KENYON ENGINEERING NEWS

DEVOTED ENTIRELY TO THE AMATEUR, SERVICE ENGINEER SOUND TECHNICIAN AND THE EXPERIMENTER

Vol. I No. 2

THE LIVE WIRE IN RADIO

FEATURES

A NEW UNIVERSAL
POWER TRANSFORMER

PRACTICAL
CATHODE RAY OSCILLOGRAPH

PORTABLE TRANSMITTER

"T" PAD KEN-O-GRAF

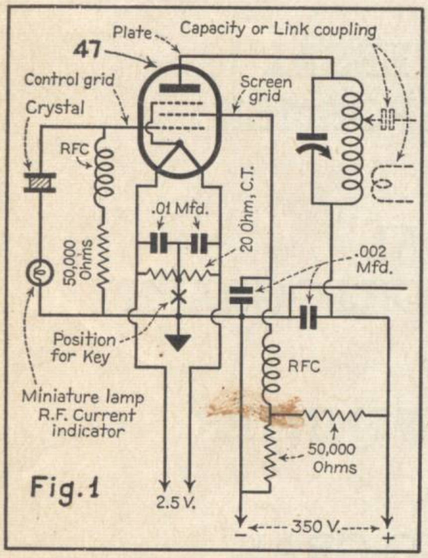
COMPLETE CATALOG OF
NEW AUDIO and POWER COMPONENTS

R-F OPERATION OF SCREEN-GRID TUBES

Notes on the Application of Tetrodes and Pentodes to Amateur Transmitters.

Screen-grid tubes are old in amateur practice as anyone who made use of the 865 at its introduction will testify. The general use of the screen-grid tube in the amateur transmitter did not become common, however, until the advantages of the 47 as a crystal oscillator were discovered, and the greatest step of all came with the introduction of suppressor-grid modulation to American amateurs by James Lamb in the early part of 1934. The tritet oscillator using a 59 had the advantages of a pentode screen-grid tube such as the 59. This had already been made known by Lamb and are important steps in the history of amateur transmitter development. Screen grid tubes of both the tetrode and pentode types were in common use in Europe before their introduction here and suppressor-grid modulation was first introduced there. The application of the tubes and this type of modulation to amateur radio can be credited to amateurs on this continent.

Tetrode tubes differ from triode types in that a grid known as a screen is inserted in the tube structure between the control grid and the plate. This grid, of relatively fine pitch in tubes used solely for R-F amplification, is normally by-passed to the filament or cathode so that the screen circuit contains no R-F impedance. Under these conditions the screen is an efficient electrostatic shield between the grid and plate



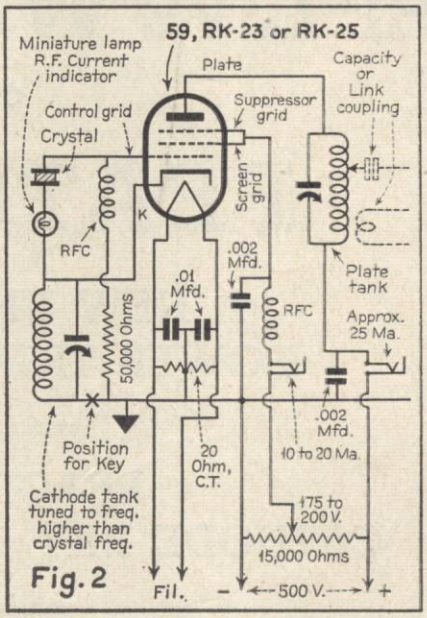
Simple Pentode Crystal Controlled Oscillator

and through the elimination of electrostatic lines of force from plate to grid, the control grid to plate capacitance is made a very small fraction of its value without the screen-grid. It has been pointed out in numerous texts that a tetrode with the screen by-passed so that it has no impedance in the external circuit is equivalent to a triode. An equivalent triode would be far beyond anything we now have along lines of conventional tube construction, however.

An examination of the family of plate-current curves for a tetrode (the old type 224 is a good example) will show that, for a fixed value of screen-grid voltage, there is little change in plate current after a plate voltage somewhat higher than the screen voltage is reached. Through the region where the plate voltage passes from a value less than the screen-grid voltage to a value above it a dip will be observed in the plate current curve for each value of control grid bias voltage.

Secondary Emission

This characteristic of the tetrode tube is caused by secondary emission from the plate surface and is made to serve a useful purpose in the dynatron oscillator. Under these conditions where the screen voltage is higher than the plate voltage, the electrons passing through the screen-grid to the plate dislodge electrons at the plate.



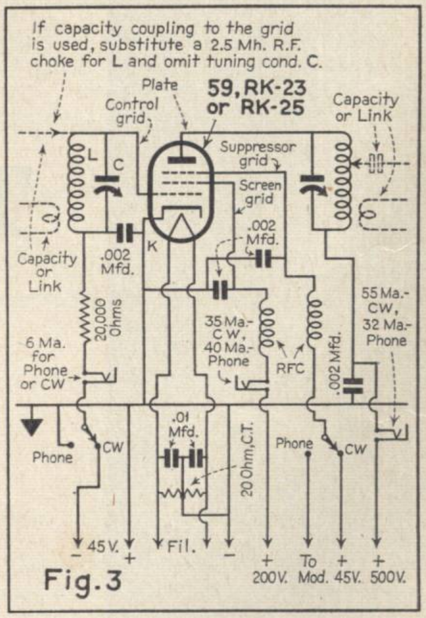
The Tritet Pentode Crystal Oscillator Current

These secondary electrons thus made free from the plate metal are more attracted by the screen than by the plate because of the higher screen-grid voltage. Therefore, the secondary electrons flow inward to the screen. In receivers, secondary emission cannot be tolerated. To eliminate this characteristic in tetrodes, those already designed were changed, principally by the substitution of carbonized nickel for bright nickel in the plate. As a result of this and other corrective changes, there are few tubes available today for dynatron oscillator use.

One very important advantage gained by the insertion of a screen-grid between the plate and control grid of a tube is an enormous gain in the voltage amplification of the tube. This applies to the tetrode as well as the pentode.

The Pentode

The pentode is the familiar tetrode with an additional grid placed between the screen-grid and the plate. This third grid is usually connected to the cathode, as in the 2A5, 41 and 42, or to the filament, as in the 47 or 33. The primary purpose of the third grid is to reduce secondary emission from the plate by placing a zero voltage barrier in front of the plate. The pitch of a suppressor-grid, as the third grid is called, is necessarily coarse to limit the effect of the grid on the flow of electrons



Low Power R-F Pentode Amplifier

from filament or cathode to the plate. In other words, the addition of the third grid at cathode potential does not greatly affect the plate resistance.

In suppressor-grid modulation, the possibility of changing the plate resistance over wide limits is used. The suppressor-grid, if by-passed to the cathode, or if connected directly to the cathode, aids the screen-grid in shielding the control grid from the plate and so makes a further reduction in the control grid to plate capacitance.

In a receiver, with the conditions strictly Class A, the control grid of a tetrode or pentode is never positive and in general remains slightly negative on signals which provide the widest grid swing. Here, the screen-grid current averages not more than 15% to 20% of the plate current. In oscillator or R-F amplifier service under Class C conditions where the control grid becomes positive for a fraction of a cycle the ratio of screen-grid current to plate current increases so that the screen current may be 50% or 60% as great as the plate current. In both of these cases, the screen-grid operates at a voltage from one-half to one-third the plate voltage.

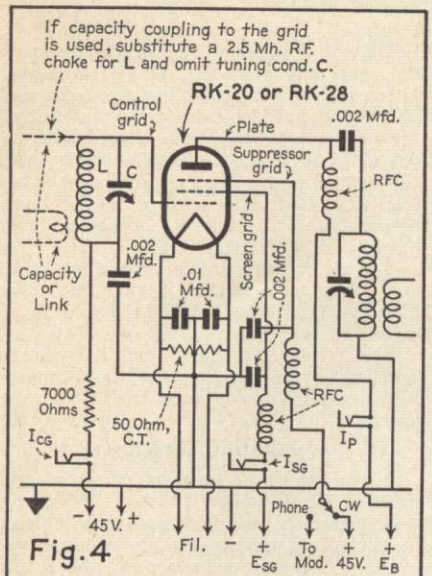


Fig. 4

CW	E_B	I_P	E_{SG}	I_{SG}	I_{CG}	
RK-20	1250	92	300	32	7	
RK-28	2000	140	400	60	11	
SUPP. MOD. PHONE						SUPP. G.V.
RK-20	1250	43	300	36	7	−45
RK-28	2000	80	400	85	11	−50

Power R-F Pentode Amplifier

The discussion of the circuits shown can be limited because all of them are familiar to most amateurs and all have been shown from time to time in construction articles. It is hoped that the comments which follow may be of some value in the practical operation of the screen-grid tubes shown in the diagrams.

Straight 47 Crystal

Fig. 1 shows a type 47 pentode connected in the conventional straight crystal oscillator circuit. As indicated, the circuit is not adapted to doubling. A variation, used successfully over a long period of time by WIGBE has an additional plate tank tuned to twice the crystal frequency placed in series with the regular plate tank which, of course, tunes approximately to the crystal frequency. A tap from the plate end of the harmonic tank provides excitation at double frequency. It will be noted that a miniature lamp is shown connected directly in series with the crystal. This lamp, which can be a flashlight lamp or a dial lamp of the brown bead type (6V., 150 ma.) should be precalibrated by passing battery current through it and noting the brilliancy for steps of current in milliamperes up to approximately 100 ma.

When in circuit in series with the crystal, the lamp will provide a sufficiently accurate measure of R-F crystal current to warn against overloading. This arrangement has been used by many amateurs and the lamp resistance does not seem to affect crystal performance appreciably.

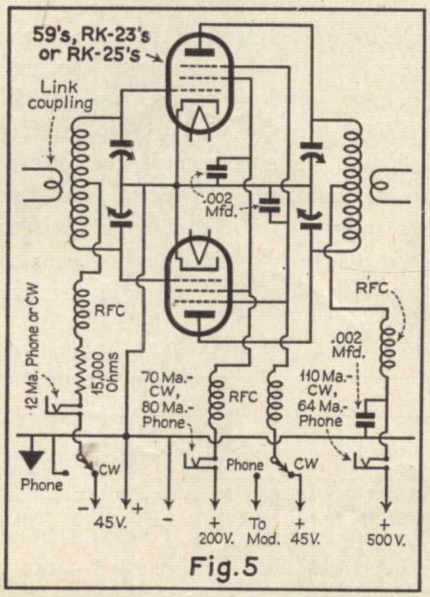
The Tritet

Fig. 2 shows the familiar Tritet circuit introduced by James Lamb. A great deal has been written about the Tritet and it stands out as an ideal arrangement among the circuits available for amateur use. If used as frequency-multiplying oscillator, the 59 works satisfactorily. Where operation as a straight oscillator is desired, with the plate tank tuned to approximately the crystal frequency, tubes having less grid-plate capacitance must be used. Such tubes were not available when the Tritet circuit was announced but they are today and are recommended over the 59 unless type 59 tubes tested for R-F output are available.

Of prime importance is the L/C ratio of the cathode tank circuit; the larger the capacity is made, the better the harmonic output. Most of the mediocre results are often traceable to failure to observe this important specification.

Trouble with this circuit can almost invariably be traced to a 59 tube which may be perfectly satisfactory in an audio circuit. The R-F losses due to getter material deposited on the stem, or even to the type of getter used may be responsible. It will be noted that the cathode is "hot" or carries an R-F potential. Across the cathode tuned circuit is the capacity between the heater and the cathode, but this amounts to only 4 to 5 micromicrofarads and is of little consequence. Heater-cathode leakage, if large, would affect operation and an inactive 59 should be checked for this defect.

It will be noted that a miniature lamp is shown in series with the crystal. Since the adjustment of the cathode tank circuit is used to control excitation, it is highly desirable to have some knowledge of the crystal current and the lamp will be found helpful.



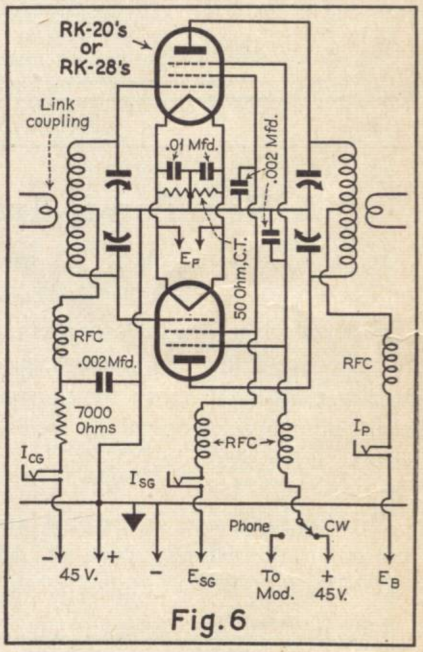
Push-Pull Low Power Pentode Amplifier

R-F Amplifiers

Figs. 3, 4, 5 and 6 show arrangements in which pentodes are used as R-F amplifiers. All of the tubes can be used as doublers but the 59 is not recommended for buffer service because of its relatively high grid plate capacitance.

The approximate values of current which should flow in each circuit are shown on the diagrams. The excitation should be sufficient to produce at least the current shown for the control grid circuit. With this excitation, the screen-grid current will have a value approximately as shown and it should be possible to loop the plate circuit to the current value indicated.

Over-excitation is fully as bad as under-excitation in a pentode used as an R-F amplifier. This is true because the screen-grid circuit contains no impedance to R-F and over-excitation increases the flow of screen current to values which cause overheating of the screen and the waste of considerable power. The most noticeable effect of over-excitation is a loss of power in the plate circuit due to the diverting of more than the proper share of the available filament or cathode electrons to the screen circuit. Thus, it may be seen that the screen grid current is a good indicator of proper excitation.



Push-Pull Power R-F Pentode. Values of Icg, Isg and Ip are twice corresponding current values shown in the Tables of Fig. 4. All voltages the same.

Biasing

In Figs. 3 and 5, a switch is shown in the control-grid return circuit arranged to connect the grid leak either to ground or phone or to 45 volts negative for CW. The purpose is to bring the plate and screen current to zero when the excitation is removed as in oscillator keying. Where the plate and screen voltage is cut off by the key, the grid leak can be connected direct to ground. Figs. 4 and 6, which show power arrangements, call for a fixed negative bias of 45 volts in addition to the bias developed across the grid leak. This is advisable since high voltages are used on the plate and loss of excitation would permit an undesirable high plate and screen current. While covering the subject of control-grid bias, it might be pointed out that the bias voltage required is determined by the screen-grid voltage rather than the plate voltage. Practically all of the R-F pentodes now available to the amateur are so designed that the best control-grid bias is approximately 100 volts negative.

The coupling of the load to the plate circuit should be adjusted so that a noticeable dip occurs when the plate tuning condenser is adjusted through resonance. If the control-grid current and screen-grid current values are about as shown in the diagrams, indicating ample excitation, and the plate current fails to dip when the tank circuit is tuned through resonance, the load coupling is too tight. Loosening the plate load coupling together with retuning the plate tank will provide higher-R-F output at a lower plate current.

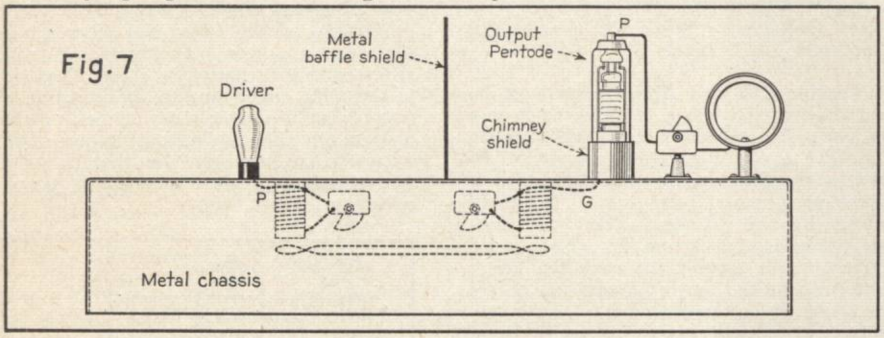
Shielding

Fig. 7 shows one desirable way to shield the input circuit of a pentode from the output circuit. With either link or capacity coupling, the plate circuit of the driver stage must be considered *a part of the input circuit of the following stage.* Therefore, the plate tank of the driver should be shielded from the field around the plate of a power pentode. This electrostatic field surrounding the plate is strong enough to light a neon lamp within three inches and to produce feedback effects at a much greater distance. The higher the operating frequency, the stronger this coupling effect becomes.

The collar surrounding the lower part of the tube and extending up to the lower internal shield should clear the bulk wall by at least one-sixteenth inch. No shielding of any kind should be placed close to the plate or at the plate end of the tube. Close shielding at these points would interfere with heat radiation and might cause destruction of the tube if a flashover from plate to shield should occur.

While the baffle shield shown in Fig. 7 may not be required on frequencies below 15 megacycles, such a shield would be of value at ten meters.

The by-pass condensers and R-F chokes associated with the screen-grid and supressor circuits should be mounted at the tube socket.



Pentode Amplifier Shielding

Oscillation Troubles

In closing this discussion of screen-grid tube circuits it might be well to suggest that suppressor grid modulation is difficult to control at frequencies above 30 megacycles and is not recommended above this frequency. Also, oscillation trouble can almost always be traced to poor shielding, insufficient control-grid bias, defective R-F chokes, or the use of electrolytic or paper by-pass condensers instead of mica.

A New Power Transformer For Use in 913 Oscillograph Circuits

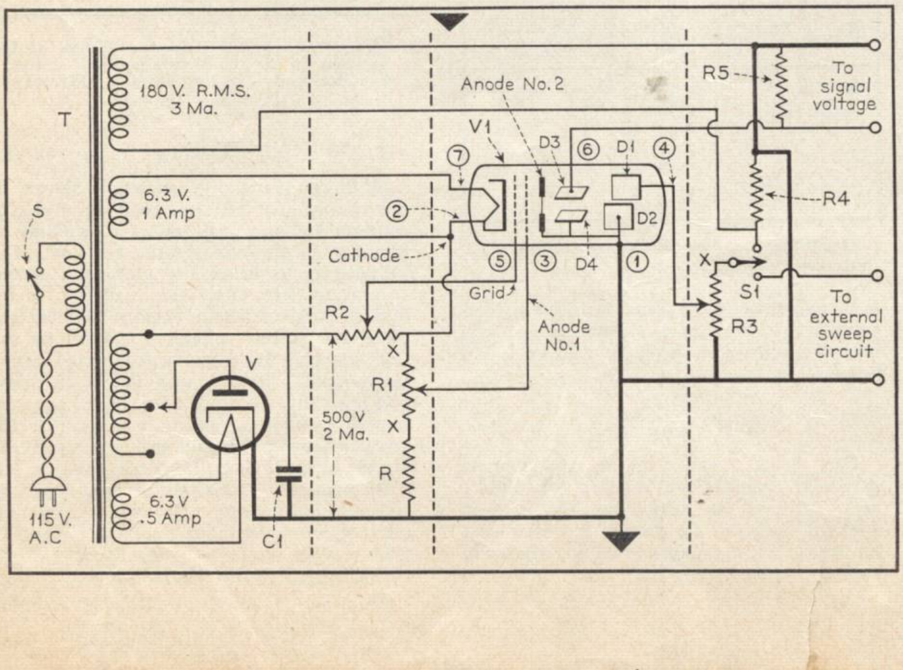
With the introduction of the 913 miniature cathode ray tube, the Kenyon Transformer Co., Inc., are pleased to announce a low cost power transformer specially designed for the various circuits encountered in oscillography using this tube.

The circuit shown below has appeared in the January issue of All Wave Radio. In the original schematic that appeared in All Wave Radio the switch connecting the plate of the rectifier tube to one side of the high voltage winding of the type T-207 power transformer was incorrectly shown. The corrected schematic is as shown below. While this circuit is entirely simple it commends itself to the majority of applications used in amateur radio, P. A. work and service work.

A variety of circuits utilizing this tube with linear sweep circuit and other variations have appeared in the following magazines:

Q. S. T., January, 1937
Radio News, January, 1937
Radio Craft, February, 1937
Short Wave and Television, March, 1937

In circuits requiring a synchronizing transformer use transformer type T-1.



COMPLETE LIST OF PARTS

R — 1.5-megohm, ½ watt resistor
R_1 — 0.5-megohm potentiometer
R_2 — 0.5-megohm potentiometer
R_3 — 0.5-megohm potentiometer
R_4 — 0.5-megohm, ½ watt resistor
R_5 — 10 megohm, ½ watt resistor
C_1 — 4-mfd., 600 volt condenser
T — Kenyon type T-207 cathode-ray transformer
V — Type 1-V half-wave rectifier tube
V_1 — Type 913 cathode-ray tube
1 — Cabinet
1 — SPST toggle switch—S
1 — SPDT toggle switch—S1
3 — Small control knobs
1 — Swivel mounting for 913 tube
1 — Octal tube socket
1 — Wafer socket, 4-prong
4 — Binding posts
1 — Line cord and plug

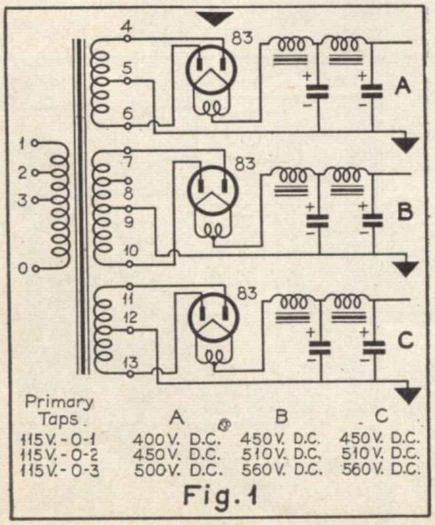
The Practical Solution To The Power Supply Problem

PROBABLY the biggest bug-a-boo in radio is the ever-existing menace of obsolescence. Of course, in such a modern industry new developments are constantly being born, and the older methods are soon discarded to make room for the later developments.

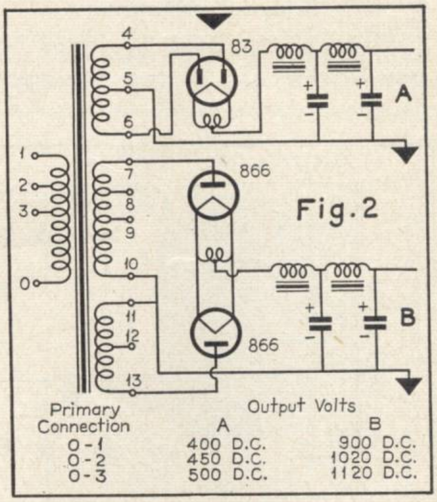
However, from the experimenter's point of view, obsolescence is quite expensive, especially when it involves the discarding of perfectly good equipment. New tubes are superior to existing types, but due to different voltages and circuit applications, changes in associated equipment are often necessary. In many instances the changes in r.f. and audio circuits are inexpensive. Moreover, a change in these circuits usually necessitates a change in the power supply. This is often the most expensive unit in the entire circuit, regardless of the application.

Universal Transformer

In transmitters or high-power public-address systems the low-power tubes require exceptionally good filtering to keep hum level as low as is consistent with good practice. If these low-level stages derive their voltage supply from the high-voltage system it is necessary to thoroughly filter the entire power supply, not only to eliminate hum but also to prevent feedback. Of course, this may be eliminated by filtering a small section that supplies only the lower level tubes. This method, however, jeopardizes condensers and resistors should the load be removed from this section.



Multiple-voltage power-supply circuits using type 83 rectifiers and operating from a single power transformer (filament transformer separate.)



High- and low-voltage power supply using a single 83 and two 866s in full-wave connection, both circuits supplied from a single power transformer (filament supplies separate).

Another method to eliminate this hazard is to use a separate transformer for the input or low-level stages. The drawback to this procedure is the excessive cost and is therefore not usually practical.

The answer lies in the use of a new type of transformer that permits any existing type of rectification in a practical and economical manner.

Voltages Available

The voltages available from this transformer range from 400 volts up to 3000 volts depending upon the type of circuit used. In the schematic (Fig. 1) three separate d.c. supplies ranging from 400 to 560 volts may be obtained. By means of a primary tap these voltages may be varied approximately 12 per cent. This circuit will supply adequate power to three separate audio or r.f. units.

In applications where it is necessary to have a separate low voltage and a high voltage, the circuit shown in Fig. 2, utilizing two 866 tubes and a type 83, is not only economical but very practical for many uses in amateur transmitters and experimental circuits.

Fig. 3 shows a similar application with the exception that the high-voltage supply is obtained from three low cost 83 type tubes in a bridge arrangement. In this application the high voltage supply delivers 140% of full wave rated value. The same voltages are also obtainable in Fig. 4. In this circuit the center tap of one of the high-voltage windings is connected to the filament of a type 83 tube, thereby forming a series connection.

By far the most versatile circuit is shown in Fig. 5. A single 83 is used for low voltage and two 866's connected for full-wave rectification supply the high voltage. Usually when this circuit is used in existing equipment two power transformers are required to accomplish what one will do with this new transformer.

Where higher voltages are desired the circuit of Fig. 6 may be used. This arrangement will supply a d.c. voltage as high as 1020 volts. In a circuit where such high voltages are used it is common practice to supply a lower power stage with a lower voltage. This is obtained from a separate winding using a type 83 full-wave rectifier.

High Voltages

For maximum volts per dollar expended the circuit of Fig. 7 is ideal for those whose pocketbooks are limited. A glance shows two of the high voltage windings connected in series. For rectification two type 83 tubes are connected in tandem. Low voltage is obtained from the other winding with another 83 tube. When it is not desired to utilize the low voltage the three windings may be connected in series. When used as shown in Fig. 8, with two 866 tubes, voltages ranging from 1300 to 1620 volts are procurable.

A still cheaper method of obtaining the same voltages is shown in Fig. 9. Here the outputs of three type 83 tubes are connected in series. In this circuit it is essential that the filament transformer supplying the 83 tubes be adequately insulated to withstand the high voltages.

Perhaps surpassing all circuits shown is the application in Fig. 10. In this circuit 21 different voltages are available. In transmitter use there is sufficient power available to supply anything from a five-watter up to a 500-watt rig. In addition to this a separate low-voltage supply may be taken off of the secondary winding marked 4, 5 and 6, when the high-voltage requirements are not over 2240 volts.

The above application refers to our triple winding power transformers, Type T658 and Type T659. Transformer T658 is rated to supply 175 MA. from each winding. Transformer T659 is similar to the above but designed for heavier current supplies. This unit will supply 350 MA. from each winding.

Another transformer similar to these units is Type T654. This unit is also a triple winding plate transformer which delivers 250 MA. from each winding. However, the voltages available from this unit differ as shown below.

T658-T659	T654
520-0-520	490-0-490
570-0-570	630-0-630
570-0-570	630-0-630

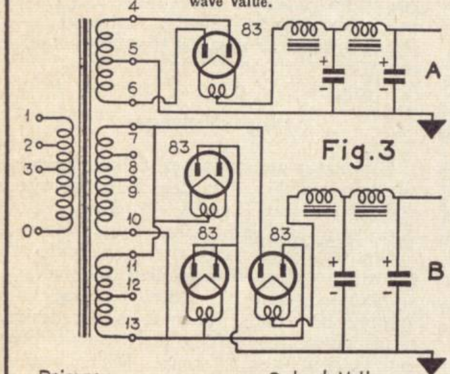
Thus it is seen that the 490 volt winding supplies rectified voltages 7% lower and the 630 volt windings 11% higher than the voltages shown in the 11 schematics.

For circuits requiring exceptionally high current where the voltage requirement does not exceed 560 volts, the circuit shown in Fig. 11 is admirably suited. By connecting two of the windings in parallel the current supply is doubled in the portion of the circuit marked "B." The usual low voltage is available from the third winding and will supply the full current ratings of the transformer.

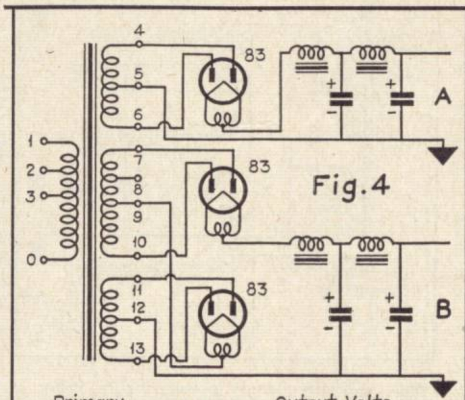
Bridge Rectification

While this description only covers the more common types of rectification applications the amateur and experimenter will no doubt find other interesting applications. It should be noted in all applications where bridge rectification is used that the maximum output obtainable should never exceed 70 per cent of the rated output of the transformer.

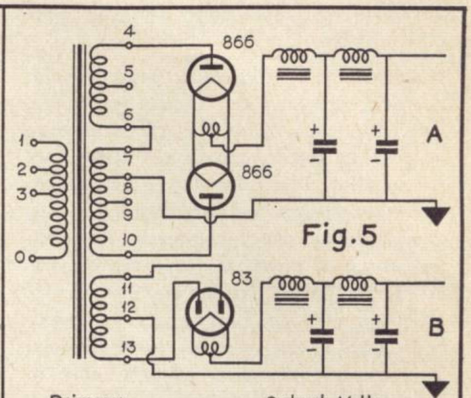
B Output current 140% of full-wave value.



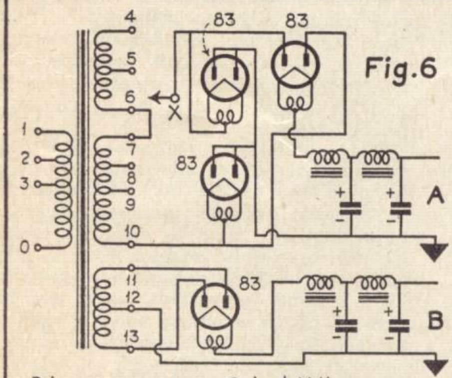
Primary Connection	Output Volts A	Output Volts B
0-1	400	900
0-2	450	1020
0-3	500	1120



Primary Connection	Output Volts A	Output Volts B
0-1	400	885
0-2	450	1000
0-3	500	1100

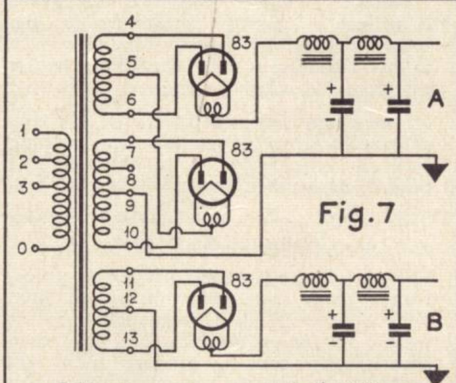


Primary Connection	Output Volts A	Output Volts B
0-1	850	450
0-2	960	510
0-3	1060	560

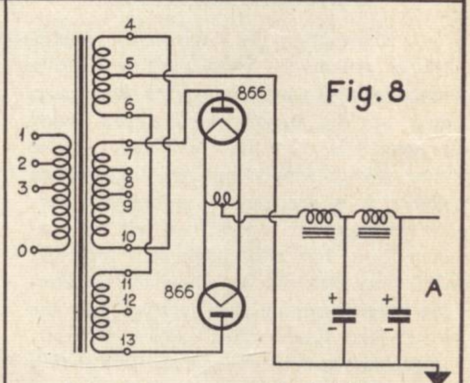


Primary Connection	A X-9	A X-8	A X-7	A X-5	B
0-1	450	870	900	1300	450
0-2	510	990	1020	1420	510
0-3	560	1090	1120	1520	560

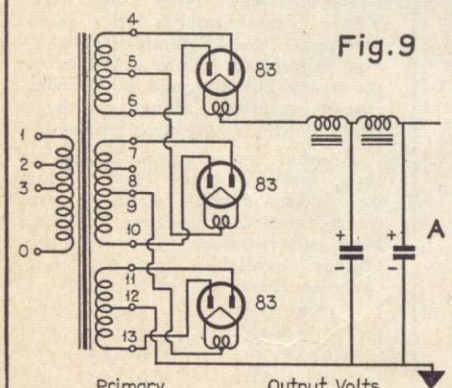
A-Output current 70% of full-wave value.



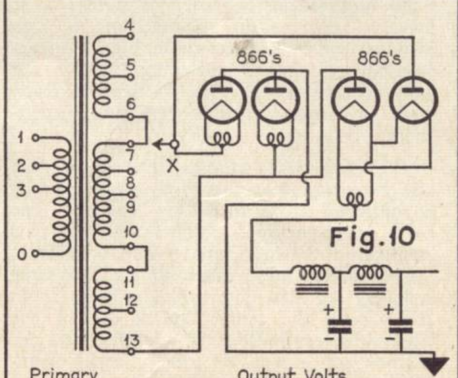
Primary Connection	Output Volts A	Output Volts B
0-1	830	450
0-2	940	510
0-3	1000	560



Primary Connection	Output Volts A
0-1	1300
0-2	1470
0-3	1620

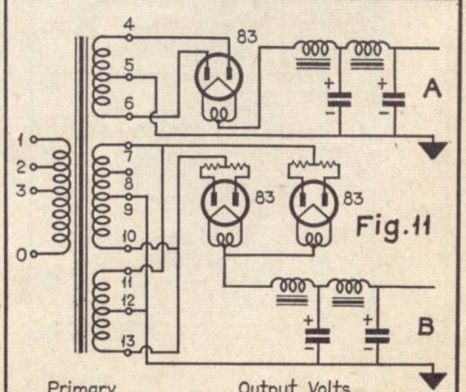


Primary Connection	Output Volts A
0-1	1300
0-2	1470
0-3	1620



Primary Connection	X-12	X-11	X-9	X-8	X-7	X-5	X-4
0-1	450	900	1350	1750	1800	2200	2600
0-2	510	1020	1530	1990	2040	2550	2940
0-3	560	1120	1680	2180	2240	2740	3240

Output current 70% of full-wave rated value



Primary Connection	Output Volts A (175 Ma.)	Output Volts B (350 Ma.)
0-1	400 D.C.	450 D.C.
0-2	450 D.C.	510 D.C.
0-3	500 D.C.	560 D.C.

Group of circuits showing the many combinations that may be had with a single universal power transformer (minus filament supply) for the purpose of deriving separate voltages of different values for the various stages of a transmitter or high-power public-address system.

KENYON AMATEUR TRANSMITTER AND PUBLIC ADDRESS COMPONENTS

Kenyon engineers have designed this complete line of audio and power transformers and reactors to make possible a popular priced line particularly suited for amateur transmitter and public address use.

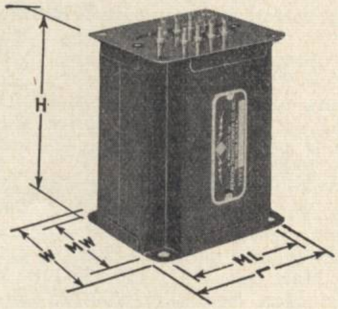
Refinements in design and controlled production result in units which are unapproachable for quality in material of this price range.

Each unit is housed in a metal case finished in a durable black eggshell enamel presenting a pleasing appearance to suit exacting commercial requirements. This case also acts as an electrostatic and electromagnetic shield.

Universal mounting facilities permit all units to be top or bottom mounted to chassis or panels.

With the exception of the high voltage units which are provided with glazed ceramic insulators all units are provided with sturdy solder lug terminals.

T LINE DIMENSIONS



	Mounting Dimensions		Overall Dimensions		
Case	ML	MW	Length	Width	Height
1A	2 1/32	1 9/16	2 7/16	2	2 7/8
2A	2 1/8	1 13/16	2 3/4	2 3/8	3 3/16
3A	2 7/16	1 15/16	3 1/16	2 9/16	3 5/8
4A	3 7/8	2 7/16	4 1/2	3	3 7/8
5A	4 5/16	3 3/16	5	3 7/8	5
6A	4 1/2	4 5/16	5	5 1/8	5
7A	5 1/2	4 5/16	6 5/16	5 3/16	6 3/8
8A	5 3/4	4 13/16	6 9/16	5 11/16	7 1/8
9A	6 15/16	5 3/4	7 3/4	6 5/8	7 3/16
10A	8 5/8	7 11/32	9 1/2	8 1/4	10 5/8

INPUT TRANSFORMERS

Type		Case	List Price
T-1	Single or double button microphone to one grid Input—400-300-200-100-50 ohms. Hum bucking type	1A	$4.00
T-2	Multiple line to one grid. Input—500-333-250-200-125-50 ohms. Hum bucking type	1A	4.00
T-3	Multiple line to P. P. grids. Input—500-333-250-200-125-50 ohms. Hum bucking type	1A	4.00
T-4	Detector plate, high impedance pickup, or double button microphone to single grid	2A	5.00

LINE TRANSFORMERS

Type		Case	List Price
T-25	Line to line matching transformer. Primary—500-200-50 ohms Secondary—500-200-50 ohms	2A	5.00
T-27	500 or 200 ohms to 15-8-4 ohms—Level 15 watts	3A	5.00
T-28	500 or 200 ohms to 15-8-4 ohms—Level 30 watts	4A	6.00
T-29	500 or 200 ohms to 15-8-4 ohms—Level 60 watts	5A	9.00

CLASS "A" INPUT TRANSFORMERS

Type		Case	List Price
T-51	Single Class A Plate 56, 76, 6C5, 77 (triode) 6C6 (triode) etc. to single Class A Grid. Ratio 1:4	1A	3.50
T-52	Single Class A Plate 56, 76, 6C5, 77 (triode) 6C6 (triode) etc. to P. P. Class A Grids. Ratio 1:4 (total pri. to total sec.)	1A	3.50
T-53	Detector plate or single button microphone to single grid	1A	3.50

For portable applications use open type KA114M. List Price $2.25

Type		Case	List Price
T-54	P. P. Class A Plates 56, 76, 6C5, 77 (triode) 6C6 (triode) etc. to P. P. Class A Grids. Ratio 1:1.8 (total pri. to total sec.)	2A	4.50
T-55	Single Class A Plate 56, 76, 6C5, 77 (triode) 6C6 (triode) etc. to single Class A Grid. Ratio 1:3	2A	4.50
T-56	Single Class A Plate 56, 76, 6C5, 77 (triode) 6C6 (triode) etc. to P. P. Class A Grids. Ratio 1:2 (total pri. to total sec.)	2A	4.00
T-57	Single Class A Plate 56, 76, 6C5, 77 (triode) 6C6 (triode) etc. to single Class A Grid. (Ratio 1:2.) Hum bucking type	2A	5.00
T-58	Single Class A Plate 56, 76, 6C5, 77 (triode) 6C6 (triode) etc. to P. P. Class A Grids. Ratio 1:2 (total pri. to total sec.). Hum bucking type	2A	5.00

CLASS "AB" AND "B" INPUT TRANSFORMERS

Type		Case	List Price
T-251	Single 53, 6A6, 56, 6C5, etc. to P. P. 53, 6A6, etc. (Single 53, 6A6, etc. in P. P.)	2A	4.50
T-252	Single 30, 49, 89 to P. P. 19, 30, or 49's	1A	3.50

For portable applications use open type KR19. List Price $1.50

Type		Case	List Price
T-253	Single 46 or 59 to P. P. 46's or 59's, 6F6's, etc.	2A	4.50
T-254	Single 45, 6F6, 2A5, 42, etc. to P. P. 6F6, 45's, 2A5's, 42's, etc.	2A	4.50
T-255	P. P. 56, 76, 6C5, 53, 6A6, 6N7 to P. P. 6L6's	2A	4.50
T-256	P. P. 56, 76, 6C5, to P. P., 45's, 2A3's, 6F6's, etc.	2A	4.50
T-257	P. P. 45's to P. P. Parallel 46's	2A	4.50
T-258	P. P. 45's to P. P. 800's	3A	5.00
T-259	P. P. 2A3's to P. P. 203A's, 838's etc.	4A	6.00
T-260	P. P. parallel 2A3's to P. P. H.D. 203A's, P. P. Parallel 838's etc	4A	8.00
T-271	P. P. 45's, 2A3's, 6F6's (triode) to P. P. Class AB_2 6L6's	3A	5.00

CLASS "A" OUTPUT TRANSFORMERS

Type		Case	List Price
T-101	Single Class A Plate 56, 76, 6C5, 77 (triode) 6C6 (triode) etc. to 500 or 200 ohms	1A	3.50
T-102	P. P. Class A Plates 56, 76, 6C5, 77 (triode) 6C6 (triode) etc. to 500 or 200 ohms	1A	3.50
T-103	P. P. 45's, or 43's to 500-200 or 15-8-4 ohms	2A	5.00
T-104	Single 2A5, 6F6, 89, 47 etc. to 500-200 or 15-8-4 ohms	2A	4.50
T-105	P. P. 2A5, 6F6, 89, 47 etc. to 500-200 or 15-8-4 ohms	2A	5.00
T-106	P. P. 6B5, 2B6, to 500-200 or 15-8-4 ohms	3A	5.50

CLASS "AB" AND "B" OUTPUT TRANSFORMERS

Type		Case	List Price
T-301	P. P. 45's, 2A3's (Class AB) 6L6's (Class A) to 500-200 or 15-8-4 ohms. Primary 5000 or 3000 ohms	4A	$6.00
T-302	P. P. 6N7, 53, 49's, 19 to 500-200 or 15-8-4 ohms	3A	5.50
T-303	P. P. 46, 59's, 6F6's (triode or pentode) 2A5's, 42's to 500-200 or 15-8-4 ohms. Primary 6000 or 10,000 ohms	4A	6.00
T-304	P. P. Parallel 45's, 2A3's, to 500-200 or 15-8-4 ohms. Primary 1500 or 2500 ohms	4A	8.00
T-305	P. P. Parallel 46's, 59's, 6F6's (triode or pentode) 2A5's, 42's to 500-200 or 15-8-4 ohms. Primary 3000 or 5000 ohms	4A	8.00
T-317	P. P. 6L6's Class AB_1 (6600 or 3800 ohms—34 watts) to 500-200 or 15-8-4 ohms	4A	8.00
T-319	P. P. 6L6's AB_2 (6000 or 3800 ohms—60 watts) to 500-200 or 15-8-4 ohms	5A	8.50

MODULATION OUTPUT TRANSFORMERS

Type		Case	List Price
T-451	Class B 6N7, 53, 6A6, RK34, to 5000 or 3000 ohms. Max. Sec. D. C. 100 M.A.	2A	4.50
T-452	Class B 19, to 5000 or 3000 ohms. Max. Sec. D.C. 50 M.A. **For portable application use open type KR19M. List Price $1.50**	1A	3.50
T-453	Class AB 2A3's, 45's or Class A, 6L6's to 5000 or 3000 ohms. Max. Sec. D.C. 130 M.A.	4A	8.50
T-454	Class B 46's or 59's, 6F6's (triode or pentode) 2A5's, 42's etc. to 4000-6000-8000 ohms. Max. Sec. D.C. 140-100-75 M.A. Primary 6000 or 10,000 ohms	4A	8.50
T-455	Class B—210's to 5000-7000-9000 ohms. Max. Sec. D.C. 180-150-130 M.A.	5A	10.00
T-456	P. P. Parallel 45's or 2A3's Class AB to 5000-7000-9000 ohms. Max. Sec. D.C. 150-100-75 M.A.	5A	10.00
T-457	P. P. Parallel 46's, 59's, 6F6's, (triode or pentode) 2A5's, 42's etc. to 3000-5000-7000 ohms. Max. Sec. D.C. 220-160-120 M.A. Primary 3000 or 5000 ohms	5A	10.00
T-465	P. P. 838's, 203A's to 4000-6000-8000 ohms. Max. Sec. D.C. 400-320-270 M.A.	7A	25.00
T-470	P. P. H.D. 203A's to 4000-6000-8000 ohms. Max. Sec. D.C. 500-400-350 M.A.	8A	42.00
T-490	Single 2A5, 42 or 6F6 grid modulation transformer to grid modulate 203A's, 211's, etc.	2A	4.50
T-491	Single 45 grid modulation transformer to grid modulate 203A's, 211's, etc.	2A	4.50
T-458	P. P. 801's to 5000-7000-9000 ohms. Max. Sec. D.C. 150-135-110 M.A.	6A	12.50
T-460	P. P. 800's to 6000-8000-10,000 ohms. Max. Sec. D.C. 200-175-150 M.A.	6A	15.00
T-492	Grid or suppressor modulation transformer—P. P. 45's to 10,000 ohm load	3A	5.00
T-459	P. P. 6L6's Class AB_2 to 2500-5000-7000 ohms. Max. Sec. D.C. 300-250-200 M.A.	5A	8.50

FILTER REACTORS

Type No.	Inductance Henries	Max. MA.	D.C. Resistance	Insulation Test	Case No.	List Price
T-155	290	10	4700	1000 V.	2A	$4.00
T-158	*350	10	10000	1000 V.	3A	4.50
T-156	30	25	800	1000 V.	1A	3.00
T-157	20	50	200	1000 V.	1A	3.00
T-153	30	90	350	1000 V.	3A	3.50
T-154	15	165	210	1000 V.	3A	4.00
T-152	10	200	100	1000 V.	3A	4.00
T-164	14	250	135	1500 V.	5A	9.00
T-166	11	300	125	1500 V.	5A	9.00
T-159	12	500	77	1500 V.	6A	12.50
T-165	10	150	275	3000 V.	3A	4.00
T-168	13	250	125	3000 V.	5A	10.00
T-160	11	300	120	3000 V.	5A	10.00
T-167	11	400	80	3000 V.	6A	12.00
T-175	10	200	140	5000 V.	4A	7.00
T-176	10	300	110	5000 V.	5A	11.00
T-178	10	400	90	5000 V.	6A	15.00
T-177	12	500	95	5000 V.	7A	18.00

*Center tapped.

SWINGING REACTORS

Type No.	Inductance Henries	Max. MA.	D.C. Resistance	Insulation Test	Case No.	List Price
T-517	15-45	90-20	350	1000 V.	3A	$3.50
T-515	10-25	165-30	210	1000 V.	3A	4.00
T-506	5-20	200-30	100	1000 V.	3A	4.00
T-507	7-25	250-50	135	1500 V.	5A	9.00
T-510	6-19	300-30	125	1500 V.	5A	9.00
T-511	5-20	170-20	275	3000 V.	3A	4.00
T-508	7-26	250-50	125	3000 V.	5A	10.00
T-514	5-20	300-50	120	3000 V.	5A	10.00
T-516	5-20	400-50	80	3000 V.	6A	12.00
T-509	6-19	200-30	140	5000 V.	4A	7.00
T-512	5-15	300-30	110	5000 V.	5A	11.00
T-513	5-18	400-50	90	5000 V.	6A	15.00
T-521	6-21	500-60	95	5000 V.	7A	18.00

PLATE TRANSFORMERS

Type No.	Primary	A.C. Secondary Volts		D.C. MA.	Case	List Price
T-664		740-0- 740		150	5A	$8.00
T-655	*Tapped	460-0- 460		250	5A	9.00
T-656	*Tapped	740-0- 740		300	6A	12.00
T-657	†Tapped	900-0- 900 900-0- 900	(2 separate secondaries)	200 200	7A	26.00
T-658	‡Tapped	520-0- 520 570-0- 570 570-0- 570	(3 separate secondaries)	175 175 175	7A	21.00
T-654	‡Tapped	490-0- 490 630-0- 630 630-0- 630	(3 separate secondaries)	250 250 250	8A	30.00
T-659	‡Tapped	520-0- 520 570-0- 570 570-0- 570	(3 separate secondaries)	350 350 350	8A	30.00
T-665	*Tapped	1180-0-1180		250	7A	22.00
T-666		1460-0-1460		350	8A	26.00
T-667		1460-0-1460		500	9A	34.00
T-660		1460-0-1460 630-0- 630	(2 separate secondaries)	500 200	9A	38.00
T-661		2080-0-2080		200	7A	22.00
T-662		2080-0-2080		300	8A	30.00
T-663		2360-0-2360		600	10A	70.00

*Primary tapped to increase the above secondary voltages approximately 25%.
†Primary tapped to increase the above secondary voltages approximately 30%.
‡Primary tapped to increase the above secondary voltages approximately 12.5% and 25%.

PLATE AND FILAMENT TRANSFORMERS

Type No.	Sec. Volts	D.C. MA.	F1	F2	F3	F4	Case	List Price
*T-249	235-0-235	20	6.3V.- .6A.CT	6.3V.-.9 A.CT.			2A	$4.50
*T-245	320-0-320	40	5 V.-2 A.	6.3V.-2 A.CT.			3A	5.00
§T-201	0-75	70	5 V.-2 A.				2A	4.50
*T-205	350-0-350	75	5 V.-2 A.	6.3V.-3 A.CT.			4A	6.50
*T-206	325-0-325	100	5 V.-3 A.	6.3V.-3 A.CT.	6.3V.- 2 A.CT.		5A	8.50
T-212	420-0-420	125	5 V.-3 A.	6.3V.-3 A.CT.	2.5V.- 4 A.CT.		5A	9.50
T-214	420-360-125-0-360-420	150	5 V.-3 A.	2.5V.-3 A.CT.	2.5V.- 5 A.CT.	6.3V.-3 A.CT.	5A	10.00
*T-244	425-0-425	165	5 V.-3 A.	6.3V.-3 A.CT.	6.3V.- 3 A.CT.		6A	12.00
*T-248	425-0-425	165	5 V.-3 A.	2.5V.-6 A.CT.	2.5V.- 6 A.CT.		6A	12.00
T-213	520-110-0-520	180	5 V.-3 A.	2.5V.-3 A.	6.3V.- 3 A.CT.	6.3V.-3 A.CT.	5A	11.50
T-215	360-125-0-360	200	5 V.-3 A.	2.5V.-3 A.CT.	2.5V.-10 A.CT.	6.3V.-2.1A.CT.	5A	11.50
T-247	590-0-590	200	5 V.-3 A.	6.3V.-3 A.CT.	6.3V.- 3 A.CT.		5A	12.00
T-216	520-85-0-520	250	5 V.-3 A.	2.5V.-3 A.	6.3V.- 3 A.CT.	6.3V.-3 A.CT.	6A	13.00
†T-207	0-275-375 0-180	10 6	6.3V.- .6A.	6.3V.-1 A.	2.5V.- 1.4A.		3A	4.00
‡T-202	0-150	20	6.3V.- .6A.				1A	4.00
§T-220	125-0-125	200	5 V.-3 A.				4A	6.00
T-246	625-0-625	250	5 V.-3 A.	6.3V.-3 A.CT.	6.3V.- 3 A.CT.		6A	13.00

*Indicates unit designed for condenser input to filter. (All other units should be used with choke input.)
†For RCA 913 Midget Cathode Ray Tube. ‡For oscillators, wave meters, etc. §For bias supplies.

FILAMENT TRANSFORMERS

Type No.	F1	F2	F3	F4	Case No.	List Price
	Single Winding					
T-352	2.5 V.-10 A. CT. 2000 V. Test				2A	$4.00
T-354	5 V.-3 A. CT. 2000 V. Test				2A	4.00
T-351	6.3 V.-3 A. CT. 2000 V. Test				2A	4.00
T-353	7.5 V.-4 A. CT. 2000 V. Test				2A	4.00
T-357	5.25 V.-12 A. CT. 2000 V. Test				4A	6.00
T-358	5.25 V.-20 A. CT. 2000 V. Test				5A	8.00
T-360	2.5 V.-10 A. CT. 5000 V. Test				3A	6.00
T-365	10 V.-4 A. CT. 5000 V. Test				3A	6.50
T-361	10 V.-8 A. CT. 5000 V. Test				4A	8.00
	Two Windings					
T-366	2.5 V.-10 A. CT. 5000 V. Test	2.5 V.-10 A. CT. 5000 V. Test			4A	8.00
T-363	10 V.-6.5 A. CT. 5000 V. Test	10 V-3.25 A. 5000 V. Test			5A	9.00
T-362	11-12 V.-8 A. CT. 5000 V. Test	10-11 V.-3.5 A. CT. 5000 V. Test			5A	11.00
	Three Windings					
T-364	2.5 V.-8 A. CT. 750 V. Test	2.5 V.-10 A. CT. 750 V. Test	5 V.-6 A. 750 V. Test		4A	7.00
T-356	6.3 V.-3 A. CT. 750 V. Test	5 V.-4 A. CT. 3000 V. Test	5 V.-8 A. CT. 3000 V. Test		4A	9.00
T-355	5 V.-3 A. CT. 4000 V. Test	5 V.-3 A. CT. 4000 V. Test	5 V.-6 A. CT. 4000 V. Test		4A	7.50
T-375	2.5 V.-5 A. CT. 6000 V. Test	2.5 V.-5 A. CT. 6000 V. Test	2.5 V.-10 A. CT. 6000 V. Test		4A	9.00
	Four Windings					
T-373	2.5 V.-5 A. CT. 750 V. Test	5 V.-3 A. 750 V. Test	7.5 V.-3.25 A. CT. 3000 V. Test	7.5 V.-8 A. CT. 3000 V. Test	5A	9.00
T-374	2.5 V.-5 A. CT. 750 V. Test	5 V.-3 A. 750 V. Test	6.3 V.-3 A. CT. 3000 V. Test	7.5 V.-8 A. CT. 3000 V. Test	5A	9.00
T-370	6.3 V.-3 A. CT. 750 V. Test	6.3 V.-3 A. CT. 750 V. Test	2.5 V.-4 A. CT. 750 V. Test	5 V.-3 A. 750 V. Test	4A	7.50
T-371	5 V.-3 A. 750 V. Test	6.3 V.-3 A. CT. 750 V. Test	6.3 V.-3 A. CT. 750 V. Test	7.5 V.-8 A. CT. 2500 V. Test	5A	8.50
T-372	5 V.-3 A. 750 V. Test	5 V.-3 A. CT. 750 V. Test	6.3 V.-3 A. CT. 750 V. Test	7.5 V.-4 A. CT. 2000 V. Test	5A	8.50
T-367	6.3 V.-5 A. CT. 2000 V. Test	6.3 V.-5 A. CT. 2000 V. Test	5 V.-6 A. CT. 2000 V. Test	5 V.-3 A. CT. 2000 V. Test	5A	9.00

Five Windings

Type No.	F1	F2	F3	F4	F5	Case No.	List Price
T-377	5 V.-3 A. 2000 V. Test	5 V.-6 A. 2000 V. Test	6.3 V.-1 A. CT. 2000 V. Test	6.3 V.-5 A. CT. 2000 V. Test	6.3 V.-5 A. CT. 2000 V. Test	5A	9.50

GUARANTY

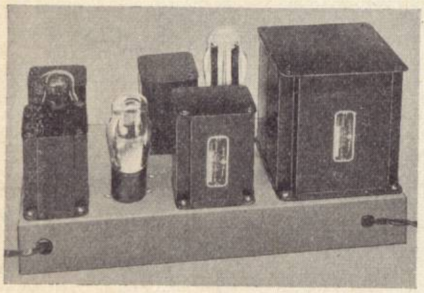
All Kenyon Transformers are guaranteed against defects in materials and workmanship for a period of ninety days from the time of sale. Inoperative transformers should be returned prepaid to our factory, where they will be inspected and, if found defective from the above mentioned causes, will be replaced without charge.

PRICES SUBJECT TO CHANGE WITHOUT NOTICE

A Portable All Band Amateur Transmitter

THE low cost practical short wave transmitter illustrated is an ideal unit for the amateur who wants a powerful yet portable circuit. This unit covers all amateur bands and may be used for phone or C.W. work. The output when used on the 1750 kilocycle band is approximately 20 watts.

The transmitter is constructed in two separate units. The top section contains the radio frequency unit which consists of the crystal controlled oscillator, the class C amplifier and the antenna coupling system. The bottom section contains the modulation unit together with a sturdy power supply. Each section can be easily removed and despite the compactness of the entire circuit there is no troublesome crowding of either the parts or wiring. In the interest of simplicity the circuit has been designed along strictly conventional lines. The oscillator circuit which utilizes a type 2A5 is capacitively coupled to a type 2A3 tube operated in class C. This together with the antenna coupling unit is mounted on the same chassis.



Modulator and Power Supply Unit

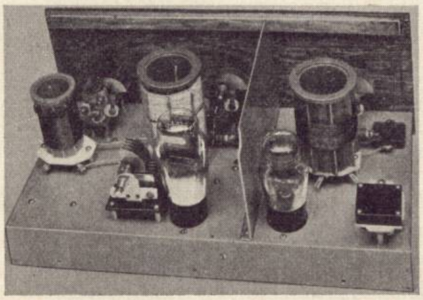
For maximum transfer of power to the antenna, the output tank circuit is link coupled to the antenna coil. Usually one or two turns of wire wrapped around the amplifier tank and the same number of turns around the antenna coil provide adequate output on all bands. A little experimenting with link coupling is advisable since tight coupling may be the cause of downward modulation when operating the transmitter for phone.

To obtain maximum power output from the radio frequency section of the circuit it is essential that all parts used be of low loss construction and that the tuning condensers be insulated from the aluminum chassis. It is preferable to use sockets for tubes and plug in coils made of isolantite or similar material to prevent excessive r. f. losses.

The modulator, mounted on one end of the bottom shelf uses two 53 type tubes which are used in a basically sound straightforward class B application.

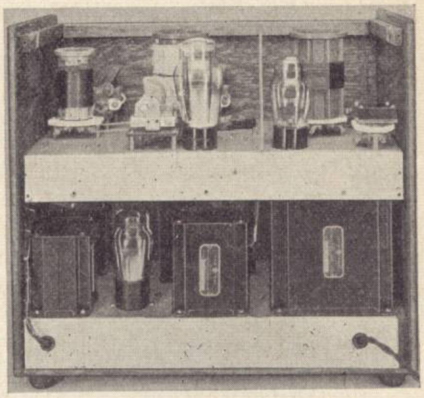
To insure good quality the modulation output transformer is designed to carry the full current of the class C stage without causing saturation. If a smaller transformer is substituted for the one shown it may be necessary to use an additional audio choke and a condenser to keep the D. C. voltage of the class C amplifier out of the secondary winding.

Since the gain of the speech system is just about right for the average single button microphone no gain control is incorporated. The gain however can be varied by the simple expedient of moving the microphone closer to or farther away from the speaker; a distance of about five to six inches will be found to be correct for most single button microphones under normal conditions.



Radio Frequency Section

The antenna arrangement employed will in most cases depend to a large extent upon space limitation. For the 160 meter band the regular Marconi Antenna Ground System will prove to be quite efficient and usually the easiest of all types to set up. The length will not be found critical as there is considerable latitude due to the size of the tuning condenser used in the antenna circuit. For the other amateur bands the familiar quarter wave Hertz is recommended.



The complete Xmtr housed in a portable case

Although no meters are included in the transmitter, provision for measuring oscillator and class C amplifier plate current is made by means of closed circuit jacks mounted on the front panel.

The distance-covering possibilities of this circuit will depend, to a large extent, on the radiation efficiency of the individual antenna system, the wave band used, location of station, and general atmospheric conditions.

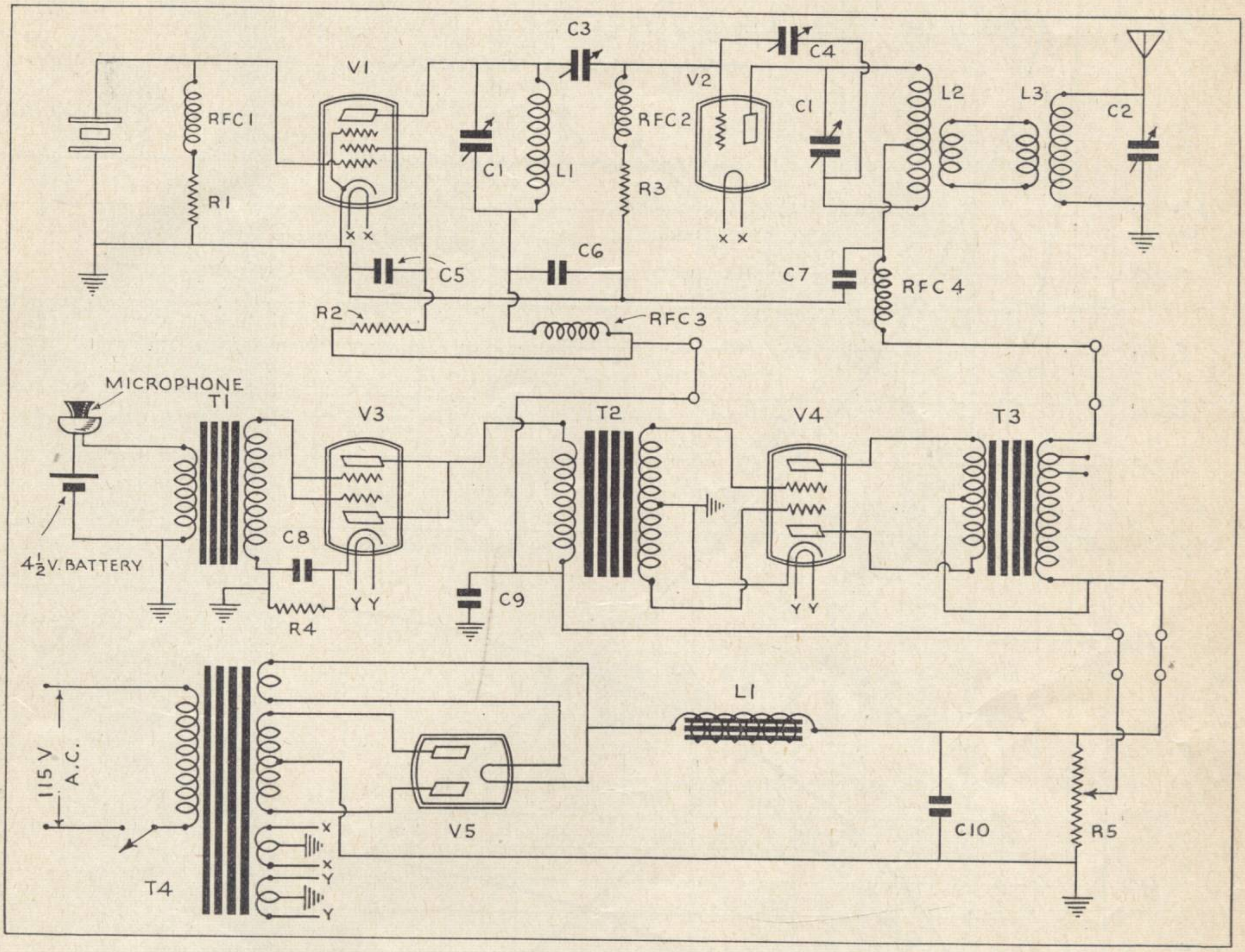
As with all short wave transmitters, this circuit should not be operated unless the owner is a licensed amateur. However, the lack of a license need not prevent you from building the circuit, and when your license is granted your station will be complete and ready to go.

COIL-WINDING DATA

Coil	1750 KC.	3500 KC.	7000 KC.	14,000 KC.
L_1	50 turns No. 22E 2″ form	34 turns No. 22E 1½″ form	19 turns No. 16E 1½″ form	9 turns No. 14E 1½″ form
L_2	54 turns No. 18E 2″ form	38 turns No. 18E 1½″ form	21 turns No. 16E 1½″ form	11 turns No. 14E 1½″ form
L_3	45 turns No. 18E 1½″ form	28 turns No. 18E 1½″ form	15 turns No. 16E 1½″ form	7 turns No. 16E 1½″ form

If the circuit will not tune to resonance, a few turns must be added or removed from the above coil data. However, the above data is correct for use with the tuning condensers specified in the list of parts.

All Band Amateur Transmitter Schematic



LIST OF PARTS

C_1	—Variable condenser, 100 mmfd.
C_2	—Variable condenser, 250 mmfd.
C_3	—Variable condenser, 100 mmfd.
C_4	—Variable condenser, 50 mmfd.
C_5 and C_6	—Fixed condenser, mica, .01 mfd.
C_7	—Fixed condenser, paper, .001 mfd.
C_8	—Electrolytic condenser, 25 volt, 50 mfd.
C_9	—Electrolytic condenser, 450 volt, 8 mfd.
C_{10}	—Electrolytic condenser, 450 volt, 8 mfd.
R_1	—Resistor, metallized, 25,000 ohm, 1 watt
R_2 and R_3	—Resistors, metallized, 50,000 ohm, 2 watt
R_4	—Resistors, metallized, 1,000 ohm, 2 watt
R_5	—Resistors, metallized, 30,000 ohm, 50 watt
RFC_1	—Radio-frequency choke, 2 mh.
RFC_2, $_3$ and $_4$	—Radio-frequency choke, 8 mh.

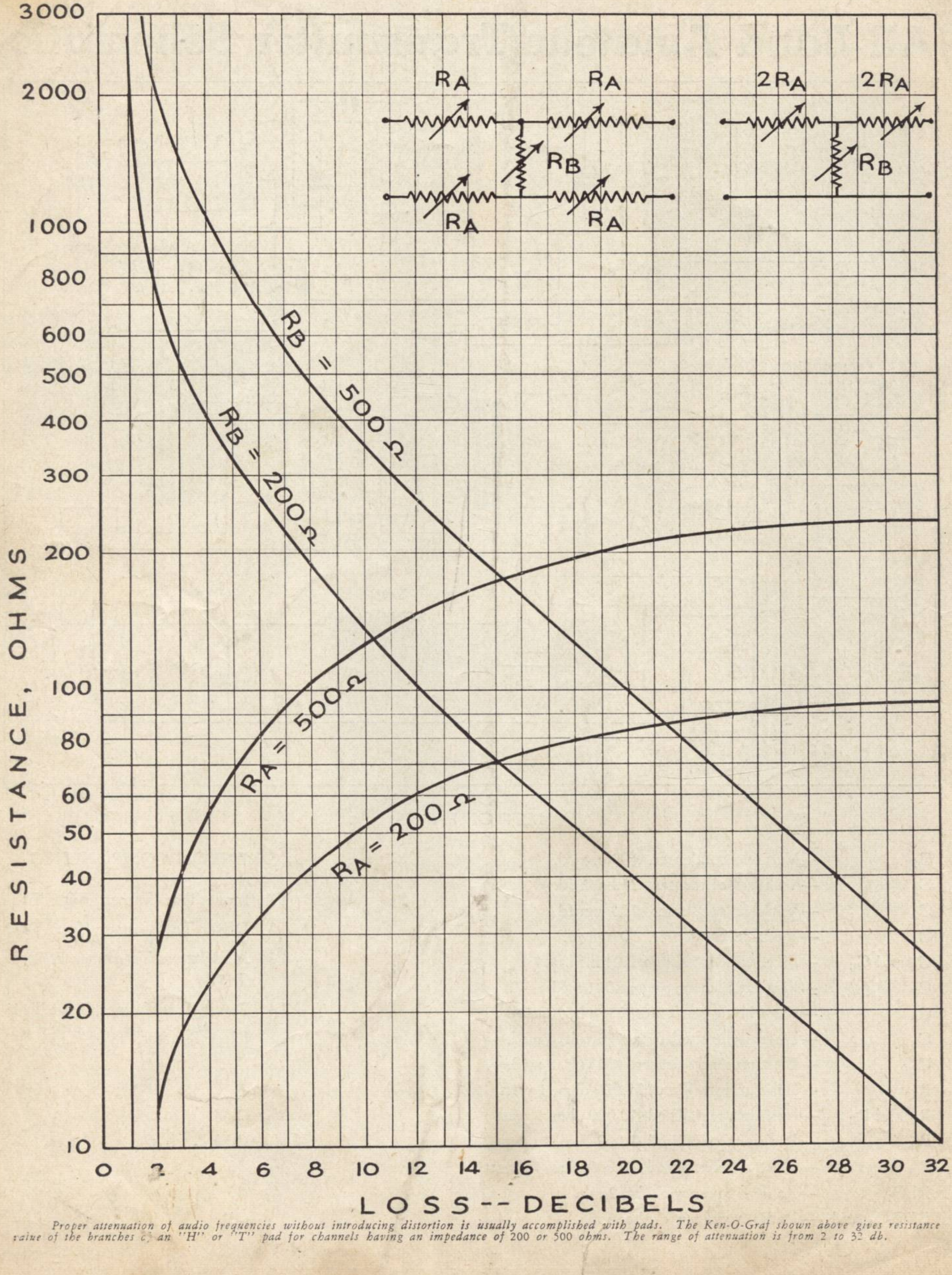
KENYON COMPONENTS

T1	Input Transformer, Type T1
T2	Driver Transformer, Type T251
T3	Modulation Transformer, Type T451
T4	Power Transformer, Type T248
L	Filter Reactor, Type T154

Tubes

V_1—2A5
V_2—2A3
V_3—53
V_4—53
V_5—83

KEN-O-GRAF



Proper attenuation of audio frequencies without introducing distortion is usually accomplished with pads. The Ken-O-Graf shown above gives resistance value of the branches of an "H" or "T" pad for channels having an impedance of 200 or 500 ohms. The range of attenuation is from 2 to 32 db.