obtained if the unit is left ungrounded. The gang condenser must be insulated from the shield—this is desirable whether or not the shield is to be grounded and is of course imperative where it is desired to ground the shield.

Practically all of the parts employed are standard, many of which the constructor will have on hand. The only exception to this is the coil which was especially designed and made for the Tenatuner. For those who may desire to construct this coil, it consists of 150 turns of No. 24 double silk covered wire on a Bakelite tube, 3 inches in diameter and 4½ inches in length. The coil is tapped at the 5th, 20th, 50th, 100th, and 150th turns.

The operation of the unit is so simple as to make detailed explanation unnecessary. Only one important point to bear in mind is to use the least inductance possible to reach resonance at any given frequency. This means that insofar as possible SW2 should be closed to place the three condensers in parallel and the coil tap selected which will permit keeping as much of this condenser capacity in the circuit as possible. The desirability of this is borne out in the tests described above. At 600 kilocycles with SW3 set at tap 6, the gain ratio obtained was 7.25. Setting SW3 on tap 7, and retuning the condenser to resonance, provided a gain ratio of only 5.3. Thus by using more of the inductance than was necessary approximately 1/3 of the gain was sacrificed.

List of Parts

C1, C2, C3—Trutest 3-gang condenser, 365 mmfd. each section, ¼-inch shaft.

L—Trutest special "Tenatuner" coil (see text for winding data).

SW1—Toggle switch, s.p.d.t.

SW2—Toggle switch, s.p.s.t.

SW3—Yaxley rotary tap switch, 7 point.

SW4—Yaxley rotary tap switch, 3 point.

1—Aluminum box shield 9 inches long, 5 inches wide, 6 inches high.

1—Bakelite dial, 2½ inches diameter.

6—Eby binding posts with insulating washers.

Hook-up wire, screws, nuts, hardware.

Outdoor Movies

(*Continued from page* 479)

the loudspeaker input of the amplifier.

Engineers' calculations revealed that the power output or size of equipment varied directly with the sound area to be covered. The design of the dynamic cone driver in the directional baffle type loudspeaker makes possible an exceptionally large power-handling capacity and the consequent minimum number of loudspeakers. The sound-heads are said to be remarkably free from distortion.

Camden's Driv-in Theatre was invented by its manager, Richard M. Hollingshead. He has plans to build several similar outdoor talkie theatres in other parts of the United States.

Crystal Filters

(*Continued from page* 477)

inductively coupled to it is placed a split winding, L3—L4, of the crystal circuit. The crystal filter output is then coupled to the secondary, of the transformer through a condenser, C4, and coupling coil, L5. The crystal circuit therefore provides the sole coupling between the detector and the first i.f. tube.

Inasmuch as the impedance of the crystal is relatively low at resonance the input transformer consisting of L1 and L3 constitute an impedance matching transformer, as do also the winding L5 and L2 of the output transformer.

The crystal holder, which consists of 2 metal plates, has a certain amount of capacity that, while small, would nevertheless by-pass a certain amount of the signal around the crystal and reduce the effectiveness of the filter. The coil L4 and the tiny variable air condenser C3 are employed to neutralize this capacity. This is accomplished by making the coils L3 and L4 exactly balanced so that the voltages induced in the two coils (from L1) will be equal but 180 degrees out of phase. When the condenser C3 is adjusted to exactly equal the capacity of the crystal holder the by-passing effect is neutralized and the only signal reaching the input circuit to the i.f. tube is that which passes through the crystal.

The condenser C3 is operated from the front of the panel by means of the knob which has been referred to above as the "interference elimination control." If this condenser is set for more or less capacity than is required to neutralize the capacity of the crystal holder the selectivity is somewhat decreased. As a result this control provides a variable degree of selectivity. This, however, is not its most important function. More important is its ability to eliminate the interfering station—and in this respect it functions exactly like a highly effective wavetrap. When the desired station is tuned to exact resonance by means of the tuning controls on the receiver then C3 is slowly rotated and at a certain sharp adjustment the interfering station simply drops out of the picture. Either side of this critical point the interfering station may again appear, proving that this method of elimination is not a matter of selectivity but rather of actually tuning the undesired signal to anti-resonance—and thus blocking it out.

One of the advantages of the crystal filter circuit as worked out in this receiver is that it can be cut in or out at will by flipping a switch on the front panel. This switch is shown at SW, Figure 1. When "out" it simply short-circuits the crystal and allows the receiver to work in its normal manner. Thus stations may be tuned in the ordinary way but when one is found to suffer from interference the crystal is switched in. If this does not eliminate the offender, C3 is carefully adjusted until the interference either completely disappears or is attenuated to a point where it is no longer troublesome.

The design of the crystal filter, as applied in this receiver, shows careful thought. As shown in the close-up photograph, the entire system consists of the dual transformer in its double-deck shield, and a small composition panel on which are mounted the crystal in its holder, the condensers C3 and C4, and the switch, SW.

The practical effect of the selectivity of the crystal circuit as applied in this receiver is shown in Figure 2. Assume that there are two c.w. stations "A" and "B", operating at frequencies 2 kc. apart. If both of these are of equal intensity at the antenna, then when signal "A" is tuned in, the interfering signal of "B" will be reduced to 1/100th of the intensity of "A" and will therefore cause negligible interference. If the heterodyne beat oscillator is set to produce a 1000 cycle note, as indicated in Figure 2, both signals would be heard as 1000 cycle tones, provided the 100 times attenuation of "B" has not reduced the interference below audibility. If, however, signal "B" were 2 kc. the other side of station "A", then station "B" would still be reduced to 1/100th of "A's" intensity but the interfering note would have a 3000 cycle pitch (if still audible) which would further differentiate it from signal "A" and therefore still further reduce the interference.

Now, suppose conditions are assumed as shown in Figure 2, but that another and very powerful interfering signal occurs as at "C", Figure 3. This signal would normally be attenuated in the same manner as was signal "B" in the previous illustration, but being much more powerful, it is assumed to be causing strong interference when the receiver is tuned to signal "A." Here is where the control knob (C3) of the crystal circuit comes into play. As this knob is slowly rotated a point will be found where the interfering signal "C" disappears, or if it does not disappear entirely, it at least will be reduced to a point where it will produce only a fractional amount of its previous interference.

Interfering stations 2 kc. off resonance were selected as examples here simply because, where a 1000 cycle beat note is employed in c.w. reception such stations are the most prolific interference makers, due to the similarity in tone. This does not mean, however, that the improved selectivity resulting from the use of the crystal filter extends only to stations 2 kc. or more off resonance. As indicated by Figure 2, excellent selectivity is provided even in the case where the interfering stations is only a fraction of a kilocycle away from the desired station.

S.W. Receivers for Yachts

(*Continued from page* 457)

case is of heavy aluminum, measuring 28½ in. long, 12 in. deep and 10 in. high. An aluminum sub-panel divides the receiver inside. Coils, tubes and intermediate transformers are mounted above the shelf and all other components below the shelf. By removing the bottom, all these component parts are readily accessible.

The receiver is arranged so that the radio operator can use it alone in his room with either phones or a dynamic speaker or so that he can feed the received program over a transmission line to the Smoking Room on the top deck. From the Smoking Room the program is amplified by the yacht's broadcast receiver power amplifier and distributed to the loudspeakers located in the Dining Room, Aft Deck, Officers' Mess, Crew's Quarters, Smoking Room and Radio Operator's Room, six altogether. Each of these speakers has its own low impedence volume control enabling regulation at that point without affecting any of the others. The speaker fields are controlled by switches on the broadcast receiver.

When using the above arrangement, the complete schematic wiring diagram appears as shown in the accompanying illustration.

The regular wavelength range of the short wave set is 10 to 200 meters, covered by using six sets of coils, giving a very liberal overlap between coils and maintaining a high L/C ratio for the first detector grid circuit.

For the reception of CW signals, the intermediate amplier is coupled to a beat oscillator. A –58 tube is used in an electron-coupled circuit. The regular oscillator for the receiver is also electron-coupled, providing great stability.

In actual operation this equipment has given very satisfactory results. Aside from easily receiving European broadcasts while in the United States, on a past trip to the Mediterranean the American short-wave broadcast stations were received well. On another trip to the Pacific through the Panama Canal, outstanding results were obtained. While at Gatun Lake, the set was also tested, using the regular broadcast-band coils and the New York stations such as WJZ, WEAF, WABC, etc., were clearly received in the late afternoon, which is outstanding daylight reception. This does not mean simply being able to identify the station but to reproduce the programs clearly over the multiple loudspeaker system.

It is expected short-wave receivers of this type will become very useful to yachts, especially those that take long trips. It will enable receiving entertainment over long distances during the daytime on many occasions when it would be impossible on the regular broadcast bands.

P. A. Systems

(*Continued from page* 466)

a rise in voltage, which will upset the balance of the r.f. stages unless it is compensated for either by shunt resistors or series resistors in the power supply. Probably it will be simpler to use a series resistance of a semi-variable type and adjust until the voltage on the r.f. tubes is correct. Additional filtration will be necessary to prevent modulation hum in the r.f. stages from reaching the detector input, but this should be simple to eliminate by additional condensers across the output of the filter.

In choosing the radio receiver or receivers, it should be borne in mind that it will be rarely necessary to pick up distant stations as the noise level would be objectionable in the output. For this reason, therefore, a particularly sensitive receiver is neither necessary nor desirable. Two stages of radio frequency and detector should be entirely suitable for this work. In a small tuner, the hiss and background noise will be much less than if a very sensitive tuner is used.

In all the preceding discussion, it has been assumed that the sources of signal will be used relatively close to the amplifying equipment, that is to say, within a matter of a few hundred feet. Up to this distance, it is perfectly safe to load the terminating end of the line with an impedance matching the source, neglecting the capacity or inductive impedance of the line, particularly where the source is of low impedance, 500 or 600 ohms. Where the source is of high impedance, it will be necessary to step the impedance down to this value to prevent an upsetting of the relationships by the added line length. However, the source may be occasionally located at considerable distance from the amplifying equipment, in which case a line will have to be constructed or rented from the local telephone company. It is not customary to use repeater circuits in a line up to 10 miles long, so it will be necessary to measure the impedance of the line and take it into account in determining the terminal loading impedance. Figure 2 shows a simple method of determining the impedance of a line, which is indicated in the drawing as X-Y. M_1 is a voltmeter and should have a range up to about 6 volts. M_2 is a current meter such as the new rectifier type meters and should have a range of about one milliampere. P is a potentiometer of about 100 ohms shunted across a source of alternating current which might be a 6 volt secondary of a step-down transformer and used on the regular 60-cycle power lines.

The method of using such a circuit is to connect the line at X-X with its terminal Y-Y open and with the potentiometer set at zero. Advance the potentiometer until a convenient reading is obtained on M_2. The impedance of the line will be the voltage divided by the current. When this value is obtained, retard the potentiometer to zero and short-circuit the terminals Y-Y. Again the impedance should be measured by the same method. The proper loading impedance of the terminal end may then be determined by taking the geometric mean of these two values, the geometric mean being the square root of their product.

Figure 3 is a typical complete input circuit including sources and mixing circuits for a public address system. This is only carried so far as the input to the amplifier, as a later article of this series will go into amplifiers completely.

Backstage

(*Continued from page* 485)

modern music, Paul Whiteman, the NBC maestro, recently instituted an annual award for "the best American composition in modern form." To the winner, who must be an American citizen not over thirty, will be awarded annually a gold medal known as the Whiteman Medal and a scholarship to one of five important musical conservatories. The winner will also receive sufficient money for financing and sustenance for a minimum period of one year.

Crystal Super

(*Continued from page* 476)

to 2174 kc., the dial settings as spread over a semi-circular dial of 100 divisions will be somewhat near the approximate tuning scale shown in Figure 16, when using the appropriate harmonic as shown in Table II (October issue).

You will find that it is possible to tune in stations in any part of the world just as easily as local stations on a broadcast receiver.

That's all there is to it, except that you will probably be amazed at the beautiful quality, fine noiseless pickup and overall ease of tuning control, once you get the hang of it.

Of course, the set can be built to grow from left to right on a long table with the rectifiers at the back or on the floor. I designed ours to go in a panel rack so it would be uniform with other input apparatus at the rebroadcast station.

Farm Radio

(*Continued from page* 463)

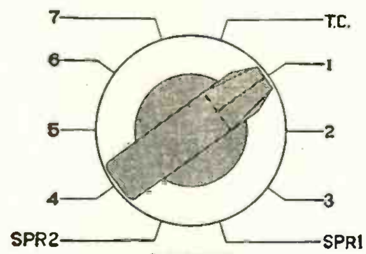
The Air-cell battery and the Air-cell tube have proved to be the means of making a practical farm receiver. Following the early practice of designating different types of battery receivers by the kind of "A" battery required, this new battery receiver is known as the Air-cell receiver. It meets all the requirements. It has the rugged dependability of the storage-battery set, without the recharging feature; it has the complete independence of the power line of the dry-battery set, without the hazards to tube and battery life inherent in dry "A" battery operation; it is as simple and as fool-proof to operate as the all-electric set, being turned "on-and-off" with a snap switch, and, like the A.C. set, without any rheostat or other form of voltage control, which, by misadjustment might cause damage; it equals, and in some respects, actually exceeds the standards of performance established by the A.C. set. It is the ideal receiver for unwired homes.

The Air-cell receiver is not new. It was introduced quietly by two or three pioneer set manufacturers in the Fall of 1930. It had to be introduced quietly because everything in it, from tubes and "A" battery to the set itself, was new and untried, and it was necessary to work the "bugs" out of it before pushing it vigorously. Most new products have bugs in them, and the Air-cell receiver was then no exception. The first tubes were not all they should have been, and the battery itself developed trouble shortly after the sets got moving. These defects were remedied by January, 1932, since which time a surprising number of Air-cell receivers has been sold to customers living all the way from Alaska, on the north, to the steaming tropics of the Central American Republics, on the south, with complete satisfaction, and no recurrence, whatever, of the early difficulties. Not only the Air-cell battery, but also everything going into the make-up of the Air-cell receiver, has thoroughly demonstrated its quality, its dependability and its complete suitability for the work it has to do.

Evidence that the Air-cell receiver has proved itself and that a new, and profitable line of activity confronts the radio industry is found in the fact that today, after the preliminary introductory phase is over, practically all the country's leading set manufacturers are making and featuring the Air-cell receiver. It is the solution to the rural radio problem! E. E. Horine, Sales Engineer, National Carbon Co., Inc.

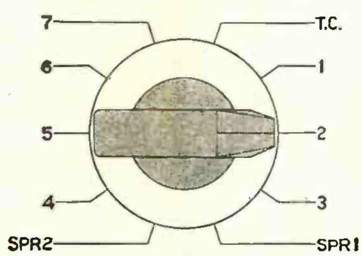
An Omission

Inadvertently the diagram of the selector switch shown below was omitted from the January ad of the Supreme Instruments Corporation, in outlining the FREE



SELECTOR 1
CURRENT

REFERENCE POINT SYSTEM OF ANALYSIS. By reading the explanation in the Supreme advertisement in January



SELECTOR 2
BIAS

RADIO NEWS *again with the diagram before you, a more complete idea* of the measurements available will be obtained.

The DX Corner

(SHORT WAVES)

(*Continued from page* 484)

tion this month: Dr. J. P. Watson, Hazlehurst, Miss.; E. M. Law, Miami, Fla.; R. I. Keeler, West Scarboro, Me.; R. H. Schiller, Hawthorne, N. J.; R. L. Weber, West McHenry, Ill.; E. J. de Lopez, La Chaux-de-Fonds, Switzerland; A. G. Taggart, Reedy Creek, Man., Can.; A. E. Berger, San Gabriel, Calif.; C. L. Bishop, Benton Harbor, Mich.; L. A. Taix, San Juan Bautista, Calif.; E. C. Lips, Pittsburgh, Pa.; B. F. Locke, Marthaville, La.; E. J. Wilson, Boston, Mass.; D. R. Barker, Boulder City, Nev.; E. L. Nicholson, Hamburg, N. Y.; C. W. Lewis, Jr., Wellesley Hills, Mass.; F. G. Hehr, Sayville, L. I.; A. Hamilton, Somerville, Mass.; R. Edkins, Transcona, Man., Can.; Roy Sanders, Worcester, Mass.; W. E. Doty, New York City; R. Wright, Brooklyn, N. Y.; C. H. Skatzes, Delaware, Ohio; R. D. Dawson, Passaic, N. J.; L. F. Barrows, Delaware, Ohio; G. W. Twomey, Minneapolis, Minn.; G. Deater, McKees Rocks, Pa.; E. G. De Haven, Los Angeles, Calif.; W. F. Buhl, Newark, N. J.; G. K. Harrison, Hobbs, N. M.; C. H. Armstrong, Atlanta, Ga.; C. W. Bourne, Council Grove, Kans.; Dr. E. Couillard, Quebec City, Can.; F. Corey, San Jose, Calif.; K. H. Moffatt, Auckland, N. Z.; W. A. McAlister, Hopkinsville, Ky.; D. E. Bame, Copaigue, L. I.; F. Helmer, Detroit, Mich.; A. M. McCormick, Johannesburg, South Africa; G. E. Dubbe, Walla Walla, Wash.; J. W. Smith, Baltimore, Md.; A. J. Conroy, Schenectady, N. Y.; F. H. Kydd, Ceballes, Cuba; J. F. Fritsch, Baltimore, Md.; Wm. Dixon, Plainfield, N. J.; W. W. Ayotte, Providence, R. I.; W. C. Couch, Asheville, N. C.; H. Evans, Chicago, Ill.; J. E. Jacobs, San Juan, P. R.; W. D. Tullis, Spokane, Wash.; E. S. Christiani, Jr., Georgetown, British Guiana; F. C. Balph, Indianapolis, Ind.; E. T. Henderson, W. Howald, E. Los Angeles, Calif.; M. Rosenberger, Elizabeth, N. J.; E. Wehmeier, Cincinnati, O.; C. T. Sheaks, Turtle Creek, Pa.; H. Adams, Jr., Baltimore, Md.

The Editors acknowledge with thanks the assistance of public-spirited readers who have thus co-operated to make these columns so successful and helpful. Let us urge our readers, one and all, to continue, in even a larger way, to send in these reports. We would be grateful if every reader who hears even a single station would send it in to us with just the data as to its wavelength, the time which it was heard, etc. Of course, we would prefer to get more information, including the Best Bets in each listener's locality, as well as definite logs of stations, their wavelengths and times of transmission. Readers will also help by stating what type of receiver they use in logging these stations.

Cathode Tubes

(*Continued from page* 465)

oscillograph is of great utility wherever simultaneous deflection along two perpendicular axes is needed; wherever the amplitude, phase or frequency relations of two voltages or currents are to be compared; wherever the wave form of voltage or current is to be observed; and wherever the relations between two quantities are to be found.

An instance of much interest is in the observation of the current-voltage characteristics of vacuum tubes. A simple circuit for obtaining the plate-voltage-plate-current characteristic is shown in Figure 6. The plate voltage is applied to the horizontal deflecting plates, and the plate current flowing through the resistor Rp causes a voltage drop that is applied to the vertical plates. Vertical deflection is proportional to plate current, horizontal deflection to plate voltage. The same condition exists on the graph of the tube characteristic. Therefore when an a.c. voltage is applied to the tube, the characteristic is automatically traced out by the spot on the screen. Photographs (c) and (d) show such characteristic curves.

The circuit of Figure 6 is not applicable to curves of current for one electrode versus voltage applied to another electrode. This problem also has been handled with much advantage by the use of a cathode-ray tube with a properly designed d.c. amplifier.

As another example of its application in engineering, the cathode-ray oscillograph is very useful in comparing frequencies, particularly in adjusting one frequency to be equal to a given frequency, or a multiple or submultiple of it.

A simple arrangement for doing this is that of Figure 7. The two frequencies are applied to the two sets of deflecting plates. A pattern called a "Lissajous figure" is obtained. If the frequencies are in integral relation the pattern is stationary. Its exact shape will depend on the phase relation, but the ratio $\frac{F_2}{F_1}$ will always be given by the number of lines cut by a line drawn vertically across the pattern, divided by the number of lines cut by a line drawn horizontally across the pattern. A Lissajous figure for a ratio of 3:1 is shown in Figure 8, for two phase relations.

For comparing the amplitude and phase

FIG. 8

of two sinusoidal voltages of the same frequency, the same circuit may be employed. An ellipse will then be seen on the screen, for example, as shown in Figure 9. This figure also shows co-ordinate axes OX and OY for purely horizontal and purely vertical deflection respectively. The length of the projection of the ellipse on the vertical axis (length aa') is twice the peak value, or 2.828 times the r.m.s. amplitude of the voltage causing vertical

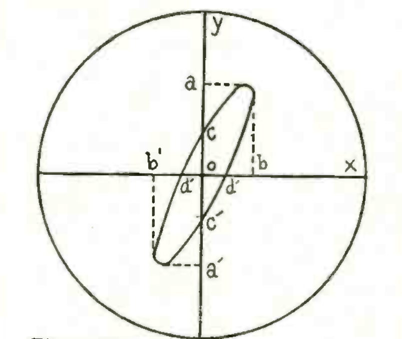


FIG. 9

deflection (using the calibration scale as a d.c. voltmeter to change units of length to units of voltage). Similarly, the r.m.s. amplitude of the voltage causing the horizontal deflection is equal to $\frac{1}{2.828}$ or .3535 times the d.c. voltage that would cause a deflection of length bb', the projection of the ellipse on the horizontal axis.

The phase angle between the two voltages can be obtained from the formula $\sin \phi = \frac{cc'}{aa'} = \frac{dd'}{bb'}$, where cc' and dd' are the points where the ellipse cuts the vertical and horizontal axis respectively. For small phase angles, the approximate formula $\sin \phi = \frac{\text{thickness}}{\text{length}}$ may be useful. For phase angles near ninety degrees accuracy is poor and it is advisable to shift the phase of one voltage by a known angle. Current can be used instead of voltage by employing magnetic deflection coils.

There are many other interesting applications. This article merely suggests a few. The final articles of this series will deal with the use of the cathode-ray tube as a transmitter and receiver for television.

Mobile Transmitter

(*Continued from page* 473)

ing sets are permanently installed in the truck. These cover short, intermediate and standard broadcast wave-lengths. The operation of these receivers provides for continuous contact with NBC New York headquarters as well as for two-way broadcasts in conjunction with the WMEF and W1OXS transmitters on board. A pack transmitter, also functioning on ultra-short waves, is always carried as standard equipment of the mobile station. On such occasions when the car itself cannot reach the spot of assignment, the pack transmitter will be strapped to the back of an announcer who can then walk about and describe the scene or event desired for the broadcast. It is also possible to send the announcer and the pack transmitter on a boat for certain marine broadcast pick-ups.

In most instances where the pack transmitter is utilized, the vehicle is used as the receiving point and relays the program to the network.

For broadcasts while in motion, Station W1OXS utilizes a tiny antenna on the roof of the car. The peculiarities of the micro-waves necessitate the selection of a nearby receiving spot, preferably at a great height, Mr. Milne said. In the New York City area, the tower of the Empire State Building will be used as a receiving point, he remarked.

When the car is stationary, the 150-watt Station WMEF broadcasts from a reel-antenna which varies in length to suit specific wavelength needs. The wire is attached to any convenient object or to a 60-foot jointed pole carried on board the wheeled transmitter.

Needed Inventions

(*Continued from page* 481)

many other enterprises in life. While the present mode is against spark gaps, against chemical resonators and "boosters," the future may find valuable technical aids in relays that need not necessarily be of the high vacuum electronic type.

It now remains for the amateur experimenter to do some pioneering. The commercial development laboratories are more interested in immediate developments that solve their present necessities. But there is no doubt that the inventions mentioned here, and many more, are necessities and would find a ready market. Who will do it and reap the rewards? Will it be you?

[1] Guglielmo Marconi: Sulla propagazione di microonde a notevole distanza. Reale Accademia D'Italia, 1933—XI, Estratto N. 16, Volume IV, p. 481.

The Service Bench

(*Continued from page* 489)

finally correctly diagnosed as a gassy oscillator tube. This would not show up on the ordinary quick tube test, but was there with bells on after a half hour's operation. (Incidentally, we used a tube tester made by Radiophone out in Oakland, California, which is one of the best we have ever seen. It employs comparative lights for each tube element rather than meters.)"

Stewart J. Robinson, Sacramento, Calif.

(*Continued next month*)

This Month's Service Shop

The service shop of Clay's Radio Ser-

INDEX TO ADVERTISERS

Read Classified Advertising—It Pays

Advertisements in this section twenty-three cents a word for each insertion. Name and address must be included at the above rate. Cash should accompany all classified advertisements unless placed by an accredited advertising agency. No advertisements for less than 10 words accepted. Objectionable or misleading advertisements not accepted. Advertisements for these columns should reach us not later than 1st of 2nd month preceding issue.
TECK PUBLICATIONS, INC.
222 West 39th St. New York, N. Y.

vice, Flint, Michigan, provides an excellent illustration of neatness and all-around efficiency. The usual equipment is at hand and arranged for quick and effective servicing. As will be observed from Figure 3, there is ample table and shelf space. The file cabinets in the lower right keep the service records straight and make them readily available.

Experts Predict

(*Continued from page 456*)

season of the year. A great deal of this activity may be attributed to the remarkable demand for automobile radio. While as yet only some hundred thousand sets have been sold, it is a rapidly growing market in which the average serviceman should be very much interested. As to the eventual channels through which automobile radio will be sold and serviced, it is difficult to predict. At the present time, automobile radio is being sold by radio dealers, by automobile dealers, and by servicemen themselves. Probably a better answer would be to say that automobile radio is being sold by those individuals and organizations who have been alert enough to realize its possibilities.

Therefore, it is our opinion that it is to the interests, not only of the serviceman himself but of the entire industry, that servicemen should play an important part in this work, and any serviceman who has not already realized this opportunity, should take advantage of it at once. **Paul S. Ellison,** Advertising Manager, Hygrade Sylvania Corp.

FROM the time of the first electrical hearing aid which was credited to Alexander Graham Bell, progress and development of these instruments had been very slow until research was begun on bone conduction and its potentialities. After many years of research, my perfection of a portable bone conduction unit has been acclaimed as the most important forward step in the science relating to hearing aids, particularly by the medical profession. With an individual transmitter affording a most faithful reproduction of natural sounds, future trends in hearing aid devices will no doubt be along the lines of a far

more extensive application of this instrument. Wired sound reception for speeches, talkies and radio, conveyed directly to the inner ear, through the Lieber Oscillator, will prove an epoch making advance in this field, affording as it does complete absence of distortion, assuring individual hearing with perfect tone quality in all frequencies. **Hugo Lieber,** Sonotone Corp.

THE electrical supply lines of our country are being called upon to feed more and more toasters, radios, refrigerators, etc. Remembering that most house lines were put in originally for lights, the increased loads have often caused heavy line drops. To compensate, the station voltages have been stepped up considerably. At night, when the radio is being used most and loads are low, the voltages climb. During the day they drop. The increased voltage variations have increased the use for real regulating voltage controls—not merely reducers. The number of electrical appliances in use will, no doubt, increase—increasing the voltage variations—and the use for a regulating voltage control. **Elliot Leeds,** President, Amperite Corporation.

Replacement Parts Catalog

Servicemen and radio dealers will be glad to know that the Grigsby-Grunow Co., manufacturer of Majestic receivers, has brought out an extremely handy 96-page replacement parts catalog. This book not only gives circuit wiring diagrams and parts numbers for every Majestic chassis ever produced, but the information is complete with illustrations, tube voltage tables and service data. Through a special arrangement these catalogs are made available to RADIO NEWS servicemen and dealer readers. The only requirement is that all requests be written on letterheads indicating that the reader is a bona fide radio serviceman or dealer. Address requests to Dept. G, RADIO NEWS, 222 West 39th St., New York City.

FEBRUARY, 1934

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- ☐ I wish to become a subscriber to RADIO NEWS, and enclose $2.50 to receive the magazine regularly for one year, and to receive this valuable technical information service free of charge.

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The NATIONAL Seven-Tube Short Wave Superheterodyne

FB.7

Incorporating many features usually found only in commercial receivers, the FB-7A anticipates the requirements of even the most advanced enthusiast. Tremendous sensitivity is taken for granted in modern short-wave receivers, but such vital features as stability, high signal-to-noise ratio, true-tracking and strictly single control tuning make the FB-7A outstanding. Send for the new National Catalogue No. 220 describing the FB-7A and other National Short Wave Receivers and Radio Products, enclosing 6c to cover mailing costs.

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