« The » "TECHNICIAN"

December, 1934

A Merry Christmas

A Happy New Year

—INDEX—

The "TECHNICIAN"

Official Publication of the Certified Radio Technicians' Association, A Corporation
An Organization of Competent, Qualified and Trustworthy Radio Technicians for the Purpose of Advancing the Radio Art and for the Protection of the Public.

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HOT CHA

EDITORIAL

By The Editor

"This Year and Next Year"

At this time of the year we are all prone to review our progress during the past year and consider activities for the coming twelve months. In view of this universal practice it is undoubtedly appropriate at this time to discuss the progress of the Radio Industry of Southern California during 1934.

In the matter of organization, many significant groups have been organized and as a result a great many worthwhile things have been accomplished, many hatchets buried and there is, generally speaking, much greater cooperation and friendly spirit among the various members of the entire trade than has been the case for a number of years.

The brilliant climax of all these activities and this spirit of cooperation was the Annual Radio Banquet, held December 6. This Banquet, planned and arranged by the Certified Radio Technicians' Association, was in the general opinion of the trade at large, a great success. The attendance was so unexpectedly large as to cause some momentary confusion, but as the main purpose of the affair was to bring all the members of the trades together, it is sincerely felt by those who were in charge that the large attendance was most desirable and really accomplished a great deal in promoting a friendly spirit, mutual acquaintance and a feeling of cooperation within the industry.

The officers and members of the CRTA, although admittedly not familiar with the details of promoting and arranging affairs of this kind, are certainly due a great vote of thanks and congratulation for their part in this event.

This great get-together really impressed the industry with the fact that it was not only desirable but possible and reasonably easy to consolidate individual efforts and take unified action toward a common goal. Many comprehensive plans for the industry have been and are being made for 1935 and an affiliation of radio associations, as previously suggested in these columns, is now practically established and will be definitely in action shortly after the first of the year.

Mr. A. Paul, Jr., President of the CRTA and most active in the promotion of greater cooperation and resultant welfare in the industry, has just made a confidential suggestion for a grand coup on behalf of the industry at large which is astounding in nature and is sure to be of vast benefit to the industry throughout Southern California. It will stimulate trade, make possible the improvement of receiving conditions and generally aid the industry in raising its standards and improving its morale. This plan will be announced in detail in the near future according to Mr. Paul. In addition to this, there are many planned activities which, if loyally supported by the leading and conscientious members of the industry, will enable us one year from today to look back upon a year of even greater progress than we are now doing.

With the sincere hope that all readers of the "Technician" will realize that their support and intelligent cooperation with others will mean great advancement and progress for all of us, both individually and collectively in the radio industry, we bid you a very merry Christmas and a most happy, successful and profitable New Year.

ELECTRICAL MEASURING INSTRUMENTS

By C. CLIFFORD ADAMS, Laboratory Superintendent
Quality Electric Company

In the year 1819, Oersted discovered that current flowing through a conductor produced an effect on a magnet. The principle of this electro and magnetic effect is used in most electrical measuring instruments.

There were many types of measuring devices built by early experimenters but only the D'Arsonval type is of interest to us at this time. If a coil of wire is suspended or pivoted so that it is free to turn between the poles of a permanent magnet and a current is passed through the coil, it will turn; this is the principle of the D'Arsonval movement.

Until about 1888, there were no reliable measuring instruments available for the electrical field. All meansurements were made with cumbersome laboratory instruments with which a great deal of calculating was necessary. Dr. Weston of the Weston Electrical Instrument Corp. was the first to realize this, and devoted a great deal of time to the development of reliable direct reading instruments and the introduction of the Weston Pivoted movable coil permanent magnet direct current instrument, revolutionized the art of Electrical Measurement.

Design

An electrical measuring instrument is in the strictest sense an electro-mechanical device. That is, it must possess clearly defined electrical characteristics and also perform certain mechanical functions.

In speaking of design, we include principle of operation, selection of materials, proportioning of parts, the development of tools, so that the composite result—the instrument—shall be the best adapted to all requirements met with in ordinary practical use. From this it can be seen that a high grade instrument is not the simple device it seems to be, but is an intricate electro-mechanical device that has been developed after exhaustive and painstaking research, and ranks high in the field of scientific achievement.

Practically all Weston Instruments employ springs for the purpose of opposing the forces acting to deflect the movable system. These springs must always function as a mechanical device, but in certain types of instruments the springs must also perform the additional service of conducting current into and away from the movable coil and thus function as an electro-mechanical device. The qualities essential to a spring performing a mechanical service are—strength and elasticity—and we super-impose suitable electrical qualities, such as proper conductivity, low temperature co-efficient and negligible Thermo-electromotive force to other conductors used in instrument construction; it will be appreciated that the problem is of exceptional difficulty. Thousands of different alloys have been compounded, analyzed and experimented with in the Weston Laboratories. An Ammeter spring must be of low resistance or high conductivity material because of the low resistance of the ammeter. The best metallic conductors, such as copper, aluminum and silver, while possessing proper characteristics of conductivity, are soft and ductile and entirely unsuited for making good springs—springs made from these materials would be permanently distorted through being put under tension, causing a set or fatigue to occur which would prevent the movable system from returning to its original zero position, thus destroying the accuracy of the instrument. Also the change of resistance of the materials is relatively large with changes of temperature. Consequently it became necessary to use some form of alloy to get a proper spring material. It was only after years of research and experimenting that an alloy was obtained that satisfactorily answered all the requirements for springs.

Simultaneously with the investigations in spring alloys, other alloys were investigated for many uses such as shunt material, resistance wire, material for pointers, damping vanes, field supports and other parts of the instruments. In certain types of instruments, such as the electrodynamometer wattmeter, it is very essential that the phase angle of the instrument is made as small as possible. This requires special design of the disposition and character of metallic parts adjacent to the movable system, so that they offer the greatest resistance possible to the generation of foucalt or eddy currents. Special alloys and position of coil supports have allowed the phase angle to be reduced to a minimum.

In the early years of electrical instrument construction, the idea that a magnet could be made permanent was derided and scoffed at. Dr. Weston has proven that it is possible to do so, provided a steel of proper characteristics is given correct heat treatment in hardening and then used to form a part of a properly designed magnetic circuit of very small air gap or reluctance.

Pointers present a very nice problem, they are usually composed of aluminum

(Continued on page 21)

TINY RESISTORS FOR HEAVY WORK

Although hardly larger than carbon resistors of low wattages, the tiny Pyrohm Junior wire-wound vitreous enamel resistors developed by Aerovox engineers are now available in 10, 15 and 20 watt ratings, and 100-30,000; 250-70,000, and 1000-100,000 ohms. The units are wound on a porcelain tube with a special high grade resistance wire, the ends of which are brazed to copper bands, while the pigtail leads are soldered to the terminal bands. The entire unit is completely coated with a vitreous porcelain enamel, thoroughly protecting the winding against moisture and mechanical injury. Proper design and conservative ratings insure adequate dissipation of heat. The units are being produced by the Aerovox Corporation, Brooklyn, N. Y

SYLVANIA 6A6 AND 83V ANNOUNCED

Sylvania 6A6 is a complete Class B output tube of the heater cathode type comprised of two triode units in a single bulb. Except for the heater rating, which is 0.8 ampere at 6.3 volts, the characteristics are the same as those for Type 53. The 6A6 may be used primarily as a Class B output tube for A-C operated receivers. Power output up to 10 watts may be obtained when the plate voltage available is 300 volts. No grid bias is required.

Sylvania 83V is a heater cathode type high vacuum rectifier designed for full-wave circuit applications. The heater requires 1.75 amperes at 5 volts. This differs from the rating for Type 83, which takes 3 amperes at 5 volts. The d-c output current (175 milliamperes) is intermediate between the ratings for Type 80 and 5Z3.

BOOK REVIEW

A regular feature which will review outstanding technical publications which the editor, the technical committee of the CRTA and the educational director of the CRTA, Mr. Edw. H. Guilford, feel justified in recommending to readers of the "Technician." Only books which have actually been examined by the editorial staff will be reviewed. A short outline of the material covered, the class of men who might be most interested in each particular publication, the publishers and price of each book will be given.

Your inquiries are invited on works not appearing in this column and a special investigation will be made.

CASE RECORDS OF BROADCAST RECEIVER REPAIRS—Captial Radio Research Laboratories, Inc., 1503 21st St., N. W., Washington, D. C.—4.75. This 9x12 flexible, leatherette binder contains 1500 alphabetically and numerically arranged records of successfully completed service jobs. Each record describes symptoms, parts responsible, electrical values, location and best replacement or repair. A very valuable book for the service technician. Pages are loose leaf, and supplements will be added from time to time.

RADIO PHYSICS COURSE A. A.—Ghirardi—Radio & Technical Publishing Company—$4.00—45 Astor Place, New York City. (Second edition revised and enlarged). This second revised and enlarged edition represents the result of an effort to include in a single book all of the material required for a complete up-to-date course in radio. It is especially recommended as a text book for service technicians and will be found to be written in an easily understandable way. It should be included in every service technician's library.

PRINCIPLES OF PUBLIC ADDRESS SYSTEMS—M. N. Beitman—Supreme Publications, 3719 West 13th Street, Chicago—50 cents. This is an up-to-date outline of the principles of public address systems and is written in an easily read manner. It includes many diagrams and tables and is recommended to the radio technician who is working with public address systems.

BROADCAST RECEIVER DESIGN—G. S. Granger—Manson Publishing Company, 521 Fifth Avenue, New York City—50 cents. This is one of three booklets covering the developemnt of the modern receiving set from its earliest stages

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HIGH-LIGHTS OF AUTOMATIC VOLUME CONTROL

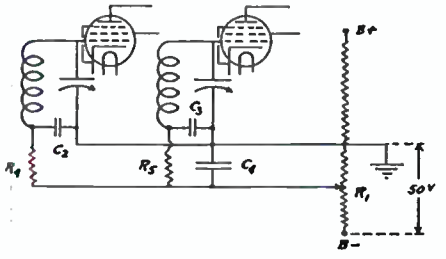
By H. K. BRADFORD
Formerly of the N.R.I. Staff. Now Technical Director Capitol Radio Research Laboratories, Inc., 1503 21st St., N. W. Washington, D. C.

Of the many methods of manual volume control developed with the progress of radio design, the variable grid bias scheme lends itself most suitable for automatic adaption. Undoubtedly the widespread use of manual bias control suggested automatic applications.

The reason why this type of volume control circuit can so easily be adapted for automatic operation is that very little electrical power is required for its actuation.

Ordinarily the grid bias type of volume control consists of a variable resistor connected from on, two or more cathodes to ground or chassis, where the grid returns and the B minus connections are made. The A.V.C. circuit is in shunt with this resistor or is across the apparatus separating the cathodes from the "absolute" negative of the power supply. Instead of being at this absolute negative terminal the grid returns are floated between the cathodes and chassis, their exact potential being determined by the factors in the A.V.C. circuit.

Fig. 1



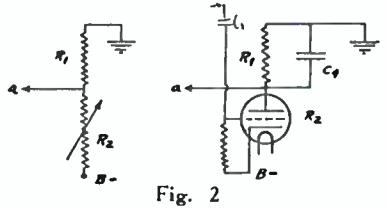


Fig. 2

The amount of amplification which can be obtained from any tube is proportional to its mutual conductance (Gm). By varying the bias from rated minimum to values beyond plate current cut-off the mutual conductance is varied from rated value to zero. No signals remain in the circuit as far as the detector when cut-off has been reached.

The total amplification of the complete signal circuit is proportional to the product of the mutual conductance values of the tubes which contribute "gain" to the receiver. Thus by controlling two tubes instead of one, the effect of limiting the gain of the entire set is squared. This becomes an important factor when it is considered that input voltages to a receiver may vary through a ratio of 100,000 to 1 or more.

Let us now inspect some actual circuits. In Fig. 1, manual control is effected by the use of a potentiometer connected between ground and B minus, between which there exists a potential difference of 50 volts. The assumption, of course, is that 50 volts will be sufficient bias to bring about complete plate current cut-off of the tube or tubes in question.

In this arrangement the resistance R-1 is constant in value and the 50 volt potential will be divided in proportion to the resistance ratio of the slider to the ground portion and the balance of the resistor.

Replacing this potentiometer with one fixed resistor and one variable one with the grid return connection at their junction as in Fig. 2 we may procure the same general result. As before the voltages across each unit are proportional to their respective values, although the total circuit current varies with the adjustment of R-2.

To obtain zero to 50 volts between ground and the tap in this case R-2 must vary from infinity to zero. This should be clear as when R-2 is infinite, no current flows through R-1 and it is at ground potential at every point. On the other hand, when R-2 is zero a direct short is established between the tap and B minus.

Although the plate circuit of a vacuum tube cannot assume the two extremes outlined above, it is an excellent substitute for R-2. Now let us follow its operation from Fig. 4. Consider a signal of average intensity being fed into the R.F. amplifier. Originally the A.V.C. grid is biassed as indicated to cut-off, that is, so that no plate current can flow in the A.V.C. plate circuit. Any carrier coming to the detector grid circuit will be fed through C-1 to the grid of the A.V.C. tube. Plate current will flow and will be almost pro-

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NEW P. A. KIT

So much interest has been shown in the Radio Supply Company's new model RS-65 portable sound amplifier kit that we are printing a description of it here. The amplifier is not just a diagram, but a tried and tested kit with the original model on display at 912 South Broadway, Los Angeles.

The fact that this amplifier kit is available in kit form only is an obvious protection and advantage to you as a dealer, for "John Public" is not interested in parts, but in the completed instrument, which only you can give.

A word as to its application. The removal of all microphone hiss, by the use of the crystal microphone, coupled with the tremendous gain built into this little thirty-pound, 6½-watt, portable amplifier kit, makes it useful for many orchestra applications. It is also suitable for dictophone use (a select group around the speaker can hear clearly and distinctly soft voices twenty-five feet or so from the microphone), or for the pick-up of music or voice in out-of-the-way rooms such as are often found in churches, schools, halls, restaurants, beer gardens, etc.

All interested parties are invited to write or call at Radio Supply Company for the four page descriptive folder and picture of the completed instrument.

LOW PRICED SHOP EQUIPMENT

The American Tool and Machine Co. has recently announced a new line of low priced quality shop equipment especially designed for radio technicians, woodworkers, and others who desire light, efficient equipment at reasonable prices. The line includes metal and wood working lathes, saber saw, sander, buffer, circular saw, and drill press.

RCA VICTOR MEETING

The RCA Victor Service meeting held in the RCA Victor Recording Studios on North Sycamore Street, Friday night, December 14, attracted an unusually large crowd. The large attendance was due to the American Arts Foundation having been invited to hold its regular meeting in conjunction with the service meeting.

The subject of the meeting was the new RCA oscilloscope. After a few words had been offered by Mr. Paul Beuhler of the Meyberg Company and Mr. Jackson of RCA Victor Company, the elementary principles, theory and practical aspects of cathode ray devices were most ably discussed by Mr. Fredricks and Mr. Westphal of the RCA Victor Company.

THE PENTAGRID CONVERTER TUBES

By J. J. GLAUBER, Chief Engineer Arcturus Radio Tube Co.

(Continued from last month)

PART TWO

A tube was therefore designed as being the best compromise between simplicity, low cost and low cathode current and still perform satisfactorily. The result is a heptode, that is a tube possessing seven elements namely a cathode, five grids and an anode. As far as I am aware the heptode was developed by the RCA Radiotron Company. A similar tube known as a hexode because it contained one less shield grid was developed at the same time by the Hazeltine Corporation.

Proceeding outward from the cathode the structural arrangement is as follows:

(0) indirectly heated cathode
(1) grid No. 1, oscillator grid
(2) grid No. 2, anode grid
(3) grid No. 3, screen grid connected to grid No. 5
(4) grid No. 4, control or modulator grid for R.F. signal
(5) grid No. 5, screen grid connected to grid No. 3
(6) anode

The cathode and grids Nos. 1 and 2 form the oscillator section of the tube. They also constitute a virtual cathode for the modulator unit. The control-grid, grid No. 4, is electrostatically shielded from the other tube elements by the screen-grids located on both sides of it. The modulator section includes the virtual cathode, the modulator control-grid, the screen and the anode. Thus the oscillator portion functions as a triode while the modulator portion functions as a variable-mu tetrode.

In operation, electrons emitted from the cathode 0 are accelerated through the oscillator grid 1 by the positive anode-grid 2 and inner screen grid 3. The anode-grid in reality consists of a pair of side-rods, no lateral wires being wound on them. Most of the electrons approaching the anode-grid possess high velocities so that they shoot past the anode-grid and for the most part through the inner screen-grid 3 and approach the modulator grid 4. This grid has a negative potential, which therefore retards the oncoming electron stream.

The cloud of retarded electrons between grids 3 and 4 therefore constitutes the virtual cathode for the modulator portion of the tube. Electrons may be drawn away from this source in a manner analogous to that by which they were originally accelerated away from the cathode element 0. Elements 4, 5 and 6 together modulator tube. The radio frequency signal is applied to grid 4 and the intermediate frequency output circuit is connected to the plate 6.

If the oscillator grid 1 is only slightly negative, or even somewhat positive, then the virtual cathode has an ample electron stream for the modulator unit. Whenever the oscillator grid swings to more negative values, the number of electrons arriving at the modulator is temporarily reduced or possibly even cut-off. Thus, the oscillator can modulate the signal in the modulator portion and produce the intermediate frequency beat-note in the anode circuit.

The current necessary to produce sustained oscillations is controlled by the oscillator grid and not by the modulator grid, the latter being incapable of producing cut-off in the oscillator portion. Thus, the gain of the modulator can be controlled to a nicety over a considerable range by a variable negative bias on the grid 4 without substantially affecting the oscillator unit. The modulator grid 4 shows a gradual and extended cut-off action, somewhat similar to the action of a variable-mu radio-frenquency pentode, but the conversion gain is considerably higher. The screen grids increase the output impedance of the tube, thereby improving the gain, and the inner one 3 serves to reduce the local frequency radiation.

This tube does not call for special follow-on design. Coils for the oscillator may be of absolutely conventional design, as employed in present-day advanced superheterodynes. Voltages less than 250 volts on the anode grid will prove adequate for the best conversion gain. For the 250 volt rating on this element a series resistance of approximately 20,000 ohms should be inserted in order to prevent excessive heating. If the resistor is omitted then rods will get red hot whenever the oscillations are feeble, due to the small bias voltage developed across the grid-leak and to the high anode-grid potential. The value of the oscillator grid resistor has not been found to be critical, but will be determined primarily by the voltage applied to the anode-grid and screen.

With some cricuit set-ups an audio-frequency oscillation was experienced. This seemed to be due to excessive feed-back for the value of grid-leak and condenser employed. In these cases it was necessary

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ELECTRICAL MEASURING INSTRUMENTS

(Continued from Page 7)

alloy tubing. Various size instruments require various sizes of pointers, which means a variety of tubing sizes. In some, the wall of the tubing is ¾ of a thousandth of an inch thick. Each pointer is balanced; this is accomplished by weights on nuts at the proper position.

In alternating current instruments, the pointers must be trussed to prevent vibration at critical frequences. The movable coils used on various instruments, differ according to the charactistics required for the instruments. It is always necessary to correctly design the coils with due regard to the current to be used; the allowable temperature error; in the case of A.C. instruments, the allowable frequency error due to self-inductance, the damping qualificatons, the weight of the coils as compared to the actuating forces, the stiffness or strength of the coil, and other things depending on the instrument.

Pivots must be of suitable size to accomodate the different size of coils. The pivots must be ground to the proper angle and with the correct roundness at the tip so that crushing will not occur and friction will be eliminated; nothing is left to chance. Pivots are individually ground, tested and inspected.

Jewels must be in proportion with the Pivot size, and shaped so as to eliminate friction and yet properly support the movable coil in any position.

In the design of cases for strength and shielding, the material used and its disposition must be carefully studied so that operating characteristics of the finished instrument shall be satisfactory.

These are just a few of the design problems. Each part of the whole presenting problems which must be considered individually. Special tools are necessary to allow manufacture on a commercial basis.

The value of any instrument depends entirely upon the manner in which each factor, electrical or mechanical, has been brought into permanent relation with the numerous other factors in order to secure the best combination or whole. Therefore, when investigating an instrument which may conform to certain superficial tests with reasonable accuracy, it is advisable to ascertain whether it is so designed and constructed that it wil meet the demands of ordinary practice as accurately under continual service as at the time of purchase.

(Continued in Next Issue)

RADIO INTERFERENCE BUREAU

MR. W. F. GRIMES, Chief Engineer Radio Interference Engineering Bureau

(This column is a regular feature and each month will consist of a report of interesting cases and activities of the RADIO INTERFERENCE ENGINEERING BUREAU. To report interference Phone Trinity 1244).

RECEIVER INSTALLATIONS

While it is not within the province of the Bureau to engage in commercial discussions, our records strongly indicate that Radio Dealers and Servicemen, in general, are overlooking splendid opportunities to not only provide the public with good reception but also to develope satisfied customers with consequent good will, increased business and profits.

During the month of November, out of a total of three hundred and twenty-nine cases of poor reception investigated, eighty-three were due directly to incorrect installations. Many of these affected late models and recently-purchased receivers which had apparntly been sold as just one more piece of furniture.

All engaged in the industry should constantly keep in mind that the public is not familiar with the technical features of the radio receiver and must depend upon the recommendations of the Dealer or Serviceman. If such recommendations are based on a correct understanding of the intentions of the design engineer as to how the receiver is to be installed, the purchaser will gladly pay a small additional charge to obtain complete satisfaction from the receiver.

The Bureau is often asked, "Why didn't they tell me that when I bought the receiver?" "They told me the receiver was so powerful I could hear stations on the East Coast without an antenna," or, "When I bought the receiver, they gave me this installation as called for by the purchase price as I bought it completely installed. I doubted if I was getting my money's worth as I wondered how the receiver could possibly operate when they wrapped that little piece of wire around the gas pipe and threw that other little piece of wire under the carpet."

An honest effort on the part of Dealers and Servicemen to obtain satisfied customers will prevent violent criticism, the necessity for repossession, the wasting of thousands of dollars in advertising true claims of receiver performance which cannot be met without a proper installation—and will prevent much wasted time and effort on the part of the Bureau.

Many, many cases of reported "man made static" will be entirely cleared by so much as a moderately good installation. A good antenna and ground are essential and not necessarily complicated or requiring more than ordinary good common sense in design.

A simple test of installation is to turn the residence lights on and off, if a "click" or change in signal volume is noted in the receiver, the installation is inadequate for good reception. Before making the test, remember that a ground connected to the antenna binding post of the receiver does not, never has and never will constitute a proper installation.

The Bureau will be pleased to cooperate with you in your installation problems. We should all endeavor to cooperate in this all important effort to give the public the best possible reception.

DR. HUND SPEAKS

At a joint meeting of the Los Angeles sections of the American Institute of Electrical Engineers and the Institute of Radio Engineers held in the Richfield Cafe November 27, Dr. August Hund, noted scientist, delivered an extremely interesting and informative paper on the subject of grid glow tubes. This paper, which lasted for about one and one-half hours, was delivered in Dr. Hund's inimitable style and everyone privileged to be present left the meeting much the wiser for the exprience. Dr. Hund has a most remarkable faculty for holding the intense interest of his audience and making his explanations so clear and full, yet without tiresome detail, that it is indeed a pleasure to be able to attend his lectures.

HAND-EE GRINDER

An amazing device has just been announced by the Chicago Wheel and Mfg. Co., manufacturers of high grade abrasive wheels and allied equipment for many years. This little grinder is a small motor which weighs only one pound and fits into the hand. Many different types, sizes, and kinds of grinding and polishing wheels, buffers, brushes and drills are available which attach to the armature by means of a small chuck. The motor attains a speed of thirteen thousand RPM making it very useful for countless purposes. It is indispensable to mechanics, technicians, and others who spend considerable time drilling, filing, sanding, cutting and routing—particularly in restrictive space. The price is surprisingly low.

tary-Treasurer.

The program presented four films of educational interest through the courtesy of the So. Calif. Telephone Co. and Electrical Research Products, Inc.

Mr. Dean T. Smith, public relations Dept. of the Telephone Co., operated the projection equipment and later demonstrated the artificial larynx.

PHILCO ALL-WAVE ANTENNA

Philco now comes into the field with an all-wave antenna system, possessing many outstanding features. According to Philco engineers, this new improved type all-wave antenna was designed and developed to meet the demands of purchasers of the Philco All-Wave Receivers, in order to assure them the utmost in all-wave reception. The antenna comes in kit form and includes coupling units making it adaptable to all receivers as well as Philcos.

UTC HIGH QUALITY

Connie Strassner, United Transformer Corp. representative, reports ever-increasing use of UTC components in broadcast transmitters and studios, movie studios, recording studios and on board ship. This company produces several complete lines of transformers and chokes.

YULETIDE GREETINGS TO OUR ADVERTISERS

We wish to take this opportunity to express our best wishes for a Merry Christmas and a Very Happy and Prosperous New Year to all the advertisers of the "Technician." We sincerely appreciate your support in word and act in the past and we shall make every effort to deserve your continued patronage in the years to come and the attendant progress in the radio industry.

NEW FIRM

The newest transcription producing firm is the Earnshaw Radio Productions established early in December by Harry Earnshaw. G. O. Sebree heads the sales staff, R. E. Messer as auditor, with headquarters in Petroleum Securities Building.

BOOK REVIEW

(Continued from Page 15)

to present high fidelity design. The remaining two booklets will be reviewed in subsequent issues of the "Technician." The treatment of the title subject is ably handled in a very thorough and understandable manner. The practical development as well as the technical development of broadcast receivers is thoroughly covered and this series of booklets is recommended to all radio technicians as a part of their radio library.

SERVICING SUPERHETERODYNES — John F. Rider, Publisher, 1440 Broadway, New York City—$1.00. We all know Rider's Manuals and their great usefulnes to the radio technician. "Servicing Superheterodynes" (revised edition) is written by John F. Rider and is recommended to the radio technician. Written in a very understandable manner, it completely covers design, operation and servicing of the superheterodyn broadcast receiver. It covers all subjects pertaining to this type of receiver and should be in every radio service technician's library.

ENCE BUREAU

dio Interference Engineering Bureau

so powerful I could hear stations on the East Coast without an antenna," or, "When I bought the receiver, they gave me this installation as called for by the purchase price as I bought it completely installed. I doubted if I was getting my money's worth as I wondered how the receiver could possibly operate when they wrapped that little piece of wire around the gas pipe and threw that other little piece of wire under the carpet."

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The Bureau will be pleased to cooperate

APPLICATION OF ALL-WAVE TEST OSCILLATOR

(Continued from Page 9)

the procedure for determining the fundamental will be as follows:

TO DETERMINE THE FREQUENCY TO WHICH THE RECEIVER IS TUNED at a given dial setting, the oscillator dial is rotated until the signal is heard in the speaker. Continue rotating the dial until the second point is found. Of these two points the fundamental frequency is the lowest frequency heard.

TO TUNE THE RECEIVER TO A GIVEN OSCILLATOR DIAL SETTING, the same procedure is used except the fundamental frequency is the highest frequency on the receiver dial.

In case the receiver oscillator operates at a lower frequency than the detector, this entire procedure is simply reversed, i.e., when rotating the oscillator dial to determine the receiver's frequency, the fundamental frequency is the highest.

CONVERTER TUBES

(Continued from Page 20)

to reduce the coupling between the oscillator-grid and anode-grid coils, or to low- with the virtual cathode provide a tetrode er the value of grid-leak resistance, this in some cases having been set at too high a value.

The average cathode current for proper operation is about 11 milliamperes. It is best not to exceed the 14 milliampere maximum rating.

The conversion gain is best controlled by a variable negative voltage on the modulator grid 4. This may be obtained either from a separate supply or from a variable resistance in the cathode circuit. If the latter method is used the oscillator-grid return must be made direct to the cathode. Otherwise the oscillator performance will be influenced by variations in the modulator-grid bias.

The range of control-grid bias voltage required to control the gain will be governed by the screen voltage. With 100 volts on the screen grids 3 and 5 and 3 volts on the signal grid, the range of bias voltage will be from -3 to a value near plate current cut-off. The cut-off will be less remote for lower screen voltages. In conjunction with automatic volume control, the pentagrid converter provides all of the advantages previously obtained with a separate oscillator and a variable-mu first detector. Because of this, its use permits a reduction in the number of tubes required.

(To be continued)

MATHEMATICS COURSE

Mr. Edw. H. Guilford, Educational Director of the CRTA, is planning a comprehensive course on mathematics, particularly as applied to radio.

Mr. Guilford, through his connection as Pacific Coast Representative of the Capitol Radio Engineering Institute, has obtained mathematics lessons of this school for the use of CRTA members attending these lectures, which will be given in conjunction with Mr. Leitner's talks at the regular Monday night meetings.

ARCTURUS PORTFOLIO

A new loose-leaf portfolio for distributors and their salesmen has just been issued by the Arcturus Radio Tube Company, Newark, N. J.

Pretentious in make-up, the portfolio contains actual samples of advertising materials such as consumers' price-lists and radio logs, characteristic charts, book matches, tube stickers, etc., that are available to dealers and service men. Samples of three post-cards for dealers' direct-mail campaigns, and a combination stationery unit comprising letterheads, envelopes and business cards are also included.

Another section of the book is devoted to combination deals on tube checkers, oscillators, set analyzers, and Rider's Manuals.

Still another section shows a comprehensive assortment of cuts or mats of various sizes that are available for newspaper, catalog or other uses. Window display units, a decalcomania and streamers are also shown.

INCREASED BUSINESS

The Pacific Radio Exchange informs us that their over-all volume of business has been very definitely increasing from month to month and that the month of December up to the time we go to press has been their most profitable in the existence of the company. This is indeed good news when we hear so much about depression.

THANKS TO NAT'L SCHOOL

In addition to offering our most sincere wishes for a Merry Christmas and a Happy, Prosperous New Year to all the members of the Nat'l School, we wish to offer the school earnest thanks for the extended use of the auditorium where we have been holding our meetings since the formation of the CRTA. Through the courtesy of Mr. Rosenkranz, we have been allowed full use of the auditorium and extra classrooms for the accommodation of the men taking examinations.

GUILFORD MOVES

Mr. Edw. H. Guilford, West Coast Representative of Capitol Radio Engineering Institute, has moved his office from Glendale and is now located at 1656 N. Serrano Street, Los Angeles, GRanite 0755, where he will be glad to meet all radio men interested in furthering their knowledge of radio engineering through the CREI course in practical radio engineering.

TRAVELING THE TERRITORY WITH MILTON

And here we are again, people; just like Santa Claus at Xmas time, still travelin'.

* * *

Bill Whisman, deep down from the vast depths of North Vine Street, comes forward to announce a new "put-put" transformer which he recently received from a local radio supply house. Bill says it sure is the bathtub's stopper for eliminating motorboating in amplifiers.

* * *

Julius Hartman, of the firm of Hartman, Hartman, Hartman, & Hartman (or just plain Hartman Radio Service to you), has just finished modernizing his tube checker. And can he pick our detectors and oscillators for short wave—just watch him!

* * *

We respectfully doff our hat in greeting to our good friend William Hansen, who recently announced the opening of his new store in Beverly Hills. It takes only a moment in the new establishment to be impressed with the good taste displayed in the furnishings and arrangement of the various apparatus, which is, without doubt, a reflection of the inherent good taste of the man himself. Congratulations and the best of good fortune!

* * *

Bill Hitt, in his eulogy and ode to the fair ladies present at the banquet, was carried away in his enthusiasm for the color and charm which they lent to the occasion. Did he also notice their vivacity? M-m-m-m.

* * *

They tell us that Al Henkin of Hollywood Radio Service recently deserted the ranks of the bachelor army for wedded bliss. May all your troubles be little ones, Al!

Boy, oh boy, oh boy! Every time the Travelor recalls the various events of the CRTA banquet, does he chuckle inwardly—huh! We wonder just how many stiff necks there were the following morning caused by inadvertent attempts to discover the presence of "Man-Mountain" Dean.

* * *

Just a word of praise for the acting of John Vincent, the screw-driver mechanic of the CRTA playlet. To say it was quite convincing would be entirely too conservative a statement—we might add that it was very con-vincent.

* * *

And speaking of additions to families, the Traveler has been informed that Roy Wallick (out Echo Park way) has been handing out the cigars so prevalent in his section. Yes, Meredith, it's a boy.

Is Sol Popelsky smiling; Yes indeedie, his trim little shop is now located on an honest-to-goodness full-fledged paved boulevard.

* * *

While snooping around the Wilshire district, the Traveler recently stumbled on Bill Hilchey of Wilshire Radio Service in the act of constructing a midget auto set. And when we say "midget" we don't mean maybe.

* * *

Yes sir, one of the most cheery telephone voices in the radio industry can be found emanating from Weir's Coast Radio Shop in El Monte. It sure warms the Traveler's heart to hear coming through the telephone receiver, "This is Old Man Weir talking. How are you, anyhow?"

* * *

And to all of those who, either out of politeness or courtesy, have followed this column through to the bitter end (or possibly its finish)—Merry Christmas, doggone yuh, a jolly Merry Christmas!

Classified Advertisements

For Sale or Trade—

FOR SALE—Double Commutator DAYFAN motor-generator, 110 volt driven to 450 volts, 60 M.A. D.C. and 7.5 volts 1.75 amp. D.C. Like new, $10. Phone PR. 3515.

Several new Universal and Inca mike and inter-stage transformers. Chas. Miller attenuator and several miscellaneous meters. Norman B. Neely, 1656 N. Serrano, GRanite 0755.

Laboratory Service—

All types of laboratory measurements and calibration of electronic devices and component parts. Dr. John F. Blackburn, Consulting Physicist. GRanite 8179.

MEN WANTED—Certified Radio Technicians interested in affiliating with a cooperative service organization write giving full details as to training experience and equipment. Mr. Barns, Box D-1, % Technician

HIGHLIGHTS OF AUTOMATIC VOLUME CONTROL

(Continued from Page 18)

portional to the carrier energy fed to the grid. Only positive grid swings allow plate current to flow and instead of rectified R.F. in the plate circuit we have C-4 to filter this into D.C.

This will make the potential at the A.V.C. plate actually drop toward B minus from ground. From this it is obvious that the A.V.C. tube supplies a 40 volt negative bias to the two 35 tubes. Their cathode resistors R-2 and R-3 of course furnish additional bias.

Resistors R-4 and R-5 are to filter the voltage fed from the plate of the A.V.C. tube. C-4 furnishes a major part of the filter system, but R-4 and R-5 also serve to prevent coupling between the two R.F. tubes. If they were ommitted it is obvious that the voltage across C-3 would be placed across C-2 thus effectively coupling the two stages. C-2 and C-3 are essential for A.V.C. to isolate the A.V.C. voltage from ground.

When the carrier decreases the excitation to the grid of the A.V.C. tube decreases and its plate current also decreases. This is true for any tube biassed at cut-off. Let us say that the tube resistance reaches 8 megohms, assuming a value of ½ meg. for R, the voltage from plate to ground (bias voltage for controlled tubes) becomes approximately 3 volts.

Thus if R-1 is chosen to be ½ meg. and the grid charge makes R-2 125,000 ohms V will be approxiately 40 volts. When R-2 is driven to 2 megs. V will be 10 volts. In this manner V can be made to assume values from a fraction of a volt to about 45 volts or more. This is a voltage which cannot be measured by any ordinary means, because of the high values of the resistors envolved in the circuit.

Condenser C-4 is 2 mfd. or sufficiently large to prevent rapid change of the A.V.C. voltage. If it changes too rapidly it will respond to carrier variations due to modulation thus destroying the signal.

THANKS TO SYLVANIA

Along with our wishes of a Merry Christmas and a Happy, Prosperous New Year to the Hygrade Sylvania Corporation, we must offer sincere thanks for their sponsorship of Mr. Leitner's lecture course. This course of lectures continued for a year and a half by various sponsors, the past several weeks having been sponsored by Sylvania, has been most beneficial to the members of the CRTA.