# The "TECHNICIAN"

Bulletin and House Organ of

The Certified Radio Technicians' Association

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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One Dollar Per Year

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1569 Munson Avenue

Los Angeles, California

Ten Cents Per Copy

VOL. 1 DECEMBER, 1933 NO. 4


## EDITORIAL

By The Editor

### *"Peace On Earth---Good Will To Men"*

With the chill of winter in the air and Christmas just a few days away we all feel the exhuberance of holiday spirit and the festivity which always comes with the Yuletide season. At this particular time we have reason to be more happy than usual and the occasion to celebrate considerably more than Christmas would ordinarily dictate. On every quarter, from the captains of industry down to the common laborer, we hear the report of better times. Our dynamic president has proved his worth and shown us that our faith was not misplaced. Under his guidance the country is already on the road to industrial recovery and general faith in the American people has been restored.

Christmas is the time of year when we all feel a little more kindly toward our fellow men. Also it is just before we begin a new year and all of us make many resolutions which we really intend to carry out faithfully. However, it is safe to say that a large majority of such resolutions made in good faith are usually violated the first few days of the new year and by the end of the first month most of them are entirely forgotten.

As a new experiment in New Year's resolutions let us resolve, first of all, to make fewer, more important resolutions and really live up to them. Let us resolve to give a little more effort to performing our everyday work and doing our job well, regardless of what it may be. Let us resolve to never let a day pass without doing some unselfish service to our industry, our employer, employee, association, country or some worthy cause. Also, let us resolve to never allow a day to pass without advancing our knowledge in some way, by study, experience, or intellectually profitable contact of some kind.

Of course, we must assume inherent honesty and a desire to be fair and square in all our dealings, to be a quality which need not be bolstered up by New Year's resolutions.

Whatever our resolutions for the New Year, let's definitely resolve to rigidly observe them and endeavor to make this old world a little better for our efforts by next Christmas. A kindly word and friendly interest is often times the difference between happiness and despair to some one of our associates. These overtures of friendship take so little effort that we should resolve to maintain and evidence an attitude of "Peace on Earth--Good Will to Men" not only during the last week of 1933 and the first week of 1934, but for all time.

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To facilitate ready contact with any member of the officers and directors of the Association, the following directory is published for your convenience:

| Name | Office | Phone | In Charge of: |
|---|---|---|---|
| A. Paul, Jr. | President | OX. 8877 | Public Relations |
| John L. Vincent | Vice-President | KE. 1640 | Arbitration |
| John A. Orme | Secretary-Treasurer | AT. 9501 | |
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| Richard G. Leitner | Director | | Consultant |

## THE AIMS AND PURPOSES OF THE CERTIFIED RADIO TECHNICIAN'S ASS'N.

The radio technician or serviceman, as he is more generally called, has from the very inception of the radio industry, been deemed a necessary evil. It was only after several years of the most intensive demand from technicians in all parts of the country that manufacturers of radio receivers have finally come to realize that it is to their best interests to supply service information to any but dealers in their wares, who more often than not threw what little there was supplied in the waste basket. Because the technician was a docile animal, didn't stop to consider the value of his services or the cost of his training, the cost of keeping his testing and mental equipment up to date or that he might ever grow old or lose his power to bring in the bare necessities of life he has been the prey of this most chaotic or shall I say idiotic industry. Individually we have from time to time endeavored to stem the tide of short-sighted selfishness but the lone wolf however heroic his stand, seldom escapes from his adversaries with a whole skin.

The events of the past few weeks have shown conclusively that The Day Has Arrived when we must exert forceful, well planned and above all, sustained United Effort if we are to maintain for ourselves the right to make an honest living, time for pleasure, study and the necessary functions of a normal and healthful existence. The Certified Radio Technician's Association was organized to provide the facilities for such a movement. It is composed of members of several technical societies of long standing. We invite any radio or electronic technician who will endeavor to maintain for the public and his fellow technicians an ethical standard of proficiency and fair play, to join with us in our endeavor to win and maintain working conditions and compensation commeasurate with the service he renders his employer or the public.

In order to effectuate the purposes of the Association for the greatest good of its members and the public at large, we have established connections with forces for the betterment of business conditions generally, such as National and State agencies. We are working very closely with the Better Business Bureau and the Federal Radio Correau and the Federal Radio Commission to clean up some of the unethical practices and rackets now prevalent in the radio service field. To protect the ethical and qualified Technician and the public from the inroads of the unscrupulous, the unqualified and those lacking the character to render proper service, we have an Examining Board to determine the qualifications and standing of those who engage in this business. We have established several services for the membership in addition to this magazine. We have a Technical Board composed of competent and recognized radio engineers and service technicians whose duty it is to assemble a library of technical information of interest and value to the members. In addition to this they maintain an inter-consultation service for the members so that difficult questions may be answered by specialists in the particular field involved. We have an employment committee which is actively working to secure for the members of this Association all the available employment in this field. We have in the course of development, a great many other services of like nature which will be of great benefit not only to the members of this organization, but to the radio industry and the public.

All these things and many more are available to the man who supports his organization, morally and financially, which would be very difficult if not impossible, for the lone wolf to procure.

JOHN A. ORME,
Secretary.



# "THE FIVE METER BAND"

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

## HISTORY

It is an interesting fact that the use of ultra-short waves is now being developed, or, perhaps "explored" would be a more correct term, because of their short range. At one time all wave-lengths below about 200 meters were despised because of their supposedly rapid absorption and consequent uselessness for long distance transmission. Then came the great discovery that, under certain conditions, short waves made long distance transmission possible with an expenditure of power ridiculously small compared with that which had been found necessary for reliable long-wave transmission. Now a new phase is developing as the result of the discovery that for wavelengths below 10 meters the waves which travel over the earth's surface are rapidly damped out, while those which are radiated upward into space do not return again to earth. They are thus admirably suited for those cases in which it is required to broadcast over a limited area, and to limit reception strictly to that area; the latter condition may arise from reasons of secrecy or from the desire to avoid interference in regions outside the limited area. As a result, when the technique of their use has been mastered to the same extent as that of longer waves, ultra-short waves will occupy a special and extremely useful niche of their own in the field of radio communication. Waves below 6 meters in length have for convenience been termed "ultra-short." Often these "ultra-short" waves are said to be quasi-optical. The designation quasi-optical refers to the fact that the waves can only be received at points within sight of the transmitting aerial, the words "within sight" being interpreted in a geometrical sense.

In the production of ultra-short waves, Heinrich Hertz was probably the first with his classical experiments carried out in the years 1880-90 on waves of two or three meters in length. In this work and in that of his successors who worked on the problem and demonstrated the various properties of the waves, spark discharge oscillators were employed which gave intermittent groups of damped oscillations. Following the application of this work to practical wireless communication, the spark transmitter was developed to a high degree on the longer wavelengths, of from 100 meters upwards. One of the most recent applications of damped waves of a few meters wavelength is the rotating beam transmitter described by C. S. Franklin in the Journal of the Institute of Electrical Engineers of 1922, Vol. 60. Using a wavelength of about 6 meters, a Hertzian rod transmitting aerial was located at the focal line of a cylindrical parabolic reflector, the whole system being rotated continuously to enable ships to determine bearings. Of recent years, also, the spark transmitter has been developed as a means of generating extremely short waves in an attempt to link up the electric wave spectrum with that of the infra-red.

After the classical work of Hertz and his successors in the production of damped waves of a few meters wavelength, a period of nearly thirty years elapsed before it became possible to produce, even on a laboratory scale, undamped oscillations of the very high frequency corresponding to this small wavelength. This phase of the science had, in fact, to await the practical development of the thermionic vacuum tube.

When considering generally the use of tubes for the generation of oscillations of extremely high frequencies, it is evident that the design and construction of the tube will set an upper limit to the frequency obtainable. For if the proper elements of the tube be connected by the shortest possible length, the limiting frequency is determined by the inductance of the loop so formed and the capacity between the elements. By the use of specially designed tubes, several investigators have reduced the inter-element capacity to such an extent as to enable them to obtain oscillations of a frequency up to nearly 300 megacycles per second, corresponding to a wavelength of 1 meter. If attempts are made to extend this process, a second limitation is soon reached, which is determined by the time of travel of the electrons from filament to plate inside the tube. The period of the waves produced by the tube must be greater than this time in order that the current through the tube may respond rapidly to the changes in potential of the grid and plate. Going back to the more usual method of producing oscillations by the use of a vacuum tube with coupling between its circuits, D. C. White described in 1916 a circuit arrangement which gave satisfactory operation at 50 megacycles. Three years later, Gutton and

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# PAD DESIGN TABLES

Pad design is not particularly difficult, but at least it involves a little slide-rule computation, and therefore most people seem to prefer to collect resistor values for such pads as they may run across, and to do without them when they really need pads whose constants they cannot find in their notebooks. Since notebook data has a most distressing habit of getting lost just when it is most needed, it has seemed desirable to collect in one place a fairly complete table of resistor values for all the pads in common use; hence the present effusion.

A few words about the choice of a pad for a given purpose may not be out of place here. For working into a high-impedance device such as the grid of a tube it is usually O. K. to use a potentiometer, which is the simplest form of pad. Here $R^1+R^2=Z_1$ (see below for diagrams and notations) and since this sum is constant only one switch arm and set of contacts will be needed if the pad is to be variable. For working between two equal impedances where it is not necessary that the impedance looking back into the pad output terminals shall equal the load impedance (probably the commonest case) we can use an L-pad. Here the equation given above no longer holds, and if the pad is to be variable we must use a double set of switch points, though the two switch arms are connected together. Finally, when the pad output impedance must match the load impedance, as in two-way circuits, mixers and certain types of amplifiers which are fussy about their input impedances, we must use a T-pad. T-pads may be either symmetrical or unsymmetrical, depending on whether the generator and load impedances are the same or not. Table I includes only symmetrical T-pads; the design of pads to match dis-similar impedances is discussed later.

All of the pads in Table I are computed for 500-ohm lines. Pads for other characteristic impedances can be computed very easily from the values given, by multiplying all of the resistances by the ratio of the desired impedance to 500 ohms. For example, suppose that a symmetrical pad is desired which will give 10 db loss in a 200 ohm line. 200÷500=0.4; from the table we find that a 10 db 500 ohm T-pad has two series resistances of 260 ohms each and a shunt resistance of 352 ohms. Multiplying each of these values by 0.4 we get 104 ohms for the series arms and 141 ohms for the shunt arm.

No values have been given for H-pads, since they may be easily derived from the corresponding T-pads. The procedure is to halve each series resistor and to put the other half in the opposite leg; if it is desired to ground the electrical center the shunt resistor must be center-tapped. As an example, if the 200 ohm 10 db pad of the previous paragraph is to be used in a balanced line with the center grounded it will take the form of an H-pad each of whose four series arms is 52 ohms and whose shunt arm is composed of two 70.5 ohm resistors in series with their common point grounded.

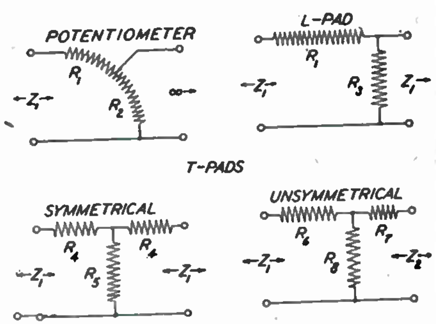


Table I. 500 Ohm Pads

| Loss, db | R1 | R2 | R3 | R4 | R5 |
|---|---|---|---|---|---|
| 1. | 54.5 | 445 | 4090 | 28.7 | 4340 |
| 2 | 103 | 397 | 1925 | 57.3 | 2160 |
| 3 | 146 | 354 | 1162 | 85.6 | 1420 |
| 4 | 185 | 315 | 855 | 113 | 1100 |
| 5 | 219 | 281 | 643 | 140 | 823 |
| 6 | 250 | 250 | 502 | 166 | 670 |
| 7 | 277 | 223 | 405 | 191 | 559 |
| 8 | 301 | 199 | 331 | 215 | 473 |
| 9 | 323 | 177 | 274 | 238 | 406 |
| 10 | 342 | 158 | 231 | 260 | 352 |
| 11 | 359 | 141 | 197 | 280 | 301 |
| 12 | 375 | 125 | 168 | 299 | 268 |
| 13 | 388 | 112 | 144 | 317 | 236 |
| 14 | 400 | 100 | 125 | 334 | 208 |
| 15 | 411 | 88.9 | 108 | 350 | 184 |
| 16 | 421 | 79.3 | 94.1 | 364 | 155 |
| 17 | 430 | 70.7 | 82.2 | 376 | 134 |
| 18 | 437 | 63.0 | 72.1 | 388 | 123 |
| 19 | 444 | 56.1 | 63.2 | 399 | 112 |
| 20 | 450 | 50.0 | 55.6 | 409 | 101 |
| 21 | 455 | 44.5 | 48.9 | 418 | 89.8 |
| 22 | 460 | 39.7 | 43.2 | 426 | 80.0 |
| 23 | 465 | 35.4 | 38.1 | 435 | 71.2 |
| 24 | 469 | 31.5 | 33.6 | 441 | 63.2 |
| 25 | 472 | 28.1 | 29.8 | 447 | 56.3 |
| 26 | 475 | 25.0 | 26.3 | 452 | 50.1 |
| 27 | 478 | 22.3 | 23.4 | 457 | 44.7 |
| 28 | 480 | 19.9 | 20.7 | 461 | 39.9 |
| 29 | 482 | 17.7 | 18.4 | 466 | 35.5 |
| 30 | 484 | 15.8 | 16.3 | 469 | 31.7 |
| 35 | 491 | 8.89 | 9.05 | 483 | 17.8 |
| 40 | 495 | 5.00 | 5.05 | 490 | 10.0 |
| 45 | 497 | 2.81 | 2.83 | 495 | 5.62 |
| 50 | 498 | 1.58 | 1.59 | 497 | 3.16 |
| 55 | 499 | 0.889 | 0.890 | 498 | 1.78 |
| 60 | 500 | 0.500 | 0.500 | 499 | 1.00 |

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## THE TECHNICIAN— A SALESMAN? SURE!

By H. D. HATFIELD

Radio technicians had not been thought of when Noah Webster wrote his well known dictionary. If Noah were doing the job now he would of course include the subject—and very likely he would not devote enough space to cover the matter properly.

There is the item of getting safely inside the gate which bears a sign stating that the dog is vicious, which he or she sometimes is. There is no record of a technician having ever been grazed, but some have reported having been scared into or out of two hours extra labor charge!

Seriously speaking a radio technician in general practice of going into homes as well as meeting all comers in the shop should be a man of parts. His radio knowledge is, of course, the first requisite. Then he must be able to create the impression that this knowledge is actually possessed, without having to boast about it. There are ways and ways of doing this, always different with the different individual. It is the first step toward that "something-or-other" which is called Salesmanship.

Salesmanship is a much abused word. Likewise it is a much abused profession. Simmered down to a few broad words salesmanship has been described as the "Truthful Presentation of Meritorious Facts in a Convincing Manner." The ramifications leading off from this family tree run all the way from soup to nuts—quite often mostly nerts. Nevertheless, sales ability is paramount in every walk of life. Without it there can be no social, industrial or any other activity.

This magazine was probably not started with the idea of selling anything. Rather it was based on the idea of exchange of ideas for the betterment of all. Yet the very first thing the editor most likely got up against was that of selling advertising space in order to make the exchange of ideas possible. The editorials, not only in the "TECHNICIAN" but in the Saturday Evening Post and every other publication are nothing more or less than sales arguments to get you to do this or to think that or the other.

So you, as a Radio Technician, should put away the notion that you are not a salesman, because you are just as good a serviceman or technician as you are a salesman and NO BETTER. Whether he realizes it or not the dealer's first line of offense, or defense for that matter, is the service technician. The impression made by the serviceman may make a friend—and friends of a business ARE the business. By the same token his impression may lose a customer.

Here then would be that Utopia of Radio: A dealer, with full confidence in his technician: a technician with full realization of the confidence so placed. No chance lost to make a friend for the business-no opportunity lost to reward the technician. It looks easy, and it wouldn't be hard to do. Worst thing about it—'twould cause Gen. Hugh Johnson to lose his job, and the code would be as unnecessary as two handles on one shovel.







DEC

# FREQUENCY PROBLEMS IN TELEVISION

**BY W. SCOTT HALL, JR., Engineer E. B. Dunn Co.**

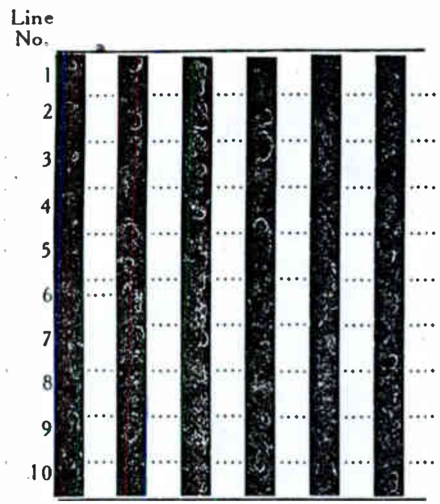
Among questions concerning television most frequently asked by technicians are the following two: the answers to which are closely related:

1. Why do television signals tune so broad?

2. Why aren't more lines used for television pictures?

The latter question usually follows an explanation of the fact that basicly, the greater the number of lines used the better the pictorial detail will be and also the more complex the picture which is being transmitted can be. One detailed (but interesting, we hope) explanation will answer both questions.

Let us examine the method by which the modulation frequencies of television signals are determined. Figure 1 represents a simple constant object consisting of alternate black and white stripes painted on cardboard which we will assume is to be televised by a ten line scanner at the rate of ten frames per second. Line 1 is scanned first, followed consecutively by lines 2, 3, 4, 5, 6, 7, 8, 9, 10, then this action is repeated. The standard method of scanning is from left to right and from top to bottom consecutively.




The scanning beam in this example thus travels across one line in 1-100 of a second. Inasmuch as it takes one complete change from a dark to a light area (or the opposite) to create one cycle of current in the photo electric cell, then for each line scanned on this object there are six complete changes from dark to light areas giving rise to 6 cycles and in the entire object. With ten line scanning there would be 60 cycles per picture or frame and at the rate of 10 frames per second the frequency would be 600 cycles per second. If there were half as many stripes or bars then the frequency would be half 600 or 300 cycles.

In the scanning of more complex and unsymmetrical objects such as a face it can be seen that it may take several lines to create one cycle, causing a low frequency or conversely the maximum number of changes possible may take place giving rise to high frequencies. The maximum number of changes which it is possible to create in any given line, assuming standard aspect ratio, is the number of lines multiplied by 120% or to state it another way, no areas of light or dark that are smaller than the scanning beam itself can be faithfully reproduced. The term aspect ratio is explained later in this article.

It has been found that for practical results the smallest number of lines that can be used to successfully televise a persons face with satisfactory definition is about 40 to 50 lines. To simulate motion smoothly it is necessary to have, in single spiral scanning systems, at least 15 frames per second. With a triple spiral system a few less frames per second can be used, approximately 12½ or 2½ per second less.

The number of lines will determine (and is equal to) the number of pictorial elements in the height of the picture. If the picture or field of view, was square it would be the same number of picture elements wide and the product of the two would give the total number of pictorial elements or units of light and dark area in the picture. The American Television Broadcastors have adopted as standard the same picture height to width ratio as a single frame of standard motion picture film which is 5 units high to 6 units wide. This is called the aspect ratio of the picture. If a picture is 45 lines high it will be 120 per cent x 45 wide or 54 elements wide. The product of these two figures 45x54 then gives 2430 which is the number of pictorial elements in the 45 line picture assuming standard aspect ratio.

In a 60 line picture we have 60 ele-

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## THE "FIVE METER BAND"

(Continued from page 5)

Touly described experiments, made with ordinary type of tube then available, in which the wavelength was reduced to 3 meters, and by the use of a special low inter-element capacity type of tube this was lowered to 2 meters.

In a paper published in 1920, Southworth made a brief analysis of the general form of the circuit of an oscillating tube and drew attention to the necessity of substituting for lumped inductances circuits having distributed inductance and capacity if successful operation at wavelengths below 10 meters is to be obtained.

In 1924, R. Mesny described the results of investigations on short waves carried out in the French Laboratory for Military Radio Telegraphy. Mesny has given particular attention to the balanced two-tube type of circuit which was described by Eccles and Jordan in Radio Review, 1919. With this arrangement wavelengths as short as 1.5 meters were obtained with low power transmitters, and experiments were carried out using voice modulation of such waves. The circuits used by most amateurs today on 5 meters is an exact duplicate of that described by Eccles and Jordan. Using the super-regenerative type of receiving circuit, these experimenters succeeded in communicating by voice over a distance of 160 miles between mountain peaks in the Alps. When the same experiment was attempted along flat ground the distance of satisfactory transmission was reduced to 1.5 to 2 miles, thus illustrating the serious absorption effect of the earth for very short waves.

An interesting extension of the symmetrical two-tube oscillating circuit above was provided by Danilewsky in 1923. He used a single five element tube containing two grids and two plates. Oscillations of a few meters wavelength were produced.

Prominent among the more recent experimenters on the subject of ultra-short wave work, may be mentioned that carried out in Japan. Uda has investigated in some detail the behavior of aerials and reflectors for use in beam transmission, while Yagi has carried out various experiments on wavelengths below 5 meters to show the effect of the earth in attenuating the waves, and of the directive properties of systems of inductively excited aerials and reflector wires.

(Continued in next issue)





DEC

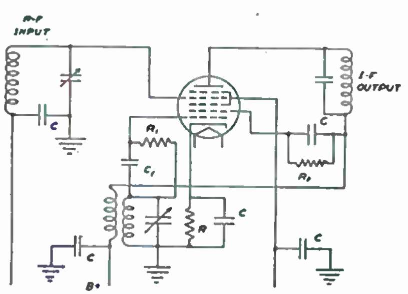
# The Electron Coupled Oscillator and Detector

**BY CONTESTANT NO. 1**

The electron coupled oscillator and detector is the latest improvement in combined detector and oscillator circuits. It has all the advantages of the older types, the saving of space and more even coupling over the wave band; independent control over the individual circuits is possible and inter-coupling and inter-locking effects are eliminated. No load is placed on the oscillator by this method with greater stability as the result.

The usual methods of combining detectors and oscillators is to use capacitive and reactive coupling between the oscillator and detector circuits, the grids and plates being used for both oscillator and detector circuits; with the new system, separate elements are used. A simple electron coupled mixing tube may be considered as a detector tube into which the modulating frequency is impressed by variations in the cathode emission of the tube. Practically, this is obtained by inserting additional elements between the cathode and the elements of the detector portion of the tube. The two extra elements, the grid and the anode grid, form the elements for the oscillator and being between the cathode and the elements of the detector circuit, modulate the space current in an electron-coupled manner.

The tubes used for electron-coupled mixers are called Pentagrid Converters. The two important models being the 2A7 and 6A7, identical except for the filament voltages which are 2.5 and 6.3 volts respectively. These tubes use seven elements in their construction; they are the filament for heating the cathode, the common cathode, the first grid and anode grid which make up the oscillator, the screen grids for shielding the control grid, the control grid between the screen grids upon which the incoming frequency is impressed, and the plate which is the output for the modulated signal.




These tubes when built into a circuit must be thoroughly shielded; the capacity in the output or plate circuit of this tube should be large enough to limit the output voltage built up across this circuit in order to prevent degenerative effects. It should be at least 50uuf.

It is very interesting to note the great flexibility obtainable with this type of tube, a great many different circuits and combinations are possible. The following is a circuit adaptable for this tube which works very well.

**Circuit Constants**

C =0.1 Microfarad
C1=200 Micro-Microfarads
R =250 Ohms Approx.
R1=10000-25000 Ohms, when Screen volts=50.
25000-50000 Ohms, when Screen volts=75.
50000-100000 Ohms, when Screen volts=100.
R2=20000 Ohms (approx.) Voltage Reducing Resistor, When Anode Grid Supply Voltage Exceeds 200 volts.

## EDUCATIONAL COURSE CONDUCTED BY R. G. LEITNER

Mr. R. G. Leitner, under the auspices of the National Union Tube Company, has conducted a very valuable course of lectures on service and practical theory. The lectures have given detailed information for the construction of semi-precision laboratory testing and measuring equipment for the service laboratory and experimenter. These lectures, held in conjunction with the meetings of the Certified Radio Technicians Association, have been attended by quite large numbers of technicians and everyone attending has voiced approval of the series. Mr. Leitner is to be complimented for the systematic and natural attack of underlying theory which has made it possible for the man with little or no technical training to grasp the fundamentals of radio servicing and attendant problems.

The National Union Tube Company, who has made it possible for Mr. Leitner to bring his lectures to the radio technicians of Southern California, indicate the possibility of continuing the series indefinitely if sufficient interest is evidenced. The lack of interest is certainly no problem so we may very probably have the pleasure of attending more of these interesting meetings after Christmas. Thank you! Mr. Leitner and National Union!

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# TRACKING OF VARIABLE CONDENSERS

**BY CONTESTANT NO. 2**

In servicing receivers we are frequently called upon to align a number of radio frequency circuits. In order to obtain satisfactory performance it is essential that the circuits not only balance at the frequencies at which the circuits are adjusted, but at all other points within the tuning range.

The capacity of an air dielectric condenser is dependent on the active surface area of the plates and the distance between them. As all the plates of a gang condenser are usually stamped with the same dies it is safe to assume that the active surface area of the plates in each section will be very nearly the same. However, in assembly, it is not so easy to control the separation of the plates, so that they will all be exactly alike. It is the purpose of this article to show how important it is that the rotor plates run as true and as close to being centralized between the stator as possible.

The capacity of an air dielectric condenser is equal to:

$$C = \frac{.225\,S}{T}$$

Where:
C=Capacity in micro-microfarads
S=Active surface area of either rotor or stator plates in inches
T=Thickness of dielectric in inches

We will assume that we have at hand a condenser with ten stator plates each having an active area of two square inches on each side, and a normal spacing between rotor and stator plates of .025 of an inch. Each plate will have two surfaces. For convenience we will call one surface the right surface and the other the left surface. Likewise we will call the capacity due to the right surface the right capacity and that due to the left surface the left capacity. We will therefore have twenty square inches or right surface and twenty square inches of left surface.

Solving for right capacity:

$$C = \frac{.225\,S}{T} = \frac{.225 \times 20}{.025} = \frac{4.5}{.025} = 180 \text{ mmfd}$$

Likewise the left capacity will be 180 mmfd.

Adding the right and left capacities:
180+180= 360 mmfd, the total capacity of the condenser.

Now assume that the plates have shifted so that the rotor plates are no longer centrally located between the stator plates. We will assume the shift to be .005 of an inch. Therefore the right spacing will be .020 of an inch and the left spacing .030 of an inch.

Solving for capacity of right surface:

$$C = \frac{.225\,S}{T} = \frac{.225 \times 20}{.02} = \frac{4.5}{.02} = 225 \text{ mmfd.}$$

Solving for capacity of left surface:

$$C = \frac{.225\,S}{T} = \frac{.225 \times 20}{.03} = \frac{4.5}{.03} = 150 \text{ mmfd}$$

Adding the right and left capacities:
225+150=375 mmfd, the total capacity of the condenser.

From the above it is seen that we have raised the capacity of the condenser by fifteen micro-microfarads by running the plates .005 of an inch off center. It can readily be seen that if the plates of one section of a gang are correctly centered and the others considerably off center that the circuits to which the condensers are connected will not track accurately.







DEC

# A MODERN ANALIZER FOR MODERN RADIO

BY CONTESTANT NO. 3

In the following article is an analizer which combines flexibility and simplicity of operation and still is within the limits of size and standard parts.

The panel is 7 by 10 inches and the case 10x13x2¾ inches inside which leaves space for all cables and batteries.

Referring to the diagram, there are four pin jacks on the left side. The two top ones are for output voltmeter connections. A triple pole double throw jack switch, S², switches to either A. C. or D. C. A shunt, R¹, is thrown in on D. C. giving the same calibration on either A. C. or D. C.

Five voltage ranges (10, 50, 250, 500 and 1000) cover all needs and are adaptable to the scale with which the meter is equipped. A tap switch, S9, selects the desired range. The multipliers are on the taps and connected in series.

The two center jacks, with switch, S², in the D. C. position are continuity and resistance. Rheostat R8 provides deflection adjustment. Accurate readings from 500 to 1,000,000 ohms are possible. For lower resistance a shunt circuit and the two lower jacks, with switch S¹ in the closed position, are used. Adjust to full scale and take reading. Lower resistances are shown at the lower end of the scale. This is very handy in checking R. F. coils for shorted turns.

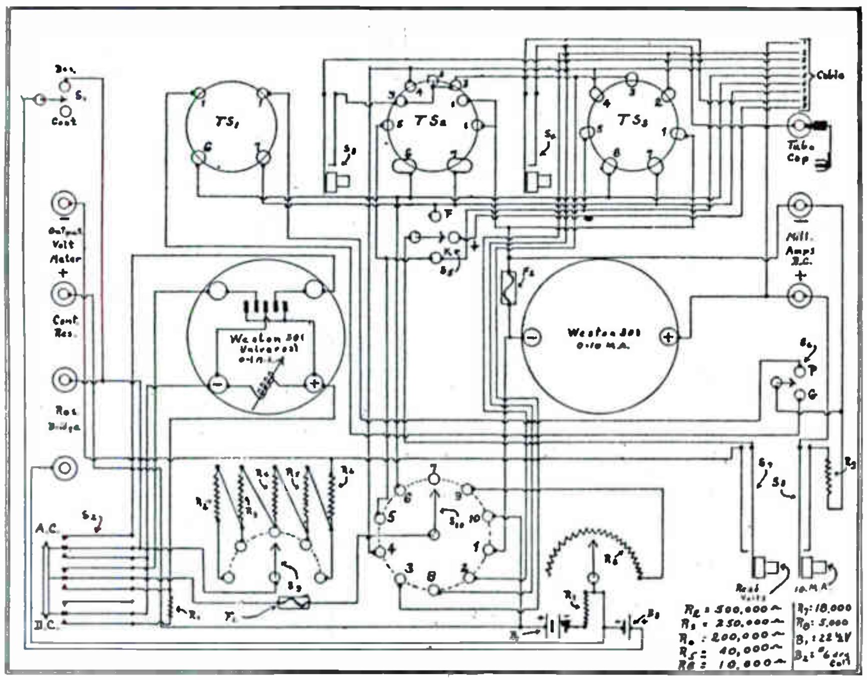
The current meter, a 10 milliammeter, is directly in the plate circuit with a 100 MA shunt, R9, across it. Opening switch S8, returns the meter to the 10 mill scale.

TS¹, a four prong socket for rectifiers, TS², a 4-5-6 prong socket and TS3, a 7-7 prong socket are connected to the radio through a nine wire cable, seven to the plug, the eighth to the grid clip and the ninth to the set ground with a battery clip.

Two button switches, S3, in the grid, and S4, in the control grid circuit, are for grid swing test. A ten point tap switch, S10, provides reading the voltage to any element. A triple throw single pole toggle switch, S5, allows any reading to be taken to either filament, cathode or ground.

For meter protection a switch, S7, is provided; the meter is open until the

(Continued on page 19)






# A NEW YEAR'S MESSAGE FROM YOUR PRESIDENT!

Steaming across the stormy water of the North Atlantic on January 23, 1909, were two great liners with their cargo of human freight.

And fate with grim humor had decreed that with all this vast domain of water available, these two ships should both arrive at the same place off the coast of Nantucket simultaneously.

Amid the din of rending steel plates and panic of fear caused by the collision of these two leviathans, an instrument which had been looked upon as an interesting toy came into its own.

Across the wild and angry waves, the cry for succor was hurled by Jack Binns, radio operator of the S. S. Republic, resulting in the saving of fifteen hundred souls.

The imagination of humanity was enthralled with the romance of the wireless.

Many equally spectacular feats have since been accomplished in the field of radio communication.

The majority of the radio engineers and technicians of today, were the boys of yesterday who were thrilled by the exploits of men like Binns, just as the kids of today who worship Lindberg will become the great flyers and aeronautical engineers of tomorrow.

These men who live and breathe the romance of radio will stop at nothing to learn more and more about their chosen calling.

They are truly professional men, and are, and always will be a credit to themselves, and the industry. These are the men who never miss an educational lecture, an association meeting, or if they are not sure of certain subjects like Ohm's Law, never miss special classes, until the mysteries have all been cleared away. This type of man will prosper when normal times return.

However there are men in the service industry, who having tried every other trade and failed through laziness or mental deficiency, finally take up radio, stating, to use their own words, that they "got into the radio racket."

The only reason these "rats" can remain in our profession is because of the fact that the public knows nothing about the mechanism of a radio set and consequently they have no way of determining a legitimate technician from the fraud.

These "gyps" do not attend association meetings regularly, they are afraid to take the examination sponsored by the majority in the industry, they advertise cut rate service such as free service calls, 50c service and any radio fixed for $2.00. They use inferior merchandise in repairs, and they do nothing but prostitute the industry to which, like leeches, they have attached themselves.

Upon these parasites rest the responsibility for the suspicious attitude with which the public regard all radio technicians.

With the coming of a new year, which will see many changes in the old economic system, it behooves us to put our own house in order, and it is my belief that through our association we can weed out the scum which infests the industry.

The elimination of the chisler is one of the primary objects of President Roosevelt's regime. Mr. Roosevelt in the face of terrific opposition from the greedy tyrants who have exploited the real producers of all wealth for so long, is gradually restoring to the people the things which are rightfully theirs and we can all do our bit by supporting him wholeheartedly in anything and everything he undertakes.

In closing, I wish to remind the members of the Certified Radio Technician's Association that this is your organization. The officers are merely your servants appointed to carry out your wishes.

It is your duty to see to it that all competent and honest technicians are invited to join.

It is also your responsibility as members to suggest ways and means for broadening the scope of the association's work.

Again, it is your duty to support our magazine, "The TECHNICIAN," by submitting technical articles, etc.

And last, but not least, you must support your association financially and morally if you wish it to thrive.

A. PAUL, Jr.
President CRT

## A CORRECTION

Due to a typographical error in the November issue, the formulae appearing in the article entitled "A Reactance Type Capacitance Meter," by C. E. Miller was incorrect. The correct formulae are as follows:

$$Z = \sqrt{R^2 + \left(\frac{1}{2\pi f C}\right)^2}$$

$$I = \frac{E}{\sqrt{R^2 + \left(\frac{1}{2\pi f C}\right)^2}}$$

DEC

# FREQUENCY PROBLEMS IN TELEVISION

(Continued from page 8)

ments high x 120 per cent = 72 elements wide and 72x60=4320 pictorial elements in the picture or nearly twice the number of elements that we have in the 45 line picture which means we can successfully televise a more complex object i. e. a head and shoulder view of a subject, whereas with the 45 line system only a little more than a head view can be shown with the same detail.

In the 80 line pictures, which are being broadcast in Los Angeles by the Don Lee Broadcasting System, the picture is 80 elements high x 96 elements wide or is composed of 7680 pictorial elements giving over three times the detail obtainable in the 45 line system. In fact the following rule always holds true: If the number of lines used in the picture is doubled then the number of pictorial elements is squared thus giving a corresponding increase in the fineness of detail of the picture.

To convey a concrete idea of the aim of television research, may it be said here, that to have television pictures with the same effective fineness of detail as home movies have, it will be necessary to employ in the neighborhood of 400 lines at 24 frames per second in scanning the picture. On this point nearly all of the country's foremost television engineers are agreed. At this point in the discussion the logical question is, Why not use more lines? We will now endeavor to answer this question by finding out to what extent our modulation frequencies change with a change in the number of lines.

Except on ultra short waves the channels assigned for television use are 100 kilocycles wide which will allow modulation frequencies up to 50,000 cycles either side of the carrier frequency.

In the 45 line pictures we have 2430 pictorial elements and if it takes two or more pictorial elements to create one cycle of current this gives a possible maximum of 1215 cycles per frame and at the rate of fifteen pictures per second this gives 18,225 cycles per second as the highest modulation frequency. This is well within the television channel frequency allowance.

With the 60 line pictures there are 4320 elements or 2160 cycles per frame and inasmuch as all television broadcasters utilizing 60 lines have standardized on 20 frames per second this gives a top modulation frequency of 43,200 cycles which is still within the allowable frequency limit.

80 line pictures are composed of 7680 pictorial elements or 3840 cycles per frame and at 15 frames per second, which is the speed at which they are shown at the present time, the top frequency is 57,600 cycles per second. It is necessary to suppress all frequencies above 50,000 cycles on the standard 109 or 140 meter television channels while on the ultra short waves modulation frequencies are many times as high as 57,600 cycles can be used so we could expect slightly better pictures on the ultra short wave channels when such a large number of lines are used. However, at the present time successful amplification and demodulation or detection of ultra short waves still present some difficulties so the gain is not so apparent as might be expected.

As a closing example let us see what frequencies arise in the scanning of a 400 line picture just to convey some idea of the difficulties to be overcome. A 400 line picture contains 192,000 elements or 96,000 cycles per frame. At 24 frames per second this is 2,304,000 cycles. The pictorial detail will be increased by $(400 \div 80)^2$ or 25 times that of an 80 line picture, and over 75 times that of a 45 line picture. Inasmuch as the broadness of a transmitted wave is determined by the highest modulation frequency we can now see why television signals are so broad.

Among some of the problems to be overcome are:

1. Obtaining photoelectric cells or other light to current translating mediums which will faithfully respond to light changes having a frequency range from practically nothing to several million cycles.
2. Properly modulating a carrier frequency with this enormous band of modulation frequencies.
3. Reception, amplification and demodulation of this wide band of frequencies.
4. Obtaining a light source for the receiver scanning system which will respond faithfully to the same wide band of frequencies.

Doubtless the non-mechanical system of scanning for both transmission and reception will eventually be used in which the scanning beam will be some practically inertialess and lagless medium such as 10,000 volts to 25,000 volts or more, electrons similar to cathode rays.

On any one of these problems there is a tremendous field of research open to anyone with the enthusiasm and desire necessary to delve into unknown territory.



# PAD DESIGN TABLES

(Continued from page 6)

The formulae from which all the resistance given above may be computed are fairly simple, but this is not the case for pads which must work between dissimilar impedances. Since we now have two variables instead of one (i. e. both attenuation and impedance ratio) any reasonably complete table would be very bulky—besides requiring much more time for computation than I care to spend—so I have tabulated values for a few of the most useful pads of this type and have added a table of coefficients for what are probably the simplest of the several equivalent design formulae for this case. Anyway, if you're too lazy to substitute in a simple formula you don't need an impedance matching pad very much.

The rule given above for changing a T- to an H-pad holds here also, though care should be taken to keep the series resistances in the proper legs; i. e. the two input series resistances should be equal and also in the two output legs. The rule for changing the characteristic impedance will also work, but only if the required pad is to have the same input to output impedance ratio as the prototype. Thus a 200 to 20 ohm pad could be made up by taking a 500 to 50 ohm pad of the required attenuation and multiplying all of the resistance by 0.4, but a 200 to 50 ohm pad could not because the impedance ratio is not the same in the two cases.

It should be noted that there is a minimum possible loss for which this type of pad can be constructed, which depends on the impedance ratio. This loss varies from zero for a ratio of 1.0 to infinite loss for ratic zero, being 4.7 db for 0.75, 7.65 for 0.5, 11.4 for 0.25, 15.80 for 0.1, etc. For this reason some of the pads in Table II, are labeled "impossible," since their losses are less than the minimum corresponding to their impedance ratios

**Table II. Unsymmetrical T-Pads**

| Loss | 10 db | | | 20 db | | | 30 db | |
|---|---|---|---|---|---|---|---|---|
| | $R_6$ | $R_7$ | $R_8$ | $R_6$ | $R_7$ | $R_8$ | $R_6$ | $R_7$ | $R_8$ |
| 600\|200 ohms— | 388 | 22.0 | 222 | 446 | 140 | 63.9 | 480 | 180 | 20.2 |
| 600\|50 ohms | Impossible | | | 478 | 19.0 | 32.0 | 490 | 39.9 | 10.1 |
| 200\|50 ohms | Impossible | | | 184 | 30.8 | 20.2 | 194 | 43.6 | 6.40 |

**Table III. Design Formulae**

**Pad Type** — **Formulae**

Potentiometer

$$R_1 = Z_1 (1 - K)$$

$$R_2 = Z_1 K$$

L-Pad

$R_1$ same as for potentiometer

$$R_3 = Z_1 \frac{K}{(1 - K)}$$

$$R_4 = Z_1 \frac{(1 - K)}{(1 + K)}$$

Symmetrical T-Pad

$$R_5 = Z_1 \frac{2K}{(1 - K^2)}$$

$$R_6 = Z_1 P_1 — P_2 \sqrt{Z_1 Z_2}$$

Unsymmetrical T-Pad

$$R_7 = Z_2 P_1 — P_2 \sqrt{Z_1 Z_2}$$

$$R_8 = P_2 \sqrt{Z_1 Z_2}$$

The constants K, $P^1$ and $P^2$ in these formulae are tabulated below. It should be noted that K is the voltage (or current) ratio corresponding to the given attenuation, and can be taken from any db-voltage ratio table or log table.

| Loss, db | K | $P^1$ | $P^2$ |
|---|---|---|---|
| 1 | 0.891 | 8.68 | 8.68 |
| 2 | .794 | 4.42 | 4.30 |
| 3 | .708 | 3.02 | 2.86 |
| 4 | .631 | 2.32 | 2.10 |
| 5 | .562 | 1.94 | 1.64 |
| 6 | .501 | 1.67 | 1.34 |
| 7 | .447 | 1.45 | 1.04 |
| 8 | .398 | 1.38 | .940 |
| 9 | .355 | 1.28 | .800 |
| 10 | .316 | 1.22 | .704 |
| 11 | .282 | 1.17 | .615 |
| 12 | .251 | 1.12 | .540 |
| 13 | .224 | 1.10 | .475 |
| 14 | .200 | 1.08 | .420 |
| 15 | .178 | 1.06 | .368 |
| 16 | .156 | 1.04 | .326 |
| 17 | .141 | 1.03 | .289 |
| 18 | .126 | 1.03 | .256 |
| 19 | .112 | 1.02 | .227 |
| 20 | .100 | 1.02 | .202 |
| 25 | .0562 | 1.00 | .112 |
| 30 | .0316 | 1.00 | .064 |
| 35 | .0178 | 1.00 | .036 |

In conclusion, although all values have been given to three figures in the above tables it is not necessary to hold the actual values of the resistors used to a very high accuracy except in special cases. An error of 5 per cent in any one resistor will cause an impedance mismatch of not more than that amount—usuall less—and a loss variation of only half a db. Most commercial wire-wound resistors and many carbons and lavites are sufficiently close for all practical purposes. So go to it with my blessing, and if you want more dope of this kind I'll try to furnish it.

—BLACKIE.

DEC

## QUESTIONS AND ANSWERS

**Q. In what respect are litz coils superior to coils wound with solid wire?**
—J. B.

A. Assuming coils of a size and inductance suitable for use in a receiver, tests have shown that the RF resistance of litz coils is less at the lower BC frequencies and higher at the higher BC frequencies than similar coils wound with solid wire. This greatly facilitates the design of litz coils having the desirable "constant gain" characteristic across the BC band. Outside the BC band, solid wire is superior for short wave coils while litz is better for IF coils due to lower RF resistance under the respective conditions.

**Q. Is there any way a O-1 DC milliammeter can be made more sensitive?**
—M. C. D.

A. Since the sensitivity of a d'Arsonval type meter depends upon the strength of the permanent field magnet, the torque of the springs, and the ampere-turns in the moving coil, there is nothing that one who is not a skilled meter expert can do to increase the sensitivity unless by chance the meter happens to have an internal shunt. In that case removal of the shunt would increase the sensitivity.

**Q. How much will the voltage be raised by substituting a 5Z3 for an 80?**
—R. H.

A. 20 to 30 volts may usually be expected, depending upon the load and the design of the pack.

**Q. Why do high grade signal generators (oscillators) use tube modulation rather than self-modulation?**—V. K. H.

A. Self-modulation necessitates the use of a grid condenser and leak. This introduction of resistance to the grid circuit broadens the tuning of that circuit and therefore the signal. A separate tube modulator has the additional advantage that the percentage and frequency of modulation may be controlled at will.

## LOCAL DESIGN ENGINEER PROMISES ARTICLE FOR "TECHNICIAN"

Mr. Louis B. Brittain, chief engineer of the Herbert H. Horn Co., manufacturers of Tiffany-Tone radios, has promised to prepare an article of exceptional interest to appear in these pages in the near future. The Herbert Horn Company has announced a new 7 tube all-wave receiver designed by Mr. Brittain which is definite proof that Southern California is capable of producing radio equipment which is on a par with any other section of the country.

## A MODERN ANALYZER

(Continued from page 12)

switch is closed. Further protection is through the use of fuses, $F^1$, and $F^2$, in the meter circuits.

Switch S6 is used to read the current of either plate of a rectifier tube. To read the voltage on both plates place the tube in $TS^2$. From plate to ground gives A. C. volts applied to plate. From filament to ground gives D. C. out-put volts of the tube.

The cable wires are numbered from one to nine corresponding to the numbers on the sockets and selector switch with the exception of points 7, 8, 9 and 10 on the selector switch. No. 8 on the switch is the grid cap, 7 is the off position, 9 the position for continuity and resistance, and 10 the position for output voltmeter.

Details of construction, etc., may be obtained from the author.



DEC

# Comparison Between Class "A" and "B" Amplification

BY A. A. SIMON

A$^1$. When $V^2$ is a class "A" stage, $T^1$ is a voltage transformer.

(a) The current in the secondary of $T^1$ is negligible because the grids of $V^2$ never swing positive.

(b) Thus the size of wire for this secondary is as small as is practical to wind.

$$R_s = \frac{E_g}{I_g} = E_g \div 0 = \text{infinity}$$

A$^2$. When $V^2$ is a class "B" stage, $T^2$ is an impedance matching transformer and $V^1$ is a power amplifier stage.

(a) The current in the secondary of $T^1$ has a definite value, depending upon the time of excursion of the grid swing while it has a positive potential.

(b) The wire used on the secondary of $T^1$ must be heavy enough to safely carry the grid current pulses.

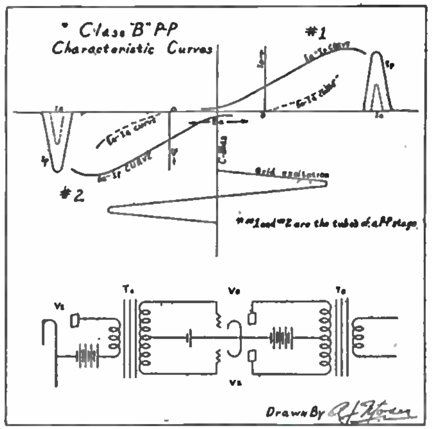
(c) The turns ratio of the impedance matching transformer is:

$$T = \frac{N_s}{N_p} = \sqrt{\frac{R_s}{R_p}}$$



B$^1$. In a class "A" stage of push-pull, the normal D. C. plate currents flowing in the plate circuit of each tube set up flux in the core of the transformer $T^2$ which are equal but of opposite polarity thereby neutralizing each other. Hence, since the possibility of core saturation is greatly reduced a small core may be used for $T^2$.

B$^2$. In a class "B" stage of push-push the normal D. C. plate current is zero, if the grids are not excited. When the




grids are excited, as shown below, a pulse of plate current flows for alternate half cycles, in the plate circuit of each tube. Since these pulses of plate current of each tube do not flow during the same half cycle each current will set up a strong D. C. field necessitating the use of a large core for $T^2$ in order to minimize the possibility of core saturation.

C. As was pointed out, the D. C. plate current remains practically constant in a class "A" push-pull stage regardless of volume input (grid excitation). However in a class "B" push-push stage the plate current increases with volume input, so the speaker field cannot be used in the plate supply circuit because its high resistance would cause fluctuations in B+ voltage as the plate current varied. Also, the internal resistance of the rectifier tube and its plate supply secondary of the power transformer, and all filter chokes, must be kept low in order to get the best possible regulation from the pack.



## NOTICE TO CONTRIBUTORS

Contributions to all departments are respectfully solicited. In order to avoid unnecessary complications in preparing copy for the printer, contributors are asked to observe the following suggestions:

Please use a separate sheet of paper for each classification of material.

Sign full name--initials are confusing.

Please use only one side of paper.

Type if possible, if not, be sure the handwriting is legible.

Please double-space.

Clearly indicate the nature of each contribution by classification title at the top of each page.

Arrange your diagrams so they conform to a square if possible.

Check your manuscript carefully for technical, grammatical and subject errors.

Strict adherence to the above suggestions will not only simplify transcription of the material submitted but will greatly reduce the possibility of errors and misconceptions of intent.

—The Editor.

## NEW MULTI-TAP REPLACEMENT TRANSFORMERS

The General Transformer Co. has introduced a new line of replacement power and audio transformers which are universal electrically, as well as physically. According to Mr. Bill Hitt, factory representative, over four hundred standard receivers may be serviced for audio and power transformer replacement with a stock of only six units. Mr. Hitt promises a technical article from the factory engineers of the General Transformer Co. in the near future which will appear in these columns.

## VOTE OF THANKS DUE NATIONAL SCHOOL

The Certified Radio Technicians Association certainly owes the National Radio and Electrical School a large vote of thanks for the extended use of the auditorium where we have been holding our regular meetings for the past several months. Through the courtesy of Mr. Rosenkrantz we have been allowed full use of the auditorium and extra class rooms for the accomodation of the men taking examinations.







DEC

DEC. 33



# RADIO CONDITIONS IN MEXICO

By LUIS LOPEZ ROMERO
Director of the Radio Technology Association

Radio in all places is a factor which not only gives joy to living, but has now gone so far as to be a vital commodity to every family and every person. In Mexico and countries south of the Rio Grande, the Latin Americans are not behind in accepting this wonder, the art of electronics. Conditions in these countries are slightly behind, the reason being, of course, the lack of sufficient expert radio talent and modern research laboratories. The ones that are installed are those owned by government or municipal authorities and they are for the sole purpose of developing naval radio beacons and weather radio stations. Only a few military bases are at the present experimenting with the popular five meter band for super-short wave telephone communication.

An outline of the status of the short wave amateur in Latin America is worth mentioning. Countless are the instances where radio amateurs rendered public service and emergency relief in moments of distress, and have proved that they are capable even if they are handicapped by the lack of advanced equipment. One proof is that here in Los Angeles there is a continuous stream of letters to our manufacturers and even retailers inquiring about parts, kits, data and installations on short wave equipment. Down there they are just beginning to feel the epidemic caused by the fatal sting of the "radio bug."

### Spanish Radio Language

Technical literature in the Spanish language for the radio man is also lacking. There was in Mexico City about a year ago, a distributor who attempted a monthly radio journal. It was said to be exclusively for radio but a couple of pages of cooking recipes were added!

Here in the United States several eastern factories are printing good pamphlets and data sheets in Spanish explaining their products, to supply the demands. When speaking of literature there comes to my mind a letter I once received. To translate all technical terms used in radio to the Spanish language has been rather difficult for they already have different electrical denominations which they have incorporated into the English radio terms and names. Just recently I received from a friend an interesting letter wherein he described the functioning of a duo-valve tube and believe me it was sort of concentrated—brief—in his entire paper not once did he mention English for his theory or notes on the tube elements.

The sales and market for American radio products in Latin America is, in my estimation, about even with the European products. There is a considerable variation in the international money exchanges but leaving the money value aside, the radio parts and broadcast receivers from the United States have more acceptance and there is a growing demand for them. Outside of "B" batteries, "A" cells and a very few cabinets everything else is imported into Mexico. Then, too, I want to say that if you happen to live in a town that is not one of the five largest in Mexico, and your radio goes on the "blink" you would have to send it by railroad to Mexico City and the charges are 15 pesos for examination only, parts and labor extra. Popular standard midgets run around 150 pesos and I won't try to make you believe what a new twenty record automatic panatrope costs (or a sixteen tube all-wave super with umpteen outstanding features described in nine syllable words.—Editor).

Season's greetings to all members of the Certified Radio Technicians Associations and I hope that there will be a closer bond of understanding between our radio minded Americas for the advancement of radio.



DEC

## NEW CITY OF LOS ANGELES ORDINANCES RELATING TO ELECTRIC REFRIGERATION

You should familarize yourself with ordinances No. 68,490, 69,856, 73,173 and 73,174, all of which have an important bearing on the sale, installation, repair and service and alterations to Electric Refrigerators.

Very quietly and mysteriously, these laws of Los Angeles were introduced and made operative through the selfish wish of some unknown parties.

In brief—every individual, firm or corporation selling, installing and servicing refrigerators, is regulated under these ordinances, and according to same is obliged to register with the Board of Building & safety Commissioners, and be issued by said Board, a Certificate as a "Refrigeration Contractor."

The annual fee for such license is \$25.00 and is renewable on July 1st of each year. At the present time, no examination is being made to establish the qualifications, ability or technical experience of each aplicant, but it is promised that before the next renewal date of July 1st, 1934, every applicant will be obliged to take a rigid examination (similar to the electricians and plumbers.)

In addition, every registration will have to provide a \$1,000 bond, payable to the City of Los Angeles, to cover any possible damages of any kind arising out of the work done by such licensee and for any infractions of existing ordinances. This annual bond will cost each applicant \$10.00.

Upon investigation, it has been stated that the intent of this license was to cover only SERVICE, REPAIRS and ALTERATIONS of refrigeration single units, multiple and remote installations. It has been stated that a retail merchant selling complete self unit refrigerators, and connecting same with electric system in home, will not be required to register or be licensed. Likewise if any SERVICE WORK is called for by user that does not require ANY disconnecting of the refrigerant line or system, will not require a licensed serviceman.

About 80 have already registered and been licensed. It is only necessary to have one registered and licensed man in an organization. The registration and bond covers the business house, either individual, firm or corporation.

Active supporters of these ordinances claim such control will eliminate the unreliable, irresponsible small individuals and firms who are not financed sufficiently to be responsible if damage claim is made. This seems to be a desire to eliminate only the small and financially weak operator and to favor the big and rich organizations. However, the weakness seems to be along the lines of insufficient examination of every applicant to determine his knowledge and ability to do efficient and qualified work.

If the chisler and faker who has a screw driver and plier and thinks he is a mechanic or refrigeration engineer, but actually has quite insufficient knowledge, was to be removed from business circulation because he could not pass a rigid examination, this would reduce accidents, hazards, damages, etc. In the manner operated now, any man, firm or corporation may register and be licensed if he can provide sufficient money to cover the fees.

This looks like a fine way to raise money for our City, for which they do practically nothing, and helps to further smother the small and financially weak, even though they may have equal or superior knowledge and technical ability.

Whether this is all wrong or right, we now have these laws and you are effected by them—so go at once to the Building Department of the Building & Safety Commission in the City Hall, register and be licensed and bonded, if, in your service, you come under the regulations.

—J. V. GUILFOYLE.





## SERVICE KINKS

A very successful condenser tester may be constructed by placing a tenth watt neon bulb in series with a D. C. voltage and touching the ends of the test prods to the condenser under test. If the condenser is good the neon will glow while the condenser is taking a charge and go out when the condenser is fully charged. The light should not glow again if prods are touched again to the condenser within 10 to 20 seconds. If the neon should glow after 10 seconds the condenser is leaky, and should be discarded. A 250,000 ohm resister is connected in parallel with the neon lamp. This tester is for paper condensers only. If properly constructed it is a very useful instrument to have on the bench.

Roy K. Tate.

When you come across a baffling case of interference at night causing a loud buzzing in the radio like a buzz-saw or powerful motor, drowning out all signals and which diminishes or vanishes when the antenna is disconnected, it may be a defective electric lamp. A simple test to determine this is to unscrew all the lighted lamps while the radio is playing. When one is found which when unscrewed will cause the noise to cease it is obviously the offending member. The lamps may appear O. K. but I have found several cases of severe interference which were traced to defective light bulbs.

—L. K.

Early model Peter Pans: If volume is low remove the 47 tube and if it is possible to hear KFI or KHJ, check the filter condensers for open-circuit.

—J. E. SCHINDLER.

Crosley 124. . . Burn out of the flexible resistor connected between the speaker socket and the screen grids of the output pentodes (47) is usually caused by a shorted untuned intermediate frequency coil. The short is usually located in the coil itself and is usually beyond repair and should be replaced with a new coil. Crosley part No. G.1-23034B. The resistor is a 750 ohm and the original should be replaced with one of not less than 5 watts capacity wire wound preferable.

Crosley 120, 121, 122, 123. Failure of the receiver to function on the low frequency end of the dial but satisfactory results are obtained on the high frequency end is usually attributed to a poor oscillator tube (24). It has been found a certain number of these tubes will check O. K. in the average tester but are poor oscillators.

Condenser replacements in Universal A. C. D. C. receivers should be made with condensers made with the high heat case. Due to intense heat radiated within this type receivers the cheaper condensers with the wax ends soon melt out and the receiver is again giving trouble.

—E. A. FREITAS.

### NEW AUDITORIUM SPEAKERS

The Lansing Manufacturing Co. has recently announced a new line of super-efficient auditorium dynamic speakers of exceptionally flat response characteristics and large power handling ability. The new speakers are commercially available either with or without built-in field supply.





DEC

# AN AUDIO OSCILLATOR

By JOHN A. ORME
Through the Courtesy of O. B. Carrier.

Some months ago while working out some special problems in sound recording a dependable audio oscillator became absolutely necessary to the progress of the work in hand. Previous to this time I had spent several months on audio oscillators of various types (straight audio oscillators, beat-frequency oscillators and dynatrons with temperature control were all discarded because of inherent shortcomings.) True, some of these faults would be of no consequence in the ordinary uses for which an oscillator is required but in this case the ultimate in audio generators was required. Absolute frequency stability was the first essential. Minimum harmonic content was a close second and a reasonably flat curve was the third consideration. Coupled with these characteristics it was necessary to be able to vary the frequency with reasonable ease from the lowest to the highest frequency and as both time and money were getting short not too much of either could be spent on this part of the problem. In the midst of my dilemma it became necessary to run a curve on a Carrier Microphone which we were using. While Mr. Carrier was running a calibration curve on the microphone I became attracted to his audio oscillator and asked for the circuit diagram. I publish this article with the permission and cooperation of Mr. O. B. Carrier, of the Carrier Microphone Company of Inglewood. This oscillator is the result of long and trying research on his part and I take no credit for any of the design but I have made some changes which made it better for my own particular problems.

It is suggested that it be built strictly according to the circuit diagram first and that the changes be made later if any are found necessary. The builder will save much time in the construction of this oscillator if he will use the transformers specified as they have been chosen for their characteristics and while I am not so bold as to say they are the only transformers which may be used neither Mr. Carrier nor myself have found any others which quite suited the requirements. A second hint is that to begin with, no attempt should be made to operate this oscillator with alternating current. For some work this may be permissable, but if the output is to be used for any kind of measurements this is definitely prohibited as the slightest amount of hum will throw all voltage measurements off, introduce beats which destroy the wave form and cause harmonics which render measurements valueless.

I made one slight change in the arrangement which made the entire range easy to cover with two revolutions of the dial. True, this is one more revolution of the dial than is required with a beat-frequency oscillator but the wave form and the absence of harmonics more than offset this and to anyone who has used the ordinary audio oscillator with fixed condensers for variation of the frequency the ease of operation of this oscillator is at once apparent.

The main frequency control is a 700,000 ohm potentiometer the frequency is varied from the lowest point up to the middle range in one revolution of this control and the switch is then thrown to the high side and the rest of the range covered by starting with the control as at first. The variable condenser acts as a fine adjustment on the high frequencies. By using a potentiometer from which the stop has been removed and mounting the change-over switch near the main control it no longer becomes necessary to return the potentiometer to zero through the entire arc and an auxiliary lever may be mounted on the shaft to throw the switch from low to high and vice-versa so that the entire range is swept with two revolutions of the dial.

Another precaution is that no change should be made in the method of obtaining bias on the tubes. The bias voltage is developed in the series filament resistor in the negative side of the filaments. Needless to say the condensers used must be of the best non-inductive types and it is recommended that they be tested for leakage in series with 250 volts of well filtered direct current and a neon lamp. Discard any condenser which shows even the slightest glow after the charging flash.

(Continued on next page)

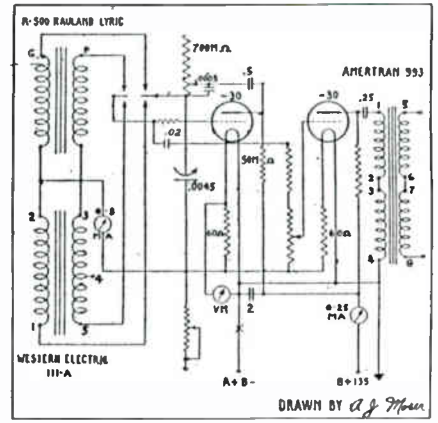


## AN AUDIO OSCILLATOR

The list of parts is as follows:

1—Western Electric—111A transformer (used in the 7a Amplifier).
1—Rauland Lyric Transformer R500.
1—Amertran 993.
1—700,000 ohm resistor (special variable Electrad Royalty).
1—General Radio .0045 variable condenser.
2—230 tubes.
2—50,000 ohm resistors.
1—500,000 ohm variable resistor.
1—500,000 ohm fixed resistor.
1—2500 ohm fixed resistor.
1—.0005 fixed condenser.
1—.5 mfd. condenser.
1—.25 mfd. condenser.
1—2.0 mfd. condenser.
1—30 ohm rheostat.
2—60 ohm filament resistors.
2—UX sockets.
1—H & H D. P. D. T. switch.
1—filament switch.
2—dials
1—chassis
1—panel
1—0-5 milliammeter (optional)
1—0-25 milliammeter (optional).
1—0-6 voltmeter (optional).
1—6 volt "A" battery.
3—45 volt "B" batteries.

The frequency stability of this oscillator is all that could be asked for. The frequency calibration of the dial remains constant and fixed month after month. Beat-frequency oscillators have the distressing habit of wobbling on the lows and unless very painstaking filtering and shielding is done, the two oscillators pull into resonance with the result that there will be no output. This oscillator has been checked with a neon lamp and a stroboscope at 5 cycles per second over a period of 14 hours without preceptible variation. Battery voltages are not critical but they should be maintained within 10 volts for the "B's" and the "A" should be above 5 volts. No recalibration has been necessary with a change of tubes. The output is very nearly constant over the band which is from about three to 9000 cycles. While I have no means of determining the exact harmonic content it is quite satisfactory for the work for which it has been used. The wave form on a phonograph recording wax is quite satisfactory. There may be oscillators which are easier to operate and have all the other desirable features that this one has, but the chances are ten to one that they are beyond the reach of the average radio shop in cost or constructional difficulties.




The operation is as follows: With the filament at 2 volts and the 0-5 milliammeter indicating oscillation the frequency should be very low when the R500 transformer is in the circuit and there is a minimum of the 700,000 ohm resistor in the circuit. On the low side the variable condenser will make no difference. If the 700,000 ohm resistor is now turned to maximum the frequency will rise to about 3000 cycles. To cover the high range the 111A transformer is switched in with the variable at zero and no resistance in the main control, the frequency should start at nearly the same point where the other transformer left off. The resistance is now turned to the full position. About 2000 cycles will be added to the range by adding the capacity of the variable condenser. If there is a gap between the two ranges this may be closed by adding capacity across 1 and 4 on the 111A transformer. If, on the other hand, the ranges overlap, capacity added across G and P on the R500 transformer will remedy the difficulty. The output curve may be flattened by a tone control in the plate of the amplifier as it will be found that the highs are more powerful if the proper precautions are taken to eliminate stray capacities.

In a subsequent issue the method of calibration and a direct reading frequency meter for audio frequencies will be given.



DEC

## ARCTURUS TUBES USED IN STRATOSPHERE FLIGHT

From Radio Press, Newark, N. J.

In the history-making ascent into the cosmic region by Lt. Com. T. W. G. Settle and Major C. L. Fordney, Arcturus Tubes were used in the stratosphere-cosmic ray meters. This extremely sensitive equipment was used in making important measurements miles above this earth, an area practically unknown to scientists.

On Arcturus Tubes, manufactured by the Arcturus Radio Tube Company, Newark, N. J., depended the success of these intricate observations. It is believed that a record for altitude performance of radio tubes was established in this flight, as well as a record for altitude—a tribute to the precision and efficiency of radio tubes as manufactured today.

### REPLACEMENT PRICE LIST

Mr. Eddie Frietas, on behalf of A. E. Ravenscroft, presented the members and guests of the CRT at the regular meeting Monday, December 4, with copies of list price quotations on all standard replacement parts such as condensers, resistors, and voltage dividers.

## TO ALL NON-MEMBERS OF THE CRT

Elsewhere in this issue you will find a brief account of the aims and purposes of this association and various accounts of our activities. We solicit members who are actively engaged in technical radio pursuits and who are interested in assisting themselves, through cooperating with others, to rise above the treacherous lowlands of the oft-mentioned depression and advance the radio art as a profession, and themselves as technicians. You are cordially invited to attend our meetings and instructive lectures and learn more of our efforts to progress through concerted action and united strength. By calling any of the directors of the Association whose phone numbers are found in this issue, you may determine the location, time, and attractions of our next meeting.

### STOLEN RADIOS

Philco Model 19B, No. J34175, Baby Grand Table model with shadow tuning. Philco Auto Radio, Model 5, No. K14257. Was, or still is, in the possession of Mr. Douglas Swanson. Installed in a Moon sedan, 1925 model, license No. 3N9469.





## NEW INTERFERENCE ASSOCIATION FORMED

Since the dissolution of the Radio Music Trades Association, the work of the interference department has been valiantly carried on under the direction of Mr. Grimes with Mr. J. V. Guilfoyle acting as unpaid secretary. The entire expense of carrying on this work has been borne by the various public utilities, and the least that we members of the radio industry can do, is to support morally and with action this work which benefits not only the radio trade but the entire listening public.

On December 6, 1933 the Radio Trades Engineering Association was formed into a permanent organization with Mr. Juneau of the Broadcaster's Association, as president, Mr. Panter of the Bureau of Power and Light, as vice-president, and Mr. Grimes, the chief engineer of the organization, also holding the office of secretary-treasurer.

With the millions of electrical appliances such as vacuum cleaners, heating pads, traffic signals, diathermy machines, neon signs, etc., in use today, radio reception would be practically impossible without some agency for the tracking down and elimination of so-called "man-made" static.

It behooves us as technicians whose livilihood is directly dependent upon the ability of the listener-in to receive satisfactory performance from his radio receiving set, to aid in every manner possible, Mr. Grimes and his assistants in clearing up such interference as develops from time to time. We can best accomplish this, first, by seeing to it that every receiving set with which we come in contact is properly installed with a good ground and an outside antenna which should be kept as far as possible from surrounding objects. Secondly, we can cooperate in this work by first making absolutely certain when a complaint of interference is received, that the source of the noise is not in the set itself. This can best be accomplished by taking a small portable super-heterodyne receiver, known to be in good condition, into the home from which the complaint was received, and noting if the same noise is also present in the output of this instrument. Lastly, a log showing the approximate time and duration of the interfering noise should be obtained from the customer extending over a period of several days.

If this information is then relayed to Mr. Grimes, it will save much time and money for the Radio Trades Engineering Association, and this is of vital importance at this time of economic stress.

The foregoing precautions will eliminate the many needless calls which have been made by the engineers of the association in the past to homes where interference was reported and which upon analysis proved to be receiver trouble.

Each branch of the radio industry is represented upon the board of directors of the Radio Trades Engineering Association and I, as your President, represent the technicians branch, and inasmuch as it is impossible for us to support this work financially at this time, the least we can do is support it by lightening the work of the engineers whenever possible, and by helping publicize to the trade and to the public the efforts of the Association.

A. PAUL, Jr.
President CRT

(As a result of Mr. Paul's ten years experience as an engineer with Western Electric, he is particularly well qualified to assist in shaping the destinies of this Association. It is indeed fortunate for everyone concerned that Mr. Paul is a member of the Board of Directors of the Radio Trades Engineering Association.—Editor.)



DEC

### THANKS

We are indebted to Mr. Thomas B. Pritchard, Southern California distributor of Arcturus Tubes, for the splendid article, "The Five Meter Band," a three part technical treatise on this absorbing subject which begins in this issue. The article was especially prepared and written for the "TECHNICIAN" by Mr. J. J. Glauber, chief engineer of the Arcturus Tube Company, at the request of Mr. Pritchard.

Mr. Pritchard has been and is one of our most earnest supporters in word, act and spirit. We wish to express our sincere appreciation of his kind cooperation and support.

### NOTICE TO ADVERTISERS AND THEIR PATRONS

Beginning with this issue each advertiser will be furnished with suitable cards to display in the proper places which will signify that the holder of the card has advertised in the "TECHNICIAN" for the month shown on the card. Advertisers will place these cards in their windows and on their counters. Technicians are urged to patronize only those firms whose advertisements appear in these pages. These men are soliciting your business and are supporting your efforts to progress—it is only fair to reciprocate by giving your business exclusively to those who evidence a willingness to help us.

### YULETIDE GREETINGS TO OUR ADVERTISERS

On behalf of the membership of the Certified Radio Technicians Association, the officers and Board of Directors and the editor of the "TECHNICIAN" wish to take this opportunity to express our best wishes for a Merry Christmas and a very successful and prosperous year to come. We sincerely appreciate your support in word and act in the past and we shall make every effort to deserve your continued cooperation during the years to come and the attendant progress in the radio field.





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# Classified Directory

JOHN A. ORME, Adv. Mgr.
Phone ATlantic 9501

### For Sale—

We have a few 60 cycle 900 RPM synchronous Television Motors on hand. Made expressly for Don Lee reception. Price very reasonable. Phone or write to E. B. Dunn Co., 3948 Halldale Ave., Los Angeles. UNiversity 4938.

### Wanted—

Used 203A, 866, 2000 volt condensers, 10A and 15 henry 300 mil. chokes. Box X-1, c|o the "TECHNICIAN."

Cash paid for stamp collections. H. I. O'Brien. 1348 E. Colorado Boulevard, Glendale.

Precision Laboratory measuring equipment. Box X-2, c|o The "TECHNICIAN."

Three foot trumpets and dynamic units, new or used. Box X-3, c|o The "TECHNICIAN."

Weston model 301 0-10 ampere meter and decade resistance box. Fox and Racon Dynamic Horn Units. Norman B. Neely, ALbany 1628.

### For Sale or Trade—

One Weston 0-4 A. C. Voltmeter, like new. One Weston 0-19 D. C. Milliammeter. Roy K. Tate.

Rider's Manual No. 1. Will sell at half price or trade for what have you? H. I. O'Brien, 1348 E. Colorado Blvd., Glendale.

Weston Model 301 meters—0-15 voltmeter, 0-30 Milliammeter, 0-1.5 milliammeter (multi-scale). Norman B. Neely, ALbany 1628.

Readrite analyzer for sale or trade. H. I. O'Brien, 1348 E. Colorado Blvd., Glendale.

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