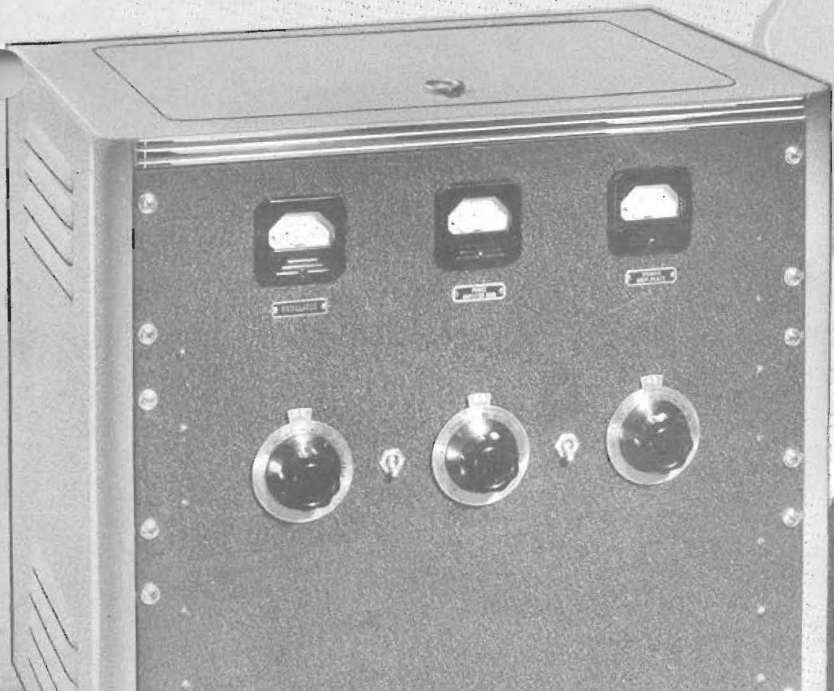

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THORDARSON

Transmitter Guide

No. 344-E

Since 1895 —

Since 1895 the Thordarson organization has pioneered in the development and manufacture of quality transformers in the progressive electrical world. The policy of the company — to engineer the best product for the application — is consistently maintained. Small wonder that Thordarson is the recipient of both national and international awards for outstanding contributions to better engineering.

From the earliest spark coil days Thordarson has devoted the major part of its engineering and laboratory resources to the development of Amateur Radio. Today, the Amateur Radio fraternity is the training ground for broadcast, communications and government engineers.

To further promote the interest and pleasure of this worthy hobby, Thordarson presents this latest Transmitter Guide. This guide offers you a wide choice of units from the smallest transmitter for the beginner to the larger and more elaborate rigs for the advanced amateur. These transmitters are conservatively rated and employ the latest technical developments for efficient and economical operation. The cabinets and panels are beautifully designed and the circuits are adaptable to a multitude of amateur applications. Simplified construction methods are employed throughout the guide and the use of Thordarson transformers and chokes will insure perfect performance for many years.

Our sincere wish is that this guide will enable you to find many hours of enjoyment in contacting old friends and making new ones on the amateur bands.

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Contents

Printed in U. S. A.

20 Watt CW Transmitter

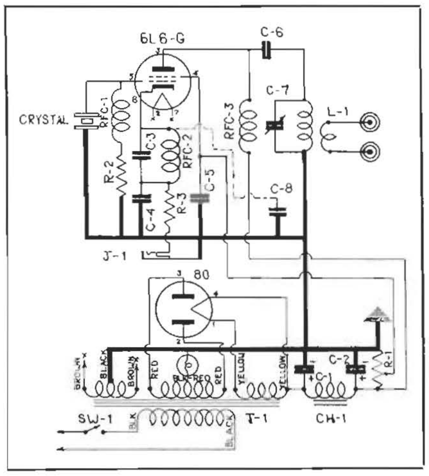
FOR the newcomer in amateur radio desiring a simple yet reliable transmitter, this transmitter with metal chassis has been designed. Its crystal controlled circuit is of such a type that operation is possible on five amateur bands. If higher power is desired at some later date this transmitter may also be used as the crystal oscillator stage of a larger multi-stage transmitter.

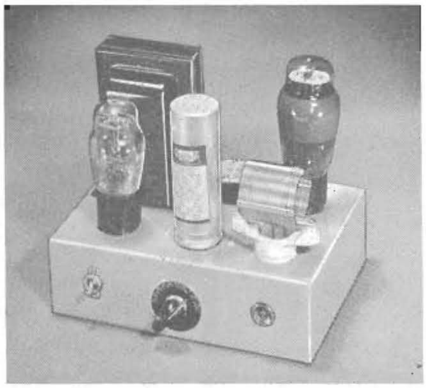
Circuit Operation

Operation on the five amateur bands from 160 to 10 meters is possible. On all of these five bands the oscillator will work "straight through"; that is, the crystal frequency and the output frequency are the same. In addition, the oscillator will give good outputs when doubling, using 160, 80 and 40 meter crystals.

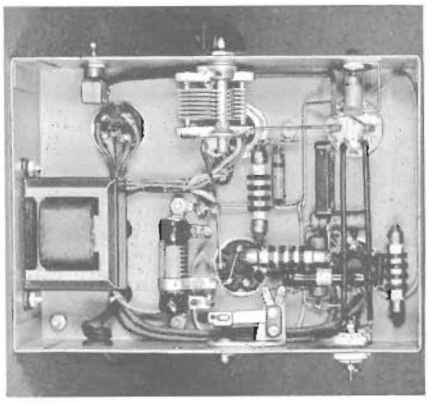
The plug-in coils on this transmitter are of a type having a built-in link on the "cold" end of the coil. If used as the exciter for a larger transmitter this unit may be link-coupled or capacity-coupled to the succeeding stage.

Successful operation of this type oscillator on the five amateur bands is made possible by including condenser C-8 in the 40 meter coil base. Since the capacity, C-3, which gives adequate performance with 10 and 20 meter crystals results in excessive crystal current with a 40 meter crystal, the 0.00025 Mfd. condenser, C-8, is mounted on the 40 meter coil base in such a manner that it is paralleled with the cathode-to-ground circuit of the 6L6G when the 40 meter coil is used. This minimizes the likelihood of high crystal current in the 40 meter crystal, yet it permits the 20 and 10 meter crystals to oscillate with highest efficiency.





Chassis View



Bottom View

A pilot lamp in the negative high voltage lead makes an inexpensive yet effective tuning indicator. For best results in tuning it is recommended that the operator start to tune from minimum capacity toward maximum capacity, until the lamp passes through its first minimum in brilliancy. The condenser should then be tuned back a slight amount toward minimum capacity to maintain good oscillator stability and ease of starting when keying. A flashlight bulb connected to a two or three turn wire loop placed over the tank coil is a handy indicator of circuit conditions when tuning.

The parts layout shown in the above photograph should be closely followed for best results. The position of the power supply leads is not critical, but all connections in the RF circuit should be made as shown.

The keying jack is mounted on the rear apron of the chassis. It is of the circuit closing type so that the removal of the keying plug closes the circuit.

When properly loaded the input to the 6L6-G plate is about 20 watts. At slightly greater antenna loading, the change in "B" current when tuning through resonance is barely noticeable.

The screen voltage may be adjusted by moving the tap on the bleeder resistor R-1. The recommended setting for this tap is approximately one-fifth of the distance from the B+ end. The position of this tap has been selected as being optimum for reasonable output on all five bands without exceeding the rated crystal current of any crystal, or the rated dissipation of the tube in any condition of loading. With the 160 or 80 meter crystals the moving of this tap closer to the B+ end of the bleeder will result in greater output without damage to the crystal or without exceeding the rated dissipation of the tube.

Parts Required

THORDARSON TRANSFORMER and CHOKE

T-1	T-70R61	Power Transformer
CH-1	T-44C02	Filter Choke

Resistors:

R-1	20,000 Ohm 25 Watt Wirewound Resistor, Semi-Variable
R-2	20,000 Ohm 1 Watt Resistor
R-3	300 Ohm 10 Watt Resistor

Condensers:

C-1, C-2	Double 8 Mfd. 450 Volt Condenser
C-3	.0001 Mfd. Mica Condenser
C-4	.01 Mfd. 400 Volt Condenser
C-5	.01 Mfd. 400 Volt Condenser
C-6	.002 Mfd. 1,000 Volt Mica Condenser
C-7	100 Mmfd. Variable Condenser
C-8	.00025 Mfd. Mica Condenser

RF Chokes:

RFC-1	RF Choke
RFC-2	RF Choke
RFC-3	RF Choke

Miscellaneous Parts:

1	Chassis 8½" x 6" x 2½" (Punched and Drilled)
2	Feed-thru Insulators
1	Name Plate
1	Dial Plate
1	Octal Socket
1	4-Contact Socket
1	5-Contact Socket
1	5-Contact Socket, Steatite
1	Pilot Lamp Socket
1	Line Cord and Plug
1	SPST Switch
1	Knob

Misc. Parts: (Cont'd)

1	Closed Circuit Jack
1	6.3 Volt Pilot Light

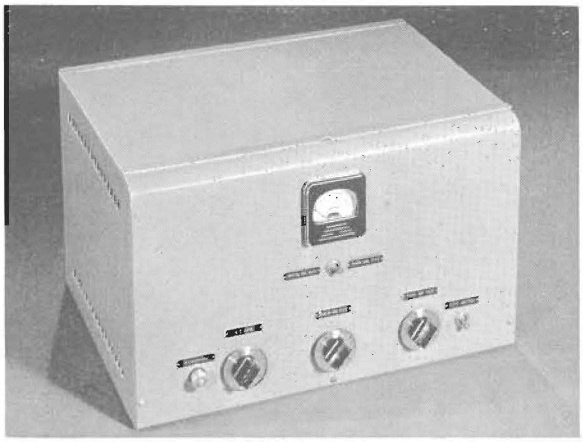
Miscellaneous nuts, bolts, soldering and mounting lugs, lock-washers and other hardware.

Accessories:

1	160 Meter RF Coil, End Linked, Bud OEL-160 or Equivalent
1	80 Meter RF Coil, End Linked, Bud OEL-80 or Equivalent
1	40 Meter RF Coil, End Linked, Bud OEL-40 or Equivalent
1	20 Meter RF Coil, End Linked, Bud OEL-20 or Equivalent
1	10 Meter RF Coil, End Linked, Bud OEL-10 or Equivalent
1	Phone Plug Yaxley No. 75 or Equivalent
1	Crystal
1	80 Tube
1	6L6-G or 6L6 GX Tube

Complete kit of the above parts with large size circuit diagram available from your local Thordarson distributor. (Accessories not included in kit).

35 Watt Phone-CW Transmitter


Cabinet View


Chassis View

THIS compact transmitter is capable of 35 watts input on CW and phone. Its power supply and its Class B audio amplifier are included on the same chassis as the RF section, and its flexibility makes it a desirable transmitter for those wishing low power on the five amateur bands from 160 to 10 meters. The complete transmitter is built upon a rectangular chassis and is housed in an attractive cabinet with a curved panel of modern design. The cabinet, panel and chassis are finished in gray flat enamel. All controls are mounted on the front panel.

The 6V6-G crystal oscillator circuit easily provides enough driving power for the 6L6-G final amplifier. The oscillator and amplifier plate voltage is 315 V. and the oscillator screen voltage is 210V. Harmonic operation of the crystal oscillator may be obtained when using 160, 80 and 40 meter crystals.

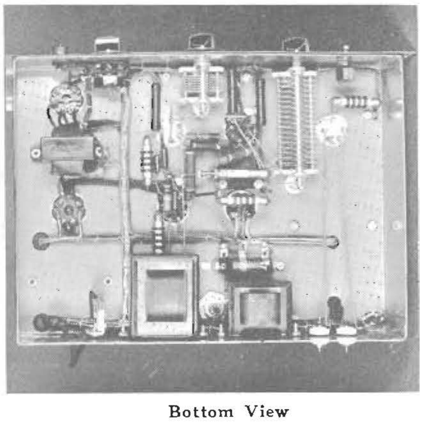
There is a condition of optimum excitation for the beam power final amplifier. In some cases it may be desirable to reduce the output of the oscillator stage so that the final stage will not be overdriven. To do this the oscillator tank is detuned by turning the tank condenser toward its minimum capacity setting.

The final amplifier may be worked "straight through," or it may be used for doubling. It delivers good power outputs when doubling to 80, 40, 20 and 10 meters. The final amplifier stage uses plate neutralization so that even on the highest frequencies no difficulty is experienced with self-oscillation. Cathode bias is used on the final amplifier; this aids in limiting the plate current when the final tank is not tuned to resonance or when there is no excitation on the final grid.

The plate tank coils for both stages are of the plug-in type. Although the crystal oscillator stage is capacity coupled to the final amplifier stage, the plug-in coil used is a Bud type OEL having a link on one end so that the coil may be used in other applications. The final tank coil is of the center-taped, center-linked type with a semi-fixed link. For the amateur who changes bands often, this provides the advantage of being able to change coils without changing the loading adjustment for each band.

Both the oscillator and final stage are keyed. The keying jack is of the closed circuit type so that no change in connections is necessary for changing quickly from CW to phone operation.

When properly loaded, the plate current in the final amplifier stage is 110 MA; and the current in the crystal oscillator plate is 25 to 30 MA. The modulator is a Class B 6A6 operating with 255 volts on the plate. Despite the high plate voltage, operation is very satisfactory in intermittent service.

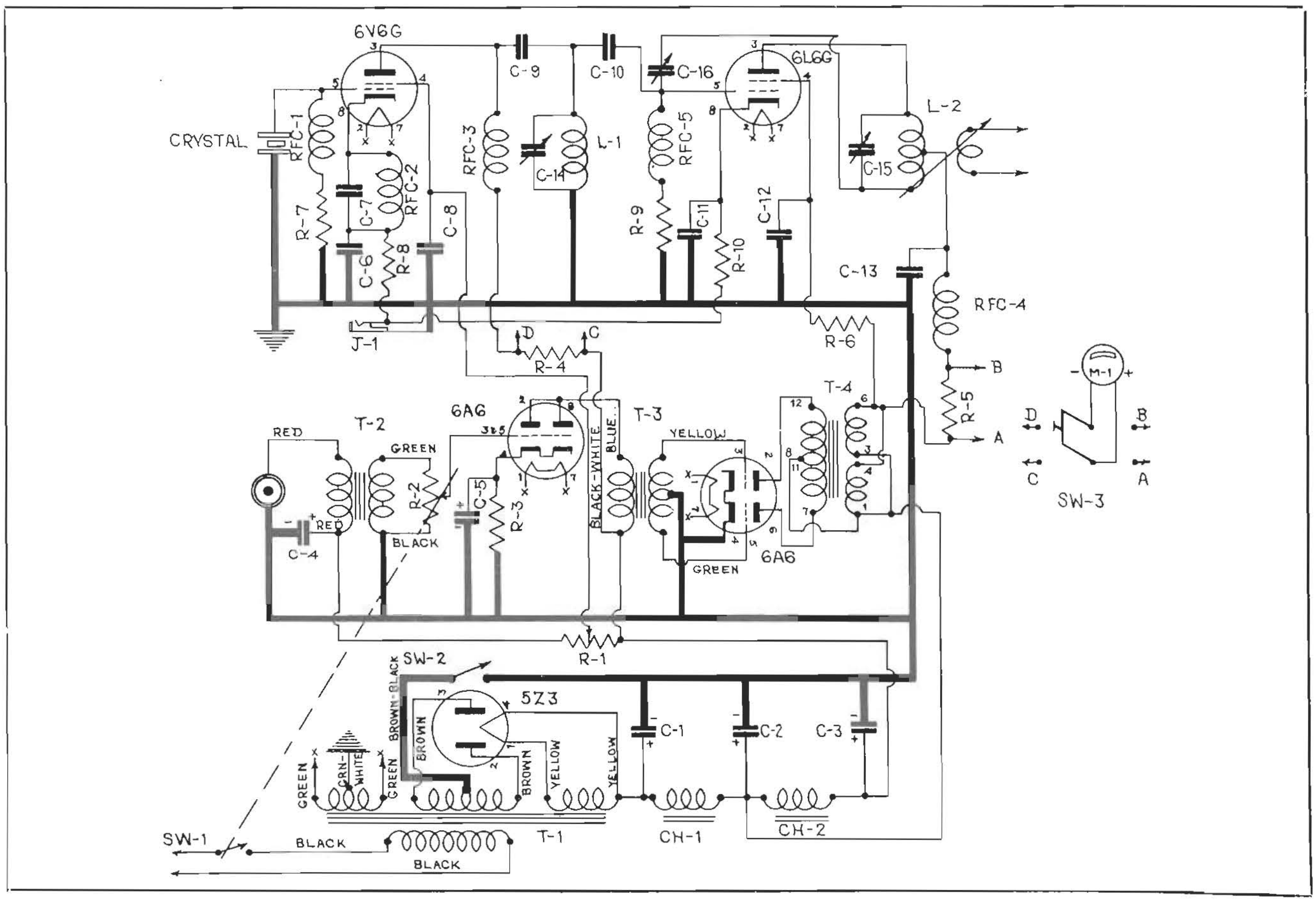

Bottom View

The 6A6 operates at zero bias, and it is driven by another 6A6 triode with its two sections in parallel. The plates of the driver are also operated at 325 volts. The cathode bias on the driver is of the order of 5 to 6 volts. High gain is realized in this stage so that no additional amplification is needed to obtain 100% modulation when using a carbon microphone.

The current for the carbon microphone is obtained by passing the bleeder current through the microphone circuit. Adequate filtering is provided so that no hum enters the audio circuit at this point. In order that the removal of the microphone plug from the chassis will not place a high voltage across C-4, the microphone connector is of the shorting type which closes the microphone circuit even when the microphone has been removed. With such a feature the operator can never inadvertently place high voltage on the condenser, C-4.

The power supply uses a 5Z3 rectifier tube. Separate switches are provided for the plate and filament supplies. A filament switch is mounted on the volume control. A handy toggle-switch on the panel controls the plate supply. A single meter is provided with switching which permits the reading of either the final plate or the oscillator plate current.

35 Watt Phone-CW Transmitter



Parts Required

THORDARSON TRANSFORMERS and CHOKES

T-1	T-92R21	Power Transformer
T-2	T-86A02	Microphone Transformer
T-3	T-19D06	Driver Transformer
T-4	T-19M13	Modulation Transformer
CH-1	T-13C30	Filter Choke
CH-2	T-74C30	Filter Choke

Resistors:

R-1	20,000 Ohm 25 Watt Semi-Variable Resistor
R-2	500,000 Ohm Volume Control with Switch
R-3	1,000 Ohm 1 Watt Resistor
R-4	50 Ohm 10 Watt Resistor
R-5	50 Ohm 10 Watt Resistor
R-6	3,500 Ohm 10 Watt Resistor
R-7	50,000 Ohm 1 Watt Resistor
R-8	200 Ohm 10 Watt Resistor
R-9	20,000 Ohm 1 Watt Resistor
R-10	200 Ohm 10 Watt Resistor

Condensers:

C-1	8 Mfd. 600 Volt Condenser
C-2, C-3	Double 8 Mfd. 450 Volt Condenser
C-4	10 Mfd. 25 Volt Electrolytic Condenser
C-5	10 Mfd. 25 Volt Electrolytic Condenser
C-6	.002 Mfd. 500 Volt Mica Condenser
C-7	.0001 Mfd. 500 Volt Mica Condenser
C-8	.002 Mfd. 500 Volt Mica Condenser
C-9	.002 Mfd. 1,000 Volt Mica Condenser
C-10	.0001 Mfd. 1,000 Volt Mica Condenser
C-11	.002 Mfd. 1,000 Volt Mica Condenser
C-12	.002 Mfd. 1,000 Volt Mica Condenser
C-13	.002 Mfd. 1,000 Volt Mica Condenser
C-14	100 Mmfd. Variable Condenser

Condensers: (Cont.)

C-15	100 Mmfd. Variable Condenser
C-16	Neutralizing Condenser

RF Chokes:

RFC-1	RF Choke
RFC-2	RF Choke
RFC-3	RF Choke
RFC-4	RF Choke
RFC-5	RF Choke

Miscellaneous Parts:

1	Chassis 14" x 10" x 3" (Punched and Drilled)
1	Panel (Punched and Drilled)
1	Cabinet
4	Feed-thru Insulators
2	5-Contact Sockets, Steatite
2	7-Contact Sockets, Large
2	Octal Sockets
1	4-Contact Socket
1	5-Contact Socket
1	Switch Plate
1	SPST Switch
1	DPDT Toggle Switch
1	Mic. Input Plug
1	Input Plug Shield
3	Knobs
2	Name Plates Marked "CRYSTAL OSC. PLATE"
2	Name Plates Marked "POWER AMP. PLATE"
1	Name Plate Marked "A.F. GAIN"
1	Name Plate Marked "PLATE VOLTAGE"
1	Name Plate Marked "MICROPHONE"

Miscellaneous Parts: (Cont.)

1	Circuit Closing Jack
1	Line Cord and Plug

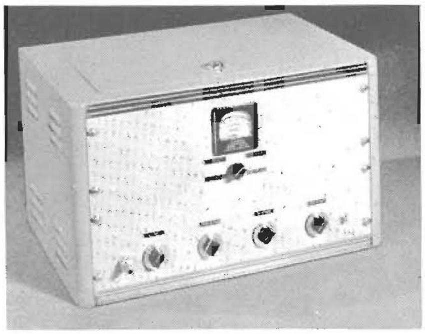
Miscellaneous nuts, bolts, soldering and mounting lugs, lock-washers and other hardware.

Accessories:

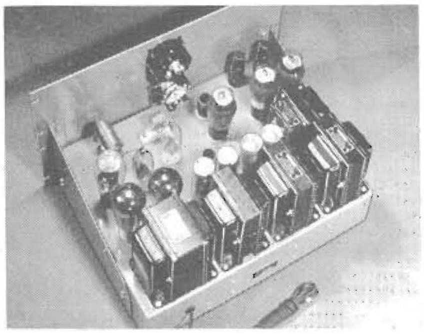
1	L-1	160 Meter RF Coil, End Linked, Bud Type OEL-160 or Equivalent
1	L-1	80 Meter RF Coil, End Linked, Bud Type OEL-80 or Equivalent
1	L-1	40 Meter RF Coil, End Linked, Bud Type OEL-40 or Equivalent
1	L-1	20 Meter RF Coil, End Linked, Bud Type OEL-20 or Equivalent
1	L-1	10 Meter RF Coil, End Linked, No Tap Bud Type OEL-10 or Equivalent
1	L-2	160 Meter RF Coil, Center Linked, Center Tapped, Bud Type OLS-160 or Equivalent
1	L-2	80 Meter RF Coil, Center Linked, Center Tapped, Bud Type OLS-80 or Equivalent
1	L-2	40 Meter RF Coil, Center Linked, Center Tapped, Bud Type OLS-40 or Equivalent
1	L-2	20 Meter RF Coil, Center Linked, Center Tapped, Bud Type OLS-20 or Equivalent
1	L-2	10 Meter RF Coil, Center Linked, Center Tapped, Bud Type OLS-10 or Equivalent
1		0-150 MA DC Meter, 2" Square Case, No Illumination Triplett 227-A or Equivalent
1		Crystal
1		6V6G Tube
1		6L6-G or 6L6GX Tube
1		5Z3 Tube
2		6A6 Tubes

Complete kit of the above parts with large size circuit diagram available from your local Thordarson distributor. (Accessories not included in kit).

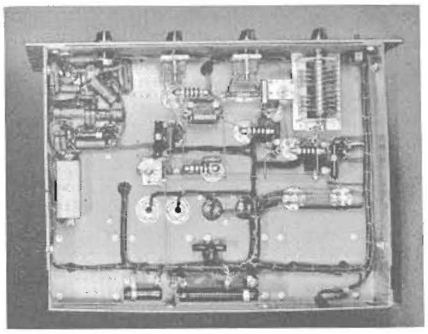
50 Watt 5 and 10 Meter Phone Transmitter



Cabinet View



Chassis View



Bottom View

THIS transmitter, designed especially for operation on the 5 and 10 meter bands, includes on one chassis a 50 watt RF section, a 25 watt modulator and the power supplies for both the RF section and modulator.

The tube line-up for the RF section is a 6L6-G tri-tet oscillator, an HK-24 doubler and an HK-24 final amplifier.

The 6L6-G oscillator uses 40 and 20 meter crystals for transmitter outputs on 10 and 5 meters respectively. The plate tank of the tri-tet is always to be tuned to a frequency double that of the crystal, and in this condition good outputs are obtained. Attempts to operate the oscillator plate tank at the crystal frequency when using a 6L6-G are likely to damage the crystal. The coil and condenser combination, L-1 and C-1, has been chosen to give a good oscillator output with reasonably low crystal current.

The HK-24 driven by the oscillator is not neutralized and is always used as a doubler stage delivering power on 10 and 5 meters. The crystal oscillator and doubler stages operate at a plate voltage of 400 volts, and the voltage on the screen-grid of the oscillator is 250.

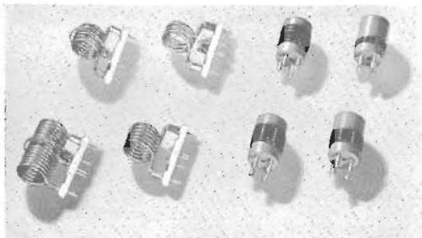
The HK-24 final amplifier is a conventional Class C stage using a split-stator tank condenser with plate neutralization. Neutralization is accomplished as easily as in transmitters operated at lower frequencies. The neutralizing condenser, C-15, is located on the under side of the chassis and is supported by the large wire connected to its terminals. It should always be adjusted with a non-metallic screw driver.

The oscillator cathode and plate tank coils are wound on 1″ forms, and the doubler and final amplifier coils are self-supporting coils wound with large copper wire and mounted on National type PB-16 plugs. The doubler plate tank is capacity coupled to the final amplifier grid, and power is taken from the final amplifier plate coil by means of a link which is supported on the coil base terminals. When properly loaded, the final amplifier plate current is 60 MA at 800 volts. The plate transformer has a nominal rating of 750 volts DC, but because of the light loading the higher plate voltage is obtained. The excitation of the final amplifier tube is such that 25 to 30 MA grid current is obtained. The cathode tank of the tri-tet oscillator should be adjusted for the maximum output consistent with good oscillator stability. It will be found that this occurs with the 100 mmfd. cathode condenser, C-1, at about one-half of its maximum capacity.

A meter, M-1, and meter switch, SW-3, are provided for metering the current to the oscillator plate, the doubler plate, the final amplifier grid and the final amplifier plate.

The modulator uses two 6L6-G tubes in push-pull and operates at a plate voltage of 400 and a screen-grid voltage of 260, operating in Class AB_1. The audio amplifier tube line-up is one 6J7 pentode, one 6J7 triode and one 6N7 phase invertor. This arrangement provides high gain for use with crystal microphones.

The power supply uses a single transformer to supply all filaments and a dual plate transformer to supply two separate rectifiers. These transformers are controlled by separate

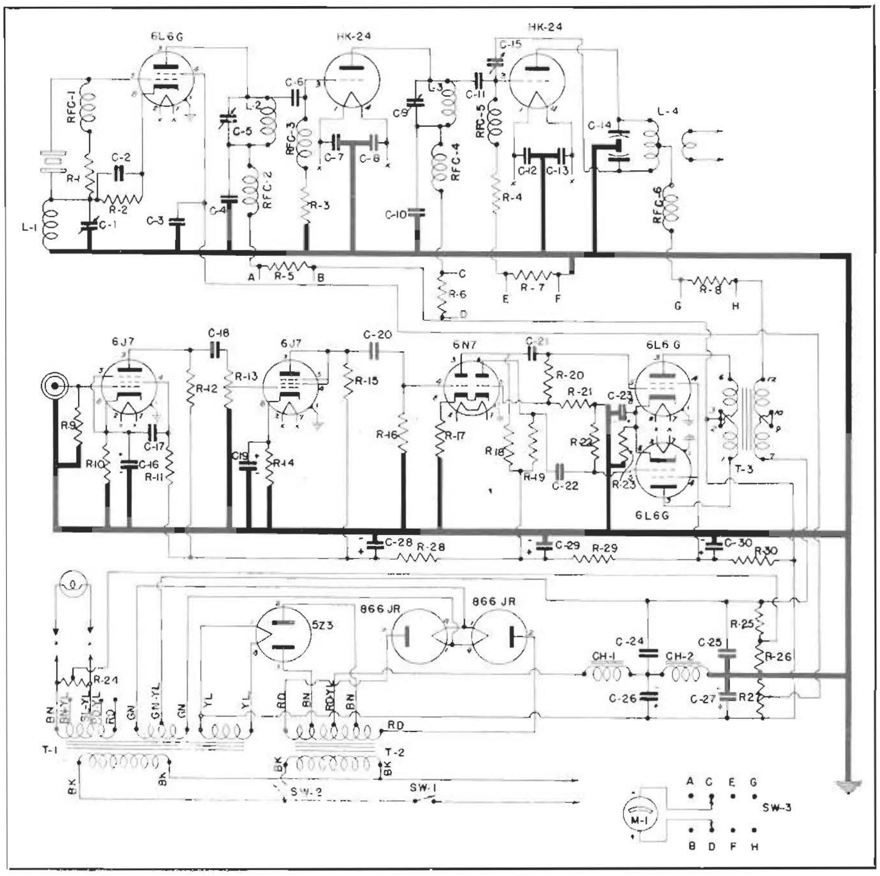


	10 Meter Operation				5 Meter Operation			
Coil	Turns	Wire Size	Diam. of Winding	Winding Length	Turns	Wire Size	Diam. of Winding	Winding Length
L-1	10	No. 16 Enam.	1″	Close Wound	4	No. 16 Enam.	1″	Close Wound
L-2	11	No. 16 Enam.	1″	⅞″	6	No. 16 Enam.	1″	¾″
L-3	7	No. 10 Bare	1″	1″	3	No. 8 Bare	1″	¾″
L-4	16 Center-Tapped	No. 10 Bare	1″	2″	6 Center-Tapped	No. 8 Bare	1″	1″

Link coupled to L-4 is of No. 14 bare copper wire 1½″ in diam. wound over the center of the plate tank coil and supported by the lugs attached to the pins on the PB-16 base. For 10 meters a 2 turn link is used: for 5 meters, a 1 turn link. Coils L-1 and L-2 are wound on 1″ forms, Millen No. 45004. Coils L-3 and L-4 are self-supporting on National PB-16 plugs.

switches on the panel. The filament switch, SW-1, is associated with the audio amplifier gain control, and the plate switch, SW-2, is of the toggle type placed in a position for convenient operation. The 400 volt supply delivers the current required by the oscillator, doubler, modulator and audio stages. It uses a type 5Z3 rectifier tube. The 800 volt supply handles the final plate power only. Although this transformer is rated at 400 and 750 volts, it is being operated at less than full load so that advantage may be taken of the higher-than-normal voltage available. Economy in the filtering of the two high voltage power supplies is obtained by using the same chokes for filtering the output of both rectifier systems. These chokes are in series with the center tap of the dual plate transformer.

The complete unit is contained on a chassis 17″ x 13″ x 3″ and is attached to a panel 19″ x 10½″ with the conventional type of chassis mounting brackets. The chassis, panel and chassis mounting brackets are finished in gray flat enamel, giving an unusually attractive appearance with the chromium dial plates. The transmitter may be enclosed in a cabinet or mounted in a rack with other equipment.



Parts Required

THORDARSON TRANSFORMERS and CHOKES:

T-1	T-19F77	Filament Transformer
T-2	T-19P70	Plate Transformer
T-3	T-19M14	Modulation Transformer
CH-1	T-75C51	Choke
CH-2	T-75C51	Choke

Resistors:

R-1	50,000 Ohm 1 Watt Resistor
R-2	350 Ohm 10 Watt Resistor
R-3	10,000 Ohm 10 Watt Resistor
R-4	2,500 Ohm 10 Watt Resistor
R-5	50 Ohm 10 Watt Resistor
R-6	50 Ohm 10 Watt Resistor
R-7	50 Ohm 10 Watt Resistor
R-8	50 Ohm 10 Watt Resistor
R-9	5 Megohm ½ Watt Resistor
R-10	5,000 Ohm 1 Watt Resistor
R-11	3 Megohm ½ Watt Resistor
R-12	500,000 Ohm ½ Watt Resistor
R-13	1 Megohm Volume Control with Switch
R-14	5,000 Ohm 1 Watt Resistor
R-15	100,000 Ohm 1 Watt Resistor
R-16	250,000 Ohm ½ Watt Resistor
R-17	2,000 Ohm ½ Watt Resistor
R-18	100,000 Ohm 1 Watt Resistor
R-19	100,000 Ohm 1 Watt Resistor
R-20	250,000 Ohm ½ Watt Resistor
R-21	12,000 Ohm ½ Watt Resistor
R-22	250,000 Ohm ½ Watt Resistor
R-23	250 Ohm 10 Watt Resistor
R-24	20 Ohm 10 Watt Center Tapped Resistor
R-25	40,000 Ohm 50 Watt Resistor
R-26	300 Ohm 10 Watt Resistor
R-27	20,000 Ohm 50 Watt Semi-Variable Resistor
R-28	20,000 Ohm 1Watt Resistor
R-29	20,000 Ohm 1 Watt Resistor
R-30	7,500 Ohm 25 Watt Semi-Variable Resistor

Condensers:

C-1	100 Mmfd. Variable Condenser
C-2	.01 Mfd. 400 Volt Condenser
C-3	.002 Mfd. 1,000 Volt Mica Condenser
C-4	.002 Mfd. 1,000 Volt Mica Condenser
C-5	35 Mmfd. Variable Condenser
C-6	.0001 Mfd. 1,000 Volt Mica Condenser
C-7	.002 Mfd. 1,000 Volt Mica Condenser
C-8	.002 Mfd. 1,000 Volt Mica Condenser
C-9	35 Mmfd. Variable Condenser
C-10	.002 Mfd. 1,000 Volt Mica Condenser
C-11	.0001 Mfd. 1,000 Volt Mica Condenser
C-12	.002 Mfd. 1,000 Volt Mica Condenser
C-13	.002 Mfd. 1,000 Volt Mica Condenser
C-14	35-35 Mmfd. Variable Condenser
C-15	Neutralizing Condenser
C-16	10 Mfd. 25 Volt Electrolytic Condenser
C-17	.04 Mfd. 400 Volt Condenser
C-18	.04 Mfd. 400 Volt Condenser
C-19	10 Mfd. 25 Volt Electrolytic Condenser
C-20	.1 Mfd. 400 Volt Condenser
C-21	.1 Mfd. 400 Volt Condenser
C-22	.1 Mfd. 400 Volt Condenser
C-23	10 Mfd. 25 Volt Electrolytic Condenser
C-24	2 Mfd. 1,000 Volt Condenser
C-25	2 Mfd. 1,000 Volt Condenser
C-26	8 Mfd. 600 Volt Electrolytic Condenser
C-27	8 Mfd. 600 Volt Electrolytic Condenser
C-28, C-29, C-30	Triple 8 Mfd. 450 V Electrolytic Condenser

RF Chokes:

RFC-1	RF Choke
RFC-2	RF Choke
RFC-3	RF Choke
RFC-4	RF Choke
RFC-5	RF Choke
RFC-6	RF Choke

Miscellaneous Parts:

1	Chassis 17″ x 13″ x 3″ (Punched and Drilled)
1	Panel 19″ x 12¼″ (Punched and Drilled)
1	Pr. Chassis Mounting Brackets
6	Octal Sockets
1	4-Contact Socket
6	4-Contact Sockets, Isolantite
2	Plug-in Sockets
4	Plug-in Bases
4	Coil Forms
1	Crystal Socket
4	Knobs
1	Pointer Knob
1	SPST Switch, N. P.
1	Double-Pole, 4-Throw Switch, Isolantite
1	Input Plug
1	Input Shield
2	Metal Tube Grid Caps
2	Metal Tube Grid Cap Shields
2	Name Plates Marked "POWER AMP. PLATE"
1	Name Plate Marked "POWER AMP. GRID"
2	Name Plates Marked "BUFFER PLATE GRID"
2	Name Plates Marked "CRYSTAL OSC. PLATE"
1	Name Plate Marked "AF GAIN"
1	Line Cord and Plug

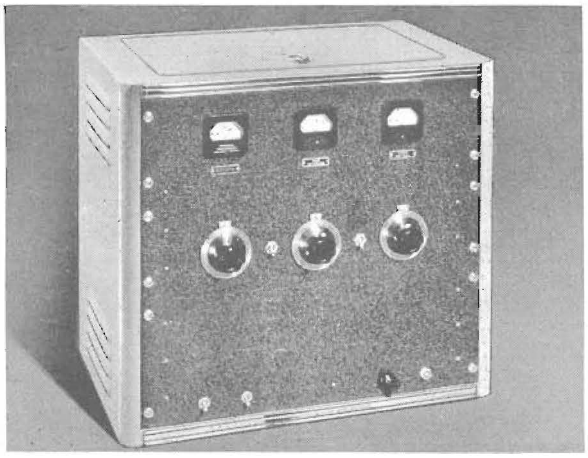
Miscellaneous nuts, bolts, soldering and mounting lugs, lock-washers and other hardware.

Accessories:

1	0-150 MA DC Meter 3″ Square Case, Rear Illumination, Triplett 327A or Equivalent		
1	Cabinet	3	6L6-G or 6L6GX Tubes
1	Crystal	1	5Z3 Tube
2	6J7 Tubes	2	866-JR Tubes
1	6N7 Tube	2	HK-24 Tubes

Complete kit of the above parts with large size circuit diagram available from your local Thordarson distributor. (Accessories not included in kit).

55 Watt Phone, 80 Watt CW Transmitter



Cabinet View

Rear View

COMPACTNESS, reliability, ease of operation and neatness of appearance are salient features of this 55 watt phone and 80 watt CW transmitter. Designed with entirely separate audio and RF sections and each having its own power supply, either of these two matched units may be used separately. For the CW operator the compact and neat appearing RF section is a pleasure to have on the operating table or in the rack. Operating with 80 watts input, the high plate efficiency of the final stage not only makes it an outstanding transmitter but also a highly desirable exciter unit for transmitters having inputs as high as 500 watts. Circuits are strictly conventional, and components are conservatively chosen.

The modulator, with an output of 30 watts, easily modulates the 55 watt Class C input of the RF amplifier. The high gain (122 db) enables it to modulate the transmitter 100% with very weak audio signals. With the Multi-Match modulation transformer the amateur may use it to modulate any transmitter requiring 30 watts of audio power.

The RF line-up is as follows: a 6F6-G crystal oscillator stage, a 6L6-G buffer-doubler stage, and an 809 final amplifier stage. The 6F6-G operates with 320 volts on the plate and 270 volts on the screen-grid. The 6L6-G operates with a plate voltage of 340 volts and a screen-grid voltage of 250. For phone operation the voltage on the 809 plate is 625 volts, and for CW operation this voltage is raised to 785.

The oscillator stage operates with all crystals from 160 to 10 meters, but for best stability and freedom from "chirps" it is recommended that for 10 meter operation a 20 meter crystal be used and doubling be carried on in the buffer-doubler stage. When the crystal stage is in an oscillating condition and is loaded by the grid of the next stage, the oscillator plate current is approximately 30 to 40 MA. The buffer-doubler stage is neutralized and may be used with excellent results either for frequency multiplying or as a regular buffer. When using 160 and 80 meter crystals, not only is doubling easily accomplished in the second stage but enough output can be obtained by quadrupling to give good excitation to the 809 grid on 40 and 20 meters. When the 6L6-G is driving the 809 grid to 30 MA of grid current, the plate current of the 6L6-G is on the order of 70 MA. The antenna loading should be adjusted so that the final amplifier plate current is 88 MA for a 55 watt phone input. For an 80 watt CW input the loading is adjusted so that the final amplifier plate current is 102 MA. The secondary of the plate transformer supplying energy to the final amplifier is equipped with taps so that by merely changing these taps the change from 625 volts for phone operation to 785 volts for CW operation may be made. Correct tuning of the buffer-doubler plate circuit is accomplished by noting the grid current reading of the final amplifier stage. Care should be taken that the 6L6-G plate circuit is not tuned to some undesired harmonic of the crystal frequency.

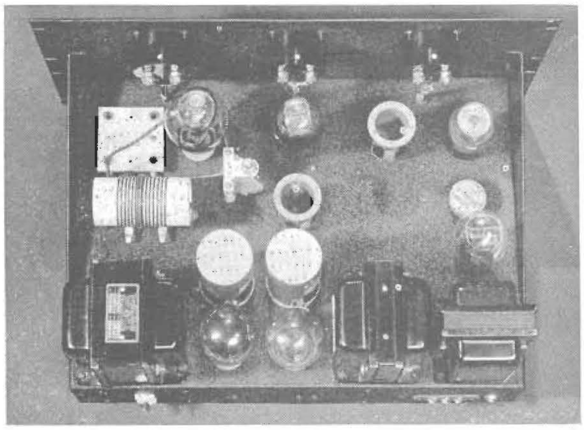
The same final tank coil is used for operation on 80 and 160 meters. For 160 meter operation a fixed air condenser is plugged into the jack-base which is shown in the top view of the RF section on page 9. If the amateur does not desire operation on 160 meters, it is unnecessary to have the Cardwell JB base or the Cardwell JD-80-OS condenser. The spacing of the final tank condenser is 0.070″, which is greater than is usually found for use with the voltages encountered in this circuit. However, such spacing permits grounding of the rotor. Should the amateur wish to build for CW operation only, a spacing of 0.050″ is satisfactory.

The modulator has for its output stage two 6L6-G's operating in Class AB_1. At no-signal the plate-to-ground (-B) voltage is 390 volts. The screen-grid voltage to ground should be adjusted by means of R-14 to a value of 310 volts. In this condition the voltage measured from cathode to ground across R-13 is 20 volts.

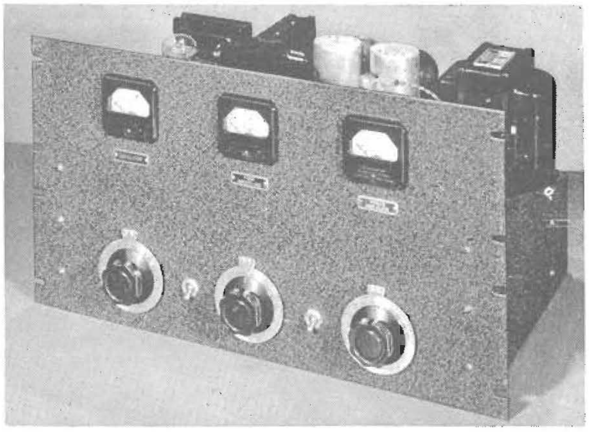
The three stages before the output stage provide adequate gain for the use of this modulator with all types of microphones. The input to the first stage, a pentode-connected 6J7, is shielded to avoid hum pick-up and to prevent pick-up of RF energy. As a further precaution against the entrance of RF energy to the grid of this stage, a filter consisting of C-1, RFC-1 and C-2 is installed in the input circuit. These elements, in addition to the grid lead and R-1, are carefully shielded with pieces of tinned copper. The result is that with the volume control wide open, the amplifier operates perfectly; and the residual hum is 45 to 50 db below the full output power.

(Continued on Page 10)

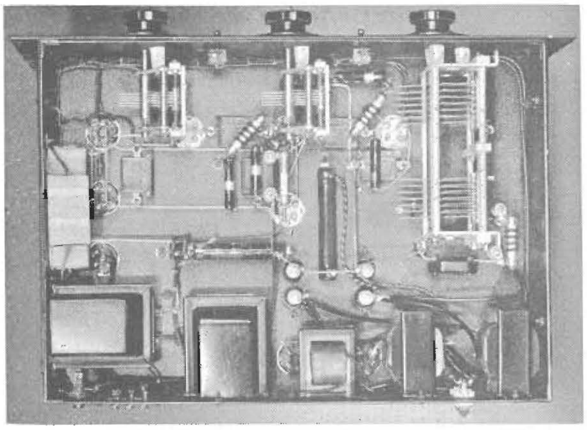
55 Watt Phone, 80 Watt CW Transmitter



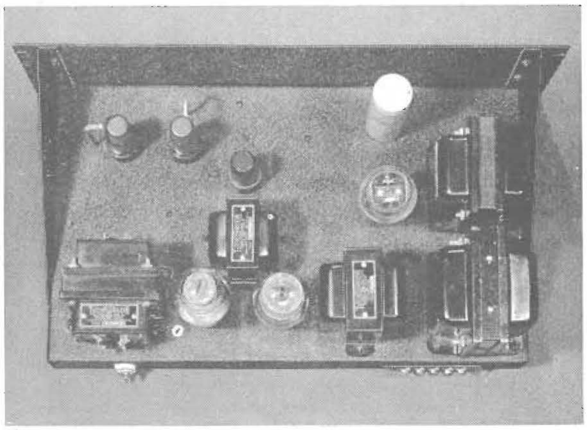
Top View of RF Section



Front View of RF Section



Bottom View of RF Section

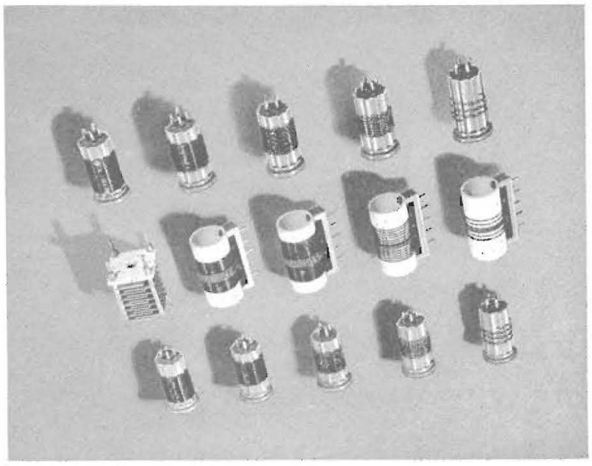


Top View of Modulator

COIL DATA — 55 or 80 WATT TRANS.

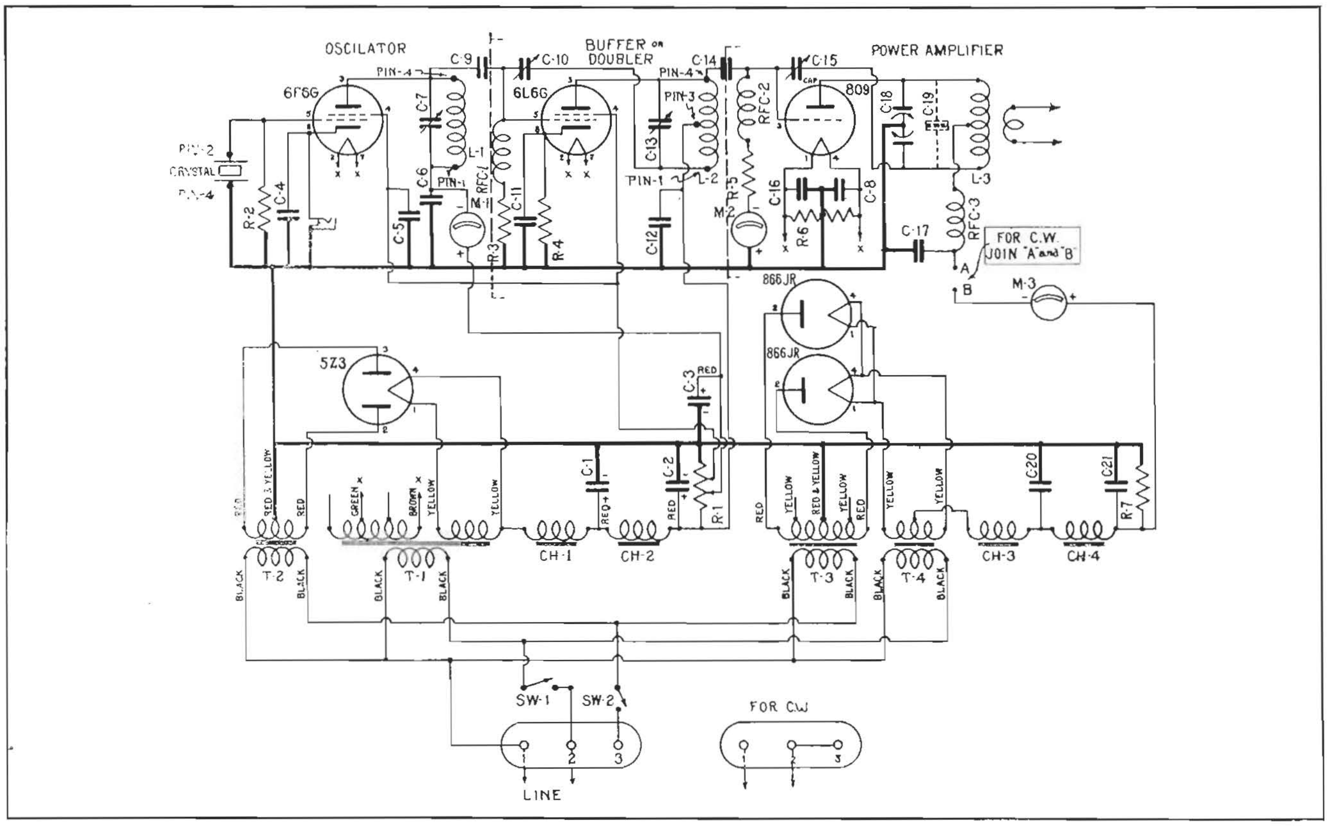
Band	L-1 and L-2 Turns	L-1 and L-2 Winding Length	L-1 and L-2 Wire Size	L-3 Turns	L-3 Winding Length	L-3 Wire Size	L-3 Link Turns
160	58	1 9/16"	#22	42	1 3/4"	#18	4
80	30	1 3/8"	#18	42	1 3/4"	#18	4
40	16	1 3/8"	#18	32	2 3/8"	#18	4
20	8	1 1/4"	#18	14	2"	#16	2
10	4	1 1/4"	#18	6	1 1/4"	#16	1

L-1 and L-2 are wound on Hammarlund XP-53 Coil Forms. The coil ends are connected to No. 1 and No. 4 pins. L-2 is center-tapped, the tap being brought out on pin No. 3. L-3 is wound on National XR-13 Coil Forms attached to a PB-5 plug. Link is wound with insulated wire directly over bare wire of plate coil.



Plug-In Coils

RF Section



(*Continued from Page 8*)

The power supply for the RF unit consists of two rectifier systems, one using a 5Z3 to supply the plates and screen-grids of the two low power stages and the other using a pair of 866-JR's to supply the plate of the final amplifier. The power supply on the modulator chassis uses a 5Z3. On each chassis there is a separate filament supply. On the RF chassis and on the modulator chassis there are two switches, one for the filament supply and one for the plate supply. Thus, one unit can be operated independently of the other. When using the RF unit alone for CW operation, join terminals No. 2 and No. 3 and connect the 115 volt supply line to terminals No. 1 and No. 2. In this condition of operation SW-1 controls the filaments and SW-2 controls the plate supplies. For phone operation, in which it is desired that a single switch operate all plate supplies, connect the 115 volt supply line to terminals No. 4 and No. 5 on the modulator chassis; then connect terminals No. 1, No. 2 and No. 3 on the modulator to their respectively numbered terminals on the RF chassis. On the RF chassis, close SW-1 and SW-2. Then, on the modulator chassis, SW-1 controls all the filaments and SW-2 controls all the plate supplies.

Parts Required

THORDARSON TRANSFORMERS and CHOKES:

T-1	T-19F76	Filament Transformer
T-2	T-19P54	Plate Transformer
T-3	T-19P56	Plate Transformer
T-4	T-19F88	Filament Transformer
CH-1	T-19C39	Input Choke
CH-2	T-19C46	Smoothing Choke
CH-3	T-57C53	Filter Choke
CH-4	T-57C53	Filter Choke

Resistors:

R-1	7,500 Ohm 50 Watt Resistor
R-2	50,000 Ohm 1 Watt Resistor
R-3	50,000 Ohm 10 Watt Wirewound Resistor
R-4	350 Ohm 10 Watt Wirewound Resistor
R-5	3,500 Ohm 10 Watt Wirewound Resistor
R-6	20 Ohm 10 Watt Center Tapped Resistor
R-7	20,000 Ohm 50 Watt Wirewound Resistor

Condensers:

C-1	4 Mfd. 600 Volt Condenser
C-2	4 Mfd. 475 Volt Condenser
C-3	4 Mfd. 475 Volt Condenser
C-4	.002 Mfd. 1,000 Volt Mica Condenser
C-5	.002 Mfd. 1,000 Volt Mica Condenser
C-6	.002 Mfd. 1,000 Volt Mica Condenser
C-7	100 Mmfd. Variable Condenser
C-8	.001 Mfd. 1,000 Volt Mica Condenser
C-9	.0001 Mfd. 1,000 Volt Mica Condenser
C-10	Neutralizing Condenser
C-11	.002 Mfd. 1,000 Volt Mica Condenser
C-12	.002 Mfd. 1,000 Volt Mica Condenser
C-13	100 Mmfd. Variable Condenser
C-14	.0001 Mfd. 1,000 Volt Mica Condenser
C-15	Neutralizing Condenser
C-16	.001 Mfd. 1,000 Volt Mica Condenser
C-17	.001 Mfd. 2,500 Volt Mica Condenser.
C-18	100-100 Mmfd. Variable Condenser
C-20	2 Mfd. 1,000 Volt Oil Filled Condenser
C-21	2 Mfd. 1,000 Volt Oil Filled Condenser

RF CHOKES:

3	RF Chokes

Miscellaneous Parts:

1	Chassis 17" x 12" x 4" (Punched & Drilled)
1	Panel 10½" x 19" (Punched & Drilled)
1 Pr.	Chassis Mounting Brackets
1	5-Contact Socket
2	Octal Sockets
3	4-Contact Isolantite Sockets
3	4-Contact Sockets
2	Feed-thru Bushings
10	Stand-off Insulators
2	Coil Forms, 4-Prong
1	Phone Jack, Circuit Closing
2	SPST Switches
1	Grid Grip
3	Dials, 2¼" Diameter
1	Coil Form
1	Coil Form Plug
1	Base for PB-5 Plug
1	Name Plate Marked "OSCILLATOR"
1	Name Plate Marked "POWER AMP. GRID"
1	Name Plate Marked "POWER AMP. PLATE"

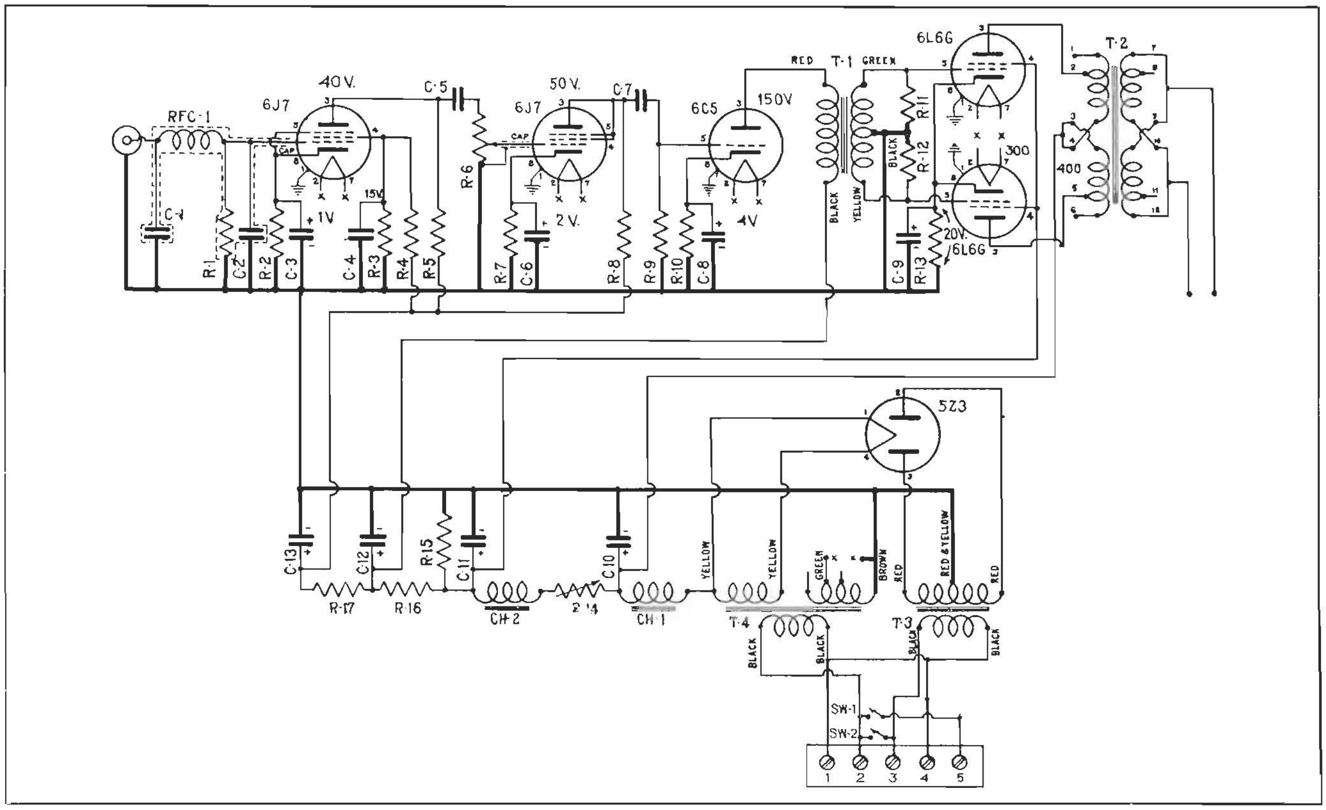
Miscellaneous nuts, bolts, solder and mounting lugs, lock-washers and other hardware.

Accessories:

1	Coil Form per band National XR13 or Equiv.
1	Coil Form Plug per band National PB-5 or Equivalent
2	Coil Forms per Band Hammarlund XP-53 or Equivalent
1	150 MA DC Meter, 2" Square Case, No Illumination, Triplett 227-A or Equivalent
1	100 MA DC Meter, 2" Square Case, No Illumination, Triplett 227-A or Equivalent
1	250 MA DC Meter, 2" Square Case, No Illumination, Triplett 227-A or Equivalent
1	Cabinet
1	Crystal
1	6F6-G Tube
1	6L6-G or 6L6 GX Tube
1	809 Tube
1	5Z3 Tube
2	866-JR Tubes
1	Jack Base Cardwell JB
1	80 Mmfd. Fixed Air Condenser (C-19) Cardwell JD-80-OS (Used only on 160 Meters)

Complete kit of the above parts with large size circuit diagram available from your local Thordarson distributor. (Accessories not included in kit).

Modulator Section



Parts Required

THORDARSON TRANSFORMERS and CHOKES:

T-1	T-74A31	Push-pull Input Transformer
T-2	T-19M14	Modulation Transformer
T-3	T-19P54	Plate Transformer
T-4	T-19F76	Filament Transformer
CH-1	T-17C00-B	Filter Choke
CH-2	T-13C27	Filter Choke

Resistors:

R-1	5 Megohm ¼ Watt Resistor
R-2	5,000 Ohm ¼ Watt Resistor
R-3	25,000 Ohm 1 Watt Resistor
R-4	250,000 Ohm ½ Watt Resistor
R-5	500,000 Ohm ½ Watt Resistor
R-6	1 Megohm Volume Control
R-7	2,500 Ohm 1 Watt Resistor
R-8	100,000 Ohm 1 Watt Resistor
R-9	250,000 Ohm ¼ Watt Resistor
R-10	1,000 Ohm 1 Watt Resistor
R-11	50,000 Ohm 1 Watt Resistor
R-12	50,000 Ohm 1 Watt Resistor
R-13	150 Ohm 25 Watt Resistor
R-14	2,500 Ohm 25 Watt Semi-Variable Resistor
R-15	12,000 Ohm 25 Watt Resistor
R-16	20,000 Ohm 1 Watt Resistor
R-17	20,000 Ohm 1 Watt Resistor

Condensers:

C-1	.0001 Mfd. 500 Volt Mica Condenser
C-2	.0001 Mfd. 500 Volt Mica Condenser
C-3	10 Mfd. 25 Volt Condenser
C-4	.03 Mfd. 400 Volt Condenser
C-5	.1 Mfd. 400 Volt Paper Condenser
C-6	10 Mfd. 25 Volt Condenser
C-7	.1 Mfd. 400 Volt Condenser
C-8	10 Mfd 25 Volt Condenser
C-9	10 Mfd. 50 Volt Condenser
C-10	8 Mfd. 600 Volt Condenser
C-11, C-12, C-13	Triple 8 Mfd. 450 Volt Condenser

RF Choke:

RFC-1 RF Choke

Miscellaneous Parts:

1	Chassis 17″ x 10″ x 2″ (Punched and Drilled)
1	Panel 19″ x 7″ (Punched and Drilled)
1	5-Lug Terminal Board
1 Pr.	Chassis Mounting Brackets
2	Feed-thru Bushings
5	Octal Sockets
1	4-Contact Socket
1	Dial Plate Marked "GAIN"
1	Microphone Input Plug
1	Microphone Input Plug Shield

Miscellaneous Parts: (Cont.)

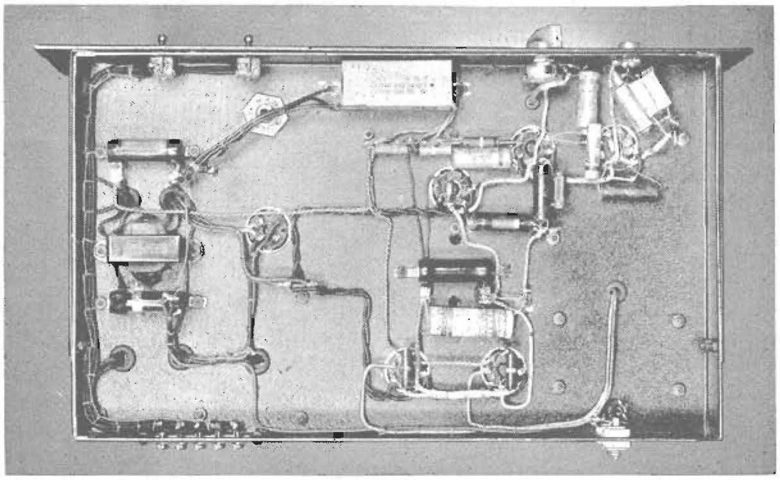
2	SPST Switches
2	Metal Tube Grid Caps

Miscellaneous nuts, bolts, resistor and mounting lugs, lock-washers, and other hardware.

Accessories:

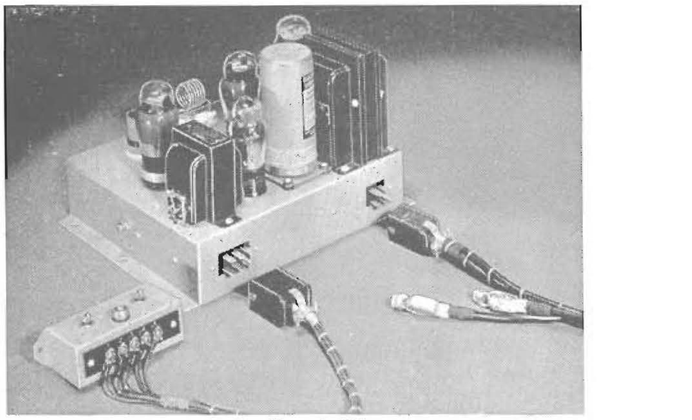
1	Cabinet		
1	Crystal		
2	6J7 Tubes	2	6L6-G Tubes
1	6C5 Tube	1	5Z3 Tube

Complete kit of the above parts with large size circuit diagram available from your local Thordarson distributor. (Accessories not included in kit).

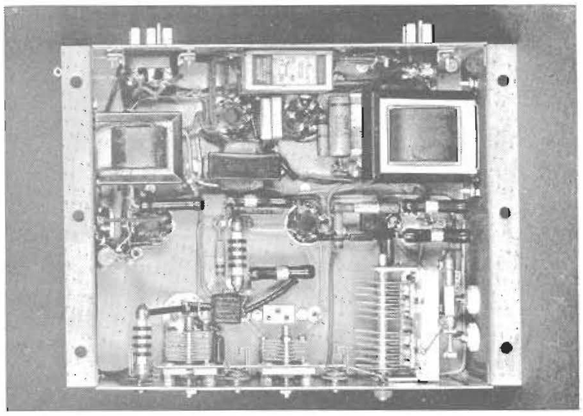


Bottom View of Modulator

12 Watt Mobile Transmitter for 5-10 Meters



Chassis View



Bottom View

PORTABLE mobile operation on 5 and 10 meters is the distinctive feature of this unit. It is of a rugged chassis type construction especially planned to be used in automobiles. It operates from a 6 volt storage battery using a vibrator power supply which may be remotely controlled from a point several feet away, as for example, a driver's seat.

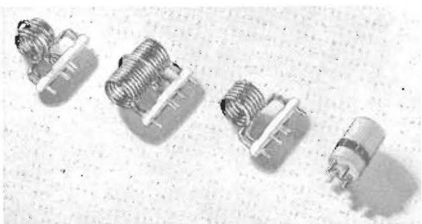
The RF tube line-up is as follows: a 6V6-G tri-tet crystal oscillator, and a T-21 final amplifier. The oscillator stage operates with a 20 meter crystal, and doubling is carried on in the plate circuit. At no time is operation of the crystal stage "straight through" recommended. The oscillator plate tank is capacity-coupled to the T-21 grid. The T-21 operates "straight through" on 10 meters, and for 5 meter operation doubling in the final is accomplished. The final tank condenser is of the split-stator type. The final amplifier is neutralized in a conventional manner. The cathode tank coil is wound on a 1″ form, and the oscillator plate and final plate tank coils are wound on National PB-16 bases with heavy copper wire. Power is taken from the final tank by means of a link.

The power input to the final amplifier plate when it is properly loaded is of the order of 10-12 watts. The final stage cathode current should be between 50 and 55 MA.

Since the transmitter will be operated in an unattended condition, the three variable condenser adjustments are made with a screw driver and then locked with special nuts. The metering of the oscillator cathode current, the final grid current and the final cathode current is done by plugging in an external meter in the jacks provided.

A single 6V6-G tube operates as a Class A amplifier to modulate the T-21 tube. Provision is made for remotely connecting a carbon microphone to the primary of the microphone transformer which is installed on the under side of the chassis. A control with a screw driver adjustment permits the adjustment of the gain of the audio system to the desired amount.

The power supply uses a vibrator having accessible actuating coil terminals. With such a vibrator it is possible to avoid switching the high current which flows in the primary of the vibrator transformer, and consequently, the control of this vibrator may be done at a distance without the necessity of using connections of high current carrying capacity. The rectifier tube is a 6W5-G. Connections made through socket S-2 to the control box, which may be located at any given convenient place, are such that the closing of switch SW-1 causes the filaments to heat and the current to flow in the microphone circuit. The closing of SW-2 starts the vibrator. Consequently, SW-2 may be used as a stand-by switch. The operator is cautioned against closing SW-2 before the filaments have had time to heat, for the premature closing is likely to damage the 6W5-G.



Separate plugs and sockets are provided for the entrance to the chassis of the power supply and the control wiring. This also aids in keeping vibrator noises out of the microphone circuit. As a further precaution against

(Continued on following page)

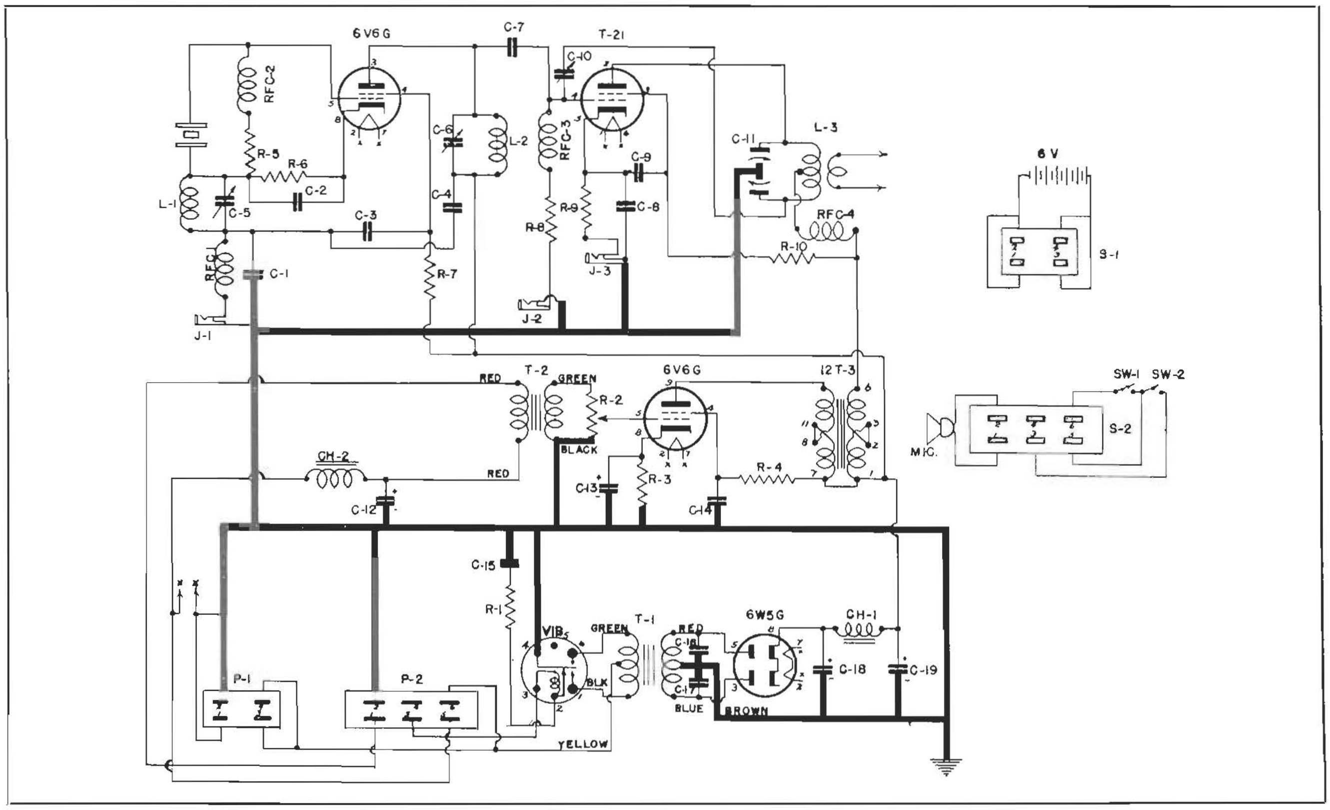
Coil	Turns	Wire Size	Diam. of Winding	Winding Length	Supporting Form
L-1	5	No. 16 Enameled	1″	Close Wound	Millen No. 45004 Coil Form
L-2	6	No. 10 Bare	1″	1″	Self-Supporting on National PB-16 Plug
L-3 10 Meters	16 Center-Tapped	No. 10 Bare	1″	2″	Self-Supporting on National PB-16 Plug
L-3 5 Meters	6 Center-Tapped	No. 10 Bare	1″	1″	Self-Supporting on National PB-16 Plug

The link on L-3 is made of 1 turn of No. 14 bare copper wire about 1½″ in diameter looped around the center portion of L-3 and supported by the terminal lugs on the PB-16 plug.

having any vibrator interference in the microphone circuit, any ripple which is superimposed on the leads from SW-1 is effectively filtered out by the CH-2—C-12 filter. All leads carrying current to the 6V primary of the power transformer should be of heavy wire, No. 16 or larger. This measure must be taken so that the full battery voltage is available at the transformer. Similarly, the wire in the power cable from S-1 to the battery should be large. This precaution also tends to minimize vibrator noise.

The polarity of the battery when connected to the transmitter is not important. However, when installed in an automobile in which one battery serves both the transmitter and the car electrical system, some attention should be given to the polarity. This is especially necessary if the transmitter chassis is in contact with the frame of the car.

In wiring, careful attention should be given to the placement of leads and chassis connections. Wherever possible the leads carrying vibrator current should not be common with those carrying signal currents.



Parts Required

THORDARSON TRANSFORMERS and CHOKES

T-1	T-14R38	Power Transformer
T-2	T-86A02	Microphone Transformer
T-3	T-19M13	Modulation Transformer
CH-1	T-57C53	Filter Choke
CH-2	T-14C61	Filter Choke

Resistors:

R-1	200 Ohm 1 Watt Resistor
R-2	500,000 Ohm Volume Control
R-3	300 Ohm 10 Watt Resistor
R-4	20,000 Ohm 10 Watt Resistor
R-5	50,000 Ohm 1 Watt Resistor
R-6	350 Ohm 10 Watt Resistor
R-7	12,000 Ohm 10 Watt Resistor
R-8	50,000 Ohm 1 Watt Resistor
R-9	350 Ohm 10 Watt Resistor
R-10	10,000 Ohm 10 Watt Resistor

Condensers:

C-1	.002 Mfd. 500 Volt Mica Condenser
C-2	.01 Mfd. 400 Volt Condenser
C-3	.002 Mfd. 500 Volt Mica Condenser
C-4	.002 Mfd. 500 Volt Mica Condenser
C-5	100 Mmfd. Variable Condenser

Condensers: (Cont.)

C-6	35 Mmfd. Variable Condenser
C-7	.0001 Mfd. 500 Volt Condenser
C-8	.002 Mfd. 500 Volt Mica Condenser
C-9	.002 Mfd. 500 Volt Mica Condenser
C-10	Neutralizing Condenser
C-11	35-35 Mmfd. Variable Condenser
C-12	100 Mfd. 25 Volt Electrolytic Condenser
C-13	10 Mfd. 25 Volt Electrolytic Condenser
C-14	.1 Mfd. 400 Volt Condenser
C-15	.1 Mfd. 400 Volt Condenser
C-16	.05 Mfd. Oil Impregnated Condenser
C-17	.05 Mfd. Oil Impregnated Condenser
C-18, C-19	Double 8 Mfd. 450 Volt Condenser

RF Chokes:

RFC-1	RF Choke
RFC-2	RF Choke
RFC-3	RF Choke
RFC-4	RF Choke

Miscellaneous Parts:

1	Chassis 11" x 8" x 3" (Punched and Drilled)
1	Vibrator Mounting Plate
1	Bottom Plate

Miscellaneous Parts: (Cont.)

1	Control Box
3	Octal Sockets
1	4-Contact Socket, Steatite
1	6-Contact Socket, Steatite
1	6-Contact Socket
1	6-Prong Plug
1	4-Prong Plug
1	6-Contact Socket
1	4-Contact Socket
2	Feed-thru Insulators
2	Coil Sockets
3	Coil Base Plugs
3	Circuit Closing Jacks
1	Crystal Socket
2	4-Prong Coil Forms
6	Resistor Mounting Strips

Miscellaneous nuts, bolts, soldering and mounting lugs, lock-washers and other hardware.

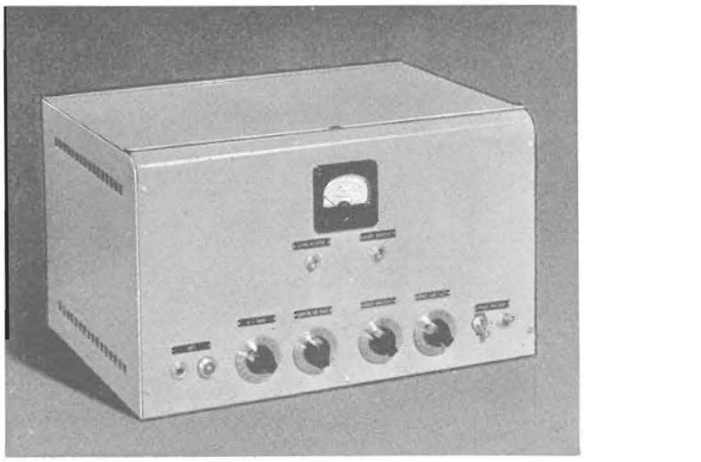
Accessories:

1	Vibrator, Electronics #427 or Equivalent
1	Crystal
1	T-21 Tube
1	6W5-G Tube
2	6V6-G Tubes

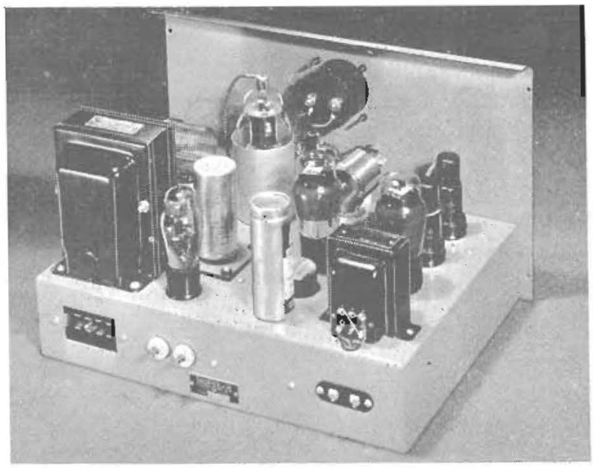
Complete kit of the above parts with large size circuit diagram available from your local Thordarson distributor. (Accessories not included in kit).

12 Watt Universal Transmitter

FOR PORTABLE AND EMERGENCY SERVICE



Cabinet View



Chassis View

OPERATING on either 115 volts AC or 6 volts DC, this unit not only provides the amateur with an emergency transmitter for battery operation but also may be used as the regular transmitter in the "shack" when so desired. No changes of parts or wiring are necessary for conversion from AC to DC — only the insertion of the proper power plug is required.

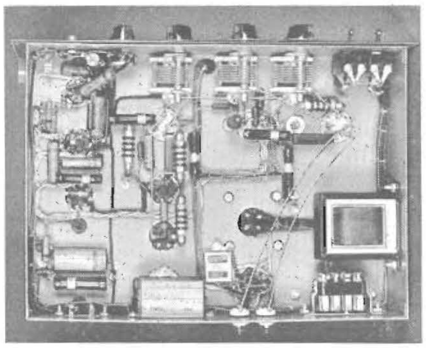
On battery operation 10 to 12 watts input may be obtained, and on AC operation, slightly more than 12 watts input may be expected.

The oscillator tube is a 6V6-G used in a regenerative type circuit having an RF choke in the cathode circuit. The final stage uses an 807 tube.

The final tank circuit consists of two condensers, C-10 and C-11, and a coil, L-2. This tank circuit may be used in the conventional manner by turning C-11 to maximum capacity, in which position a bent rotor plate shorts it out and grounds one side of the link. For settings of C-11 less than full capacity, the 807 is working into a pi network having for its elements C-10, C-11 and L-2. A single-wire antenna may then be connected to the high side of C-11, and the degree of loading may be adjusted by varying C-11 and retuning C-10. In all cases C-10 should be tuned for the minimum plate current, and each re-adjustment of C-11 will require a change of C-10. This provides an easy method of connecting a wide variety of types of single-wire antennas to the transmitter and quickly adjusting to the proper degree of loading. The loading is made greater as the capacity of C-11 is decreased.

A single meter is provided with a switch which permits reading plate current in either the oscillator or the final stage. Because of the excellent shielding and the good circuit layout it was unnecessary to neutralize the 807 tube.

The transmitter may be used on all bands from 160 to 10 meters, and doubling may be accomplished in the crystal stage when using 160, 80 and 40 meter crystals. A closed circuit jack is provided which permits keying the oscillator and amplifier stages simultaneously. Too much grid excitation on the 807 final causes the screen-grid current to become too high. Because the screen-grid voltage is obtained through a dropping resister, this increase in screen current causes the screen-grid voltage to become low enough that the power output capability of the 807 is reduced. In cases where less excitation is desired, the oscillator tank condenser C-6 may be turned toward its minimum capacity setting.



Bottom View

The modulator is a 6V6-G operating Class A, and the audio amplifier section consists of two 6J7 tubes, pentode connected, providing enough gain for operation with a crystal microphone.

The power supply uses a special vibrator transformer which may be used on either 6 volts DC or 115 volts AC. For AC operation the heater voltage for the tubes is obtained from a transformer winding; and for DC operation the heater voltage is obtained directly from the battery.

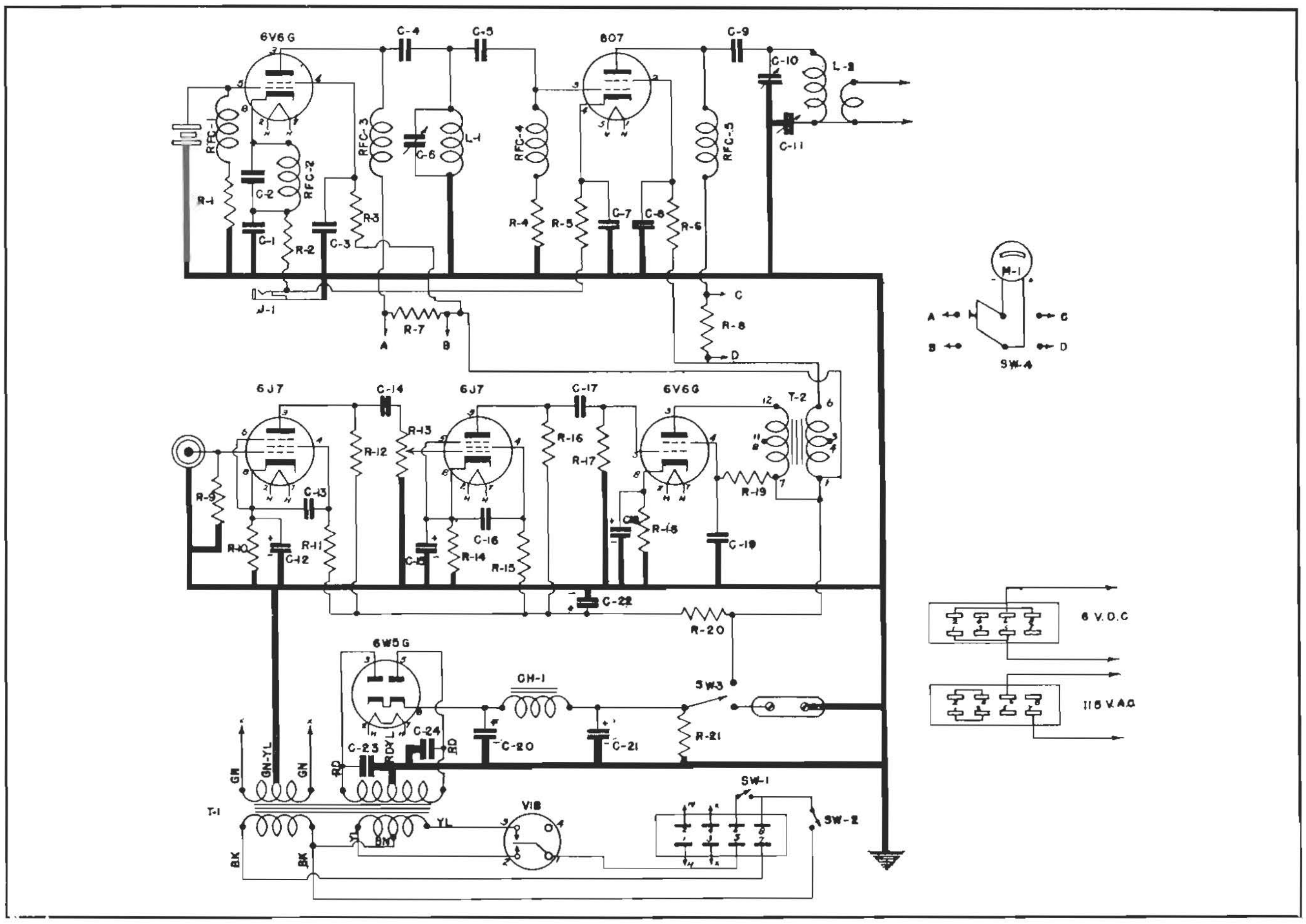
In DC operation the closing of SW-1 causes the filaments to be heated, and the closing of SW-2 causes the vibrator to operate. A short time should be allowed for the heaters to warm up before closing SW-2. Unless such a precaution is taken, there is possibility of damaging the 6W5-G tube.

In AC operation SW-1 should be closed, and the complete power supply is then controlled by SW-2. To provide a source of high voltage DC for the operation of receivers or any other auxiliary equipment, a switch is provided on the meter panel which removes the plate voltage from the tubes in the transmitter and makes it available at a terminal board to which may be connected any other equipment. This switch, SW-3, can then be used as a stand-by switch between transmissions. This source of voltage is available in either AC or DC operation. It is an extremely handy way of supplying the high voltage required for a receiver. Currents up to 100 MA may be drawn from the supply for use on external equipment.

The complete transmitter is mounted in a small metal cabinet and the entire unit, including the cabinet, is finished in gray flat enamel.

12 Watt Universal Transmitter

FOR PORTABLE AND EMERGENCY SERVICE



Parts Required

THORDARSON TRANSFORMERS and CHOKES

T-1	T-14R40	Power Transformer
T-2	T-19M13	Modulation Transformer
CH-1	T-57C53	Filter Choke

Resistors:

R-1	20,000 Ohm 1 Watt Resistor
R-2	350 Ohm 10 Watt Resistor
R-3	15,000 Ohm 10 Watt Resistor
R-4	100,000 Ohm 1 Watt Resistor
R-5	300 Ohm 10 Watt Resistor
R-6	15,000 Ohm 10 Watt Resistor
R-7	50 Ohm 10 Watt Resistor
R-8	50 Ohm 10 Watt Resistor
R-9	5 Megohm ½ Watt Resistor
R-10	5,000 Ohm 1 Watt Resistor
R-11	3 Megohm ½ Watt Resistor
R-12	500,000 Ohm ½ Watt Resistor
R-13	1 Megohm Volume Control
R-14	5,000 Ohm 1 Watt Resistor
R-15	3 Megohm ½ Watt Resistor
R-16	500,000 Ohm ½ Watt Resistor
R-17	500,000 Ohm ½ Watt Resistor
R-18	300 Ohm 10 Watt Resistor
R-19	20,000 Ohm 1 Watt Resistor
R-20	20,000 Ohm 1 Watt Resistor
R-21	30,000 Ohm 20 Watt Resistor

Condensers:

C-1	.01 Mfd. 400 Volt Condenser
C-2	.0001 Mfd. 500 Volt Mica Condenser
C-3	.01 Mfd. 400 Volt Condenser
C-4	.002 Mfd. 1,000 Volt Mica Condenser
C-5	.0001 Mfd. 500 Volt Mica Condenser
C-6	100 Mmfd. Variable Condenser
C-7	.002 Mfd. 500 Volt Mica Condenser
C-8	.002 Mfd. 500 Volt Mica Condenser

Condensers: (Cont.)

C-9	.002 Mfd. 1,000 Volt Mica Condenser
C-10	100 Mmfd. Variable Condenser
C-11	100 Mmfd. Variable Condenser
C-12	10 Mfd. 25 Volt Electrolytic Condenser
C-13	.04 Mfd. 400 Volt Condenser
C-14	.04 Mfd. 400 Volt Condenser
C-15	10 Mfd. 25 Volt Electrolytic Condenser
C-16	.04 Mfd. 400 Volt Condenser
C-17	.04 Mfd. 400 Volt Condenser
C-18	10 Mfd. 25 Volt Electrolytic Condenser
C-19	.5 Mfd. 400 Volt Condenser
C-20	4 Mfd. 600 Volt Condenser
C-21, C-22	Double 8 Mfd. 450 Volt Condenser
C-23	.05 Mfd. 1,600 Volt Condenser
C-24	.05 Mfd. 1,600 Volt Condenser

RF Chokes:

RFC-1	RF Choke	RFC-4	RF Choke
RFC-2	RF Choke	RFC-5	RF Choke
RFC-3	RF Choke		

Miscellaneous Parts:

1	Chassis 10" x 14" x 3" (Punched and Drilled)
1	Panel (Punched and Drilled)
1	Cabinet
1	Vibrator Mounting Plate
3	Feed-thru Insulators
3	5-Contact Sockets
5	Octal Sockets
1	4-Contact Socket
1	5-Contact Socket
2	DPST Switches
1	SPDT Switch
1	DPDT Switch
1	Phone Jack, Circuit Closing

Miscellaneous Parts: (Cont.)

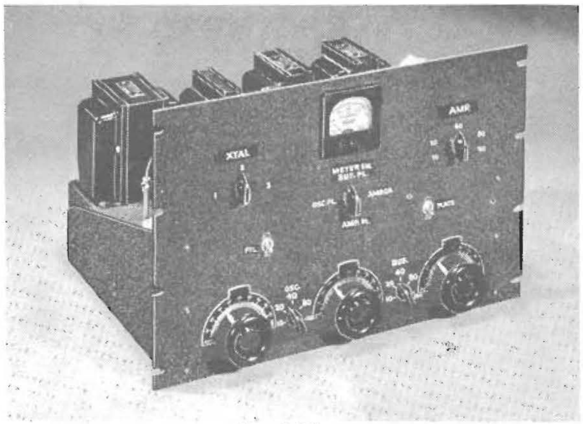
1	Plug
2	Sockets
1	Mic. Plug
1	Mic. Plug Shield
4	Knobs
1	Name Plate Marked "A.F. GAIN"
1	Name Plate Marked "CRYSTAL OSC. PLATE"
2	Name Plates Marked "POWER AMP. PLATE"
1	Name Plate Marked "SEND-RECEIVER"
1	Name Plate Marked "PLATE VOLTS"
1	Name Plate Marked "KEY"
1	Name Plate Marked "PLATE CURRENT"

Miscellaneous nuts, bolts, soldering lugs, lockwashers, grommets and other hardware.

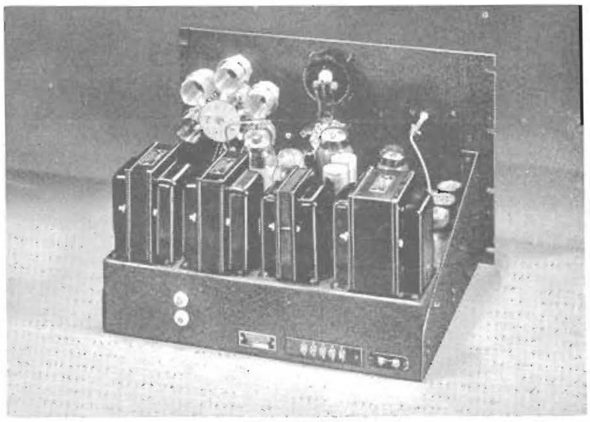
Accessories:

1	Vibrator Mallory 825 or Equivalent
1	0-100 MA DC Meter 2" Square Case Triplett 227A or Equivalent
1	Crystal
1	6W5-G Tube
2	6V6-G Tubes
2	6J7 Tubes
1	807 or HY61/807 Tube
2	160 Meter RF Coils, End Linked, No Tap, Bud OEL-160, or Equivalent
2	80 Meter RF Coils, End Linked, No Tap, Bud OEL-80, or Equivalent
2	40 Meter RF Coils, End Linked, No Tap, Bud, OEL-40, or Equivalent
2	20 Meter RF Coils, End Linked, No Tap, Bud OEL-20, or Equivalent
2	10 Meter RF Coils, End Linked, No Tap, Bud OEL-10, or Equivalent

Complete kit of the above parts with large size circuit diagram available from your local Thordarson distributor. (Accessories not included in kit).



Panel View



Chassis View

THIS 40 watt exciter operates on the five amateur bands from 160 to 10 meters, all bands being selected by switches on the panel. The operator has the choice of three crystal frequencies, which may provide operation on all bands or at slightly different points in the same band.

The exciter is a three-stage unit using a 6V6-G crystal oscillator, a 6L6-G buffer-doubler and an 807 final amplifier. The exciter is built on a 17" x 13" x 4" chassis, complete with its filament and high voltage power supplies. It is supplied with a specially prepared 19" x 12¼" panel designed to harmonize with the many high power units with which it may be associated. The panel is finished in black with white lettering opposite all switches and dials. No additional markings or lettering are necessary. The position of each coil switch is clearly shown. The chassis is equipped with a five-lug terminal board so that connections can be made for controlling high voltage power supplies and filament supplies for other units by means of the switches on this chassis.

Circuit Details

The 6V6-G crystal oscillator is of the regenerative type having an RF choke in its cathode circuit. The oscillator plate tank coil is a Barker and Williamson type 2AB, which may be tuned with one condenser to all five frequency bands. This tank coil is divided into five sections, and the switching is such that all five sections are used for 160 meters; and only one section for 10 meters. The shorting switch on this coil is such that not only are the unused portions of the coil shorted out, but the unused portion adjacent to the one in operation is independently and directly shorted out. This feature reduces the losses due to shorted turns.

The oscillator stage operates with a plate voltage of 350 volts and a screen voltage of 180 volts. When loaded by the buffer-doubler stage, the oscillator plate current is about 20 to 25 MA. For 10 meter operation best results are obtained by using a 20 meter crystal, although quadrupling from 40 meters may also be easily carried out in the buffer-doubler. The crystals are mounted on the chassis with very short leads to the grid circuit. Crystal switching is accomplished by means of a flexible shaft connected to the crystal switch on the panel. This allows the crystal to be well placed to avoid undesirable electrical effects and also permits the crystal switch to be placed in a position on the panel which makes operation most convenient.

The buffer-doubler stage uses a 6L6-G with a plate voltage of 400 V. and a screen voltage of 180 V. This stage also has for its plate tank coil a type 2AB coil which covers five bands with one condenser. When loaded down by the grid of the final stage, the buffer-doubler plate current is 35 to 40 MA. With excitation on any band from 160 to 20 meters the buffer-doubler stage very efficiently doubles. With excitation on 160, 80 and 40 meters, quadrupling may be accomplished in this stage. Although the 6L6-G is not neutralized, the amount of feedback is so low that the stage may be worked "straight through" on 160 meters.

The final amplifier stage uses an 807 and operates with 400 volts on the plate and 270 volts on the screen. A power input of 40 watts may be obtained under such conditions, and the power output is of the order of 25 watts. The excitation to this stage should be adjusted so that the grid current is 5 to 10 MA. Care should be taken not to overdrive this beam power tube, for in such a case the plate efficiency decreases. Usually more than enough excitation is obtainable, and the reduction of excitation to this stage may be accomplished by slightly detuning the buffer-doubler tank. The cathode bias on the buffer-doubler stage prevents the current from rising to abnormal values when detuning. The final plate coil is of turret type construction; and the turret has mounted upon it a coil for each of the five bands, each coil with its associated link. Provision is made for shorting out the four unused coils and their links. The final tank condenser is of the split-stator type with the rotor grounded. It was not found necessary to neutralize the final amplifier.

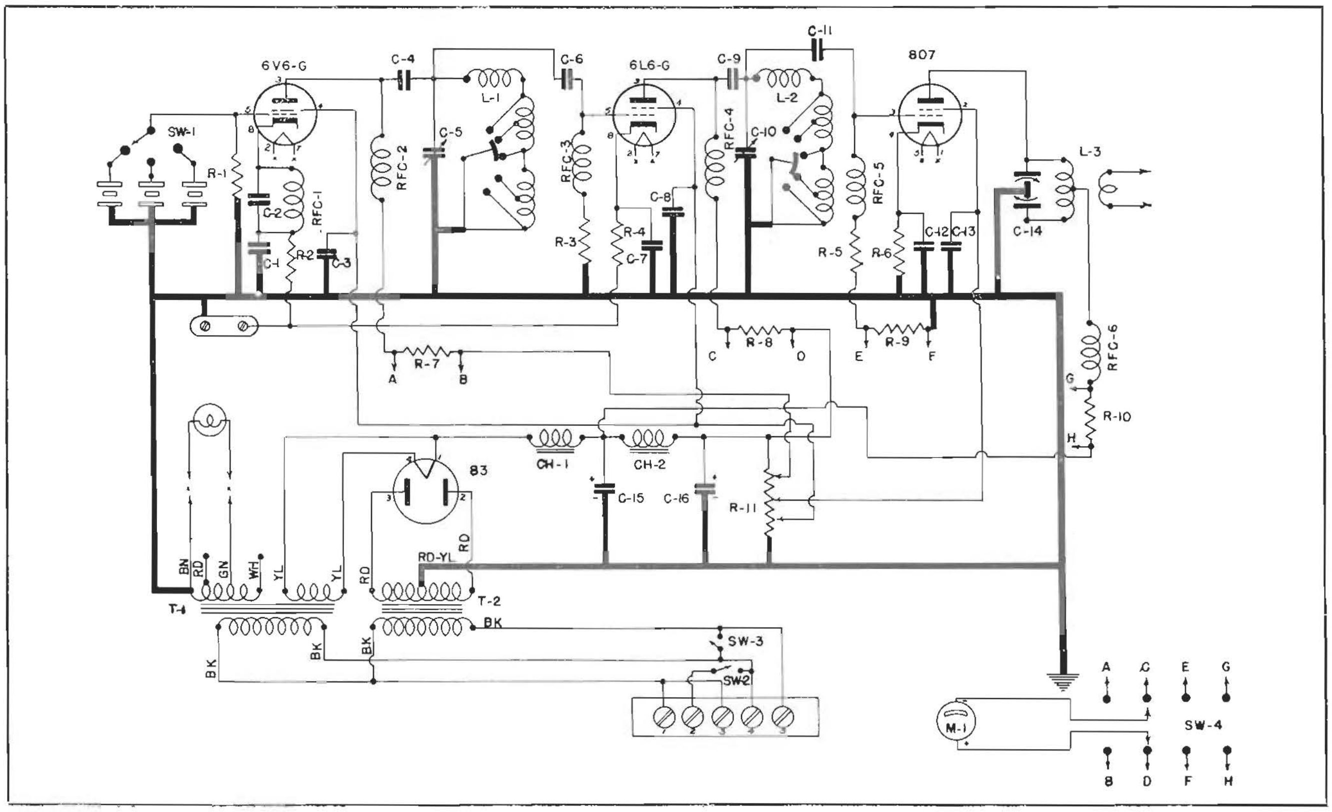
The power supply uses an 83 rectifier, and the power transformer is conservatively rated. Filament and plate supplies may be switched separately from the front of the panel. The switches are plainly marked on each panel.

The oscillator tank and buffer tank coils are mounted with their axes at right angles to each other to avoid any interaction. The final tank coil is mounted above the chassis, and no coupling exists from the final coil to any of the low power stages.

The power output is sufficient to excite Class C stages having inputs as high as 250 to 400 watts. A single meter on the panel and its associated switch provide current readings in the following circuits: crystal oscillator plate, buffer-doubler plate, final amplifier grid and final amplifier plate.

The chassis construction is so arranged as to provide for an increase in power output by changing to the circuit shown for the 120 watt band switching exciter. Knock-out holes are made for the addition of rectifier tube sockets, and extra holes are drilled in the chassis to accommodate the dual plate transformer and the T-19F77 filament transformer required because of the additional 866-JR filament load. Space is provided on the under side of the chassis for the mounting of the high voltage condensers used to filter the output of the 866-JR's.

40 Watt Band-Switch Exciter



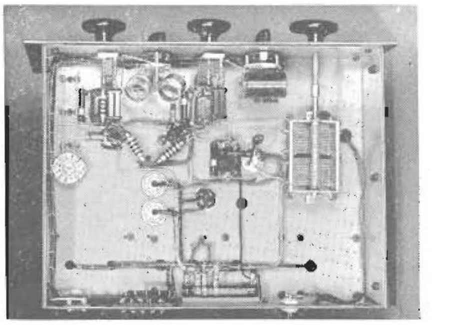
Parts Required

THORDARSON TRANSFORMERS and CHOKES

T-1	T-19F76	Filament Transformer
T-2	T-84P60	Plate Transformer
CH-1	T-75C51	Filter Choke
CH-2	T-75C51	Filter Choke

Resistors:

R-1	20,000 Ohm 1 Watt Resistor
R-2	350 Ohm 10 Watt Resistor
R-3	100,000 Ohm 1 Watt Resistor
R-4	350 Ohm 10 Watt Resistor
R-5	10,000 Ohm 10 Watt Resistor
R-6	350 Ohm 10 Watt Resistor
R-7	50 Ohm 10 Watt Resistor
R-8	50 Ohm 10 Watt Resistor
R-9	50 Ohm 10 Watt Resistor
R-10	50 Ohm 10 Watt Resistor
R-11	25,000 Ohm 50 Watt Semi-Variable Resistor, Ohmite or Equivalent



Bottom View

Condensers:

C-1	.002 Mfd. 1000 Volt Mica Condenser, CD-4-6D2 or Aerovox 1455
C-2	.0001 Mfd. 1000 Volt Mica Condenser, CD-4-6T1 or Aerovox 1455
C-3	.002 Mfd. 1000 Volt Mica Condenser, CD-4-6D2 or Aerovox 1455
C-4	.002 Mfd. 1000 Volt Mica Condenser, CD-4-6D2 or Aerovox 1455
C-5	100 Mmfd. Variable Condenser, Cardwell ZU-100-AS or Equivalent
C-6	.0001 Mfd. 1000 Volt Mica Condenser, CD-4-6T1 or Aerovox 1455
C-7	.002 Mfd. 1000 Volt Mica Condenser, CD-4-6D2 or Aerovox 1455
C-8	.002 Mfd. 1000 Volt Mica Condenser, CD-4-6D2 or Aerovox 1455
C-9	.002 Mfd. 1000 Volt Mica Condenser, CD-4-6D2 or Aerovox 1455
C-10	100 Mmfd. Variable Condenser, Cardwell ZU-100-AS or Equivalent
C-11	.0001 Mfd. 1000 Volt Mica Condenser, CD-4-6T1 or Aerovox 1455
C-12	.002 Mfd. 1000 Volt Mica Condenser, CD-4-6D2 or Aerovox 1455
C-13	.002 Mfd. 1000 Volt Mica Condenser, CD-4-6D2 or Aerovox 1455
C-14	260-260 Mfd. Variable Condenser, Cardwell MR-260-BD or Equivalent
C-15	8 Mfd. 600 Volt Electrolytic Condenser, Mallory HS-693 or Equivalent
C-16	8 Mfd. 600 Volt Electrolytic Condenser, Mallory HS-693 or Equivalent

Tubes:

1	6V6-G	Tube
1	6L6-G or 6L6 GX	Tube
1	807 or HY61/807	Tube
1	83	Tube

RF Chokes:

RFC-1	RF Choke, Millen #34101 or Equiv.
RFC-2	RF Choke, Millen #34101 or Equiv.
RFC-3	RF Choke, Millen #34100 or Equiv.
RFC-4	RF Choke, Millen #34101 or Equiv.
RFC-5	RF Choke, Millen #34100 or Equiv.
RFC-6	RF Choke, Millen #34100 or Equiv.

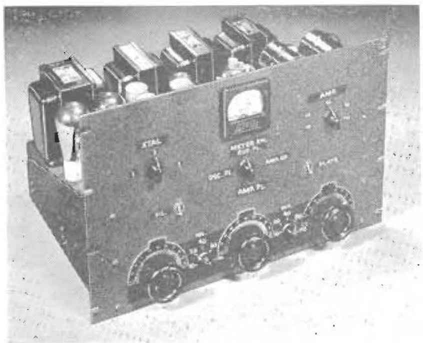
Miscellaneous Parts:

1		Punched Chassis 17" x 13" x 4"
1		Panel 19" x 12¼"
1 Pr.		Chassis Mounting Brackets
1		Condenser Mounting Bracket
2		Bushings
2		Octal Sockets
1		4-Contact Socket
1		5-Contact Socket, Steatite
3		4-Contact Sockets, Steatite
2		Feed-thru Insulators
1		Grid Grip
3		Crystal Sockets, Millen #33002 or Equiv.
1	SW-1	Single Pole 4-Throw Switch, Isolantite, Centralab 2542 or Equivalent
1	SW-2	SPST Switch, Arrow H & H #20994
1	SW-3	SPST Switch, Arrow H & H #20994 or Equivalent
1	SW-4	2-Pole 4-Throw Switch, Isolantite, Centralab 2543 or Equivalent
1	L-1	Band Switch Coil, B-W Type 2AB or Equivalent
1	L-2	Band Switch Coil, B-W Type 2AB or Equivalent
1	L-3	Baby Turret, B-W Type BTCL
1	M-1	0-200 MA DC Meter, 3" Square Case, Rear Illumination, Triplett #327A or Equivalent
1		Grid Grip, National Type 24 or Equiv.
3		Control Wheels 2¼" Diameter, Coto CI-45 or Equivalent
5		Knobs, Crowe #588 or Equivalent
1		Tube Shield, Hammarlund Type PTS or Equivalent
1		Shaft Extension, Yaxley #RS-242
1		Panel Bearing Assembly, Johnson #256 or Equivalent
1		Shaft Coupling, National TX-11

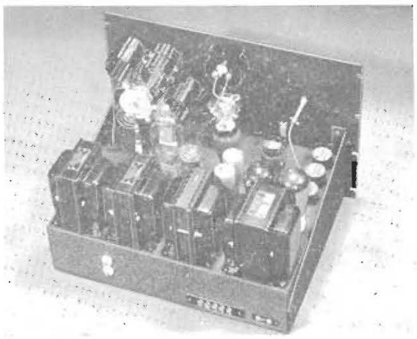
Miscellaneous screws, nuts, bolts, lock-washers required hook-up wire and other hardware.

Circuit diagram, drawings and full size template of chassis available from Thordarson 15 cents net each, postpaid.

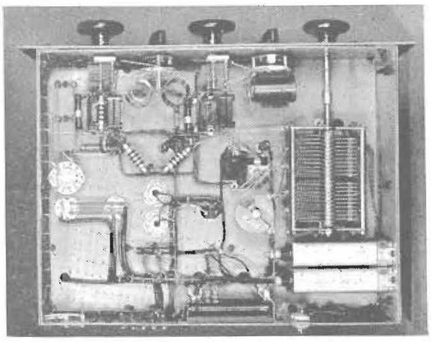
120 Watt Band-Switch Exciter



Panel View



Chassis View



Bottom View

FOR transmitters having inputs as high as 700 or 800 watts this exciter provides adequate excitation on all bands from 160 to 10 meters without the necessity of plugging in different coils. Three crystal frequencies and five operating bands may be selected at will by means of controls on the panel.

The exciter uses for its final amplifier an 811 tube operating at a plate voltage of 1000 volts. The power input to the final stage is 120 watts, and power outputs of over 70 watts may be realized on all bands.

The panel is an especially designed unit requiring no additional name plates or markings. It is finished in black with white lettering, and the position of each control is clearly indicated.

The chassis and panel are the same as those used on the 40 watt band switching exciter. For converting the 40 watt unit to this 120 watt unit it is necessary only to replace the filament plate transformers, to add two filter condensers, a neutralizing condenser and a bleeder resistor; and to replace the final tank circuit with a larger unit. The same convenience of operation and attractive appearance will be retained by the amateur who wishes to increase the power output of his exciter without obsoleting the smaller equipment.

The crystal oscillator stage uses a 6V6-G tube operating with a plate voltage of 350V. and a screen-grid voltage of 190V. This stage drives a buffer-doubler stage with a 6L6-G tube operating at a plate voltage of 400V. and a screen-grid voltage of 275V. This buffer-doubler stage provides adequate excitation to the 811 grid on all bands.

The crystal oscillator stage operates with crystals in any band from 160 to 10 meters. When using crystals in the 160, 80 and 40 meter bands, doubling may be accomplished in the oscillator; and enough output is available from it to drive the 6L6-G buffer-doubler stage easily. When working "straight through" in the crystal oscillator stage, the plate current is of the order of 20 to 25 MA when loaded with the grid of the buffer-doubler stage. The buffer-doubler stage may be operated "straight through," or it may be used to double. With grid excitation on 160, 80, 40 and 20 meters, doubling is easily accomplished in this stage with enough power output to excite the 811 final stage easily. With excitation on 160, 80 and 40 meters, quadrupling can be carried on to give good outputs on 40, 20 and 10 meters.

Although the buffer-doubler stage is not neutralized, no difficulties will be encountered when operating "straight through." However, for best results, it is recommended that wherever possible frequency multiplication be accomplished in this stage.

The oscillator and buffer-doubler plate tank coils are sectionalized and mounted on a switch so that the amount of the coil being used can be easily controlled from the panel. It is thus possible to tune to all five bands with a single condenser. These tank coils are of the type in which the unused winding is short circuited.

The buffer-doubler stage is capacity coupled to the 811 grid. At resonance, and when loaded by the final grid, the plate current in the buffer-doubler stage is of the order of 55 to 60 MA.

The final tank circuit consists of a split-stator condenser and a Barker-Williamson type BCL turret assembly. This coil assembly consists of five coils, one for each frequency band. The coil which is desired may be selected from the panel, and the other four coils with their links shorted out.

The 811 tube is neutralized in a conventional manner, and no difficulty is encountered in obtaining perfect neutralization.

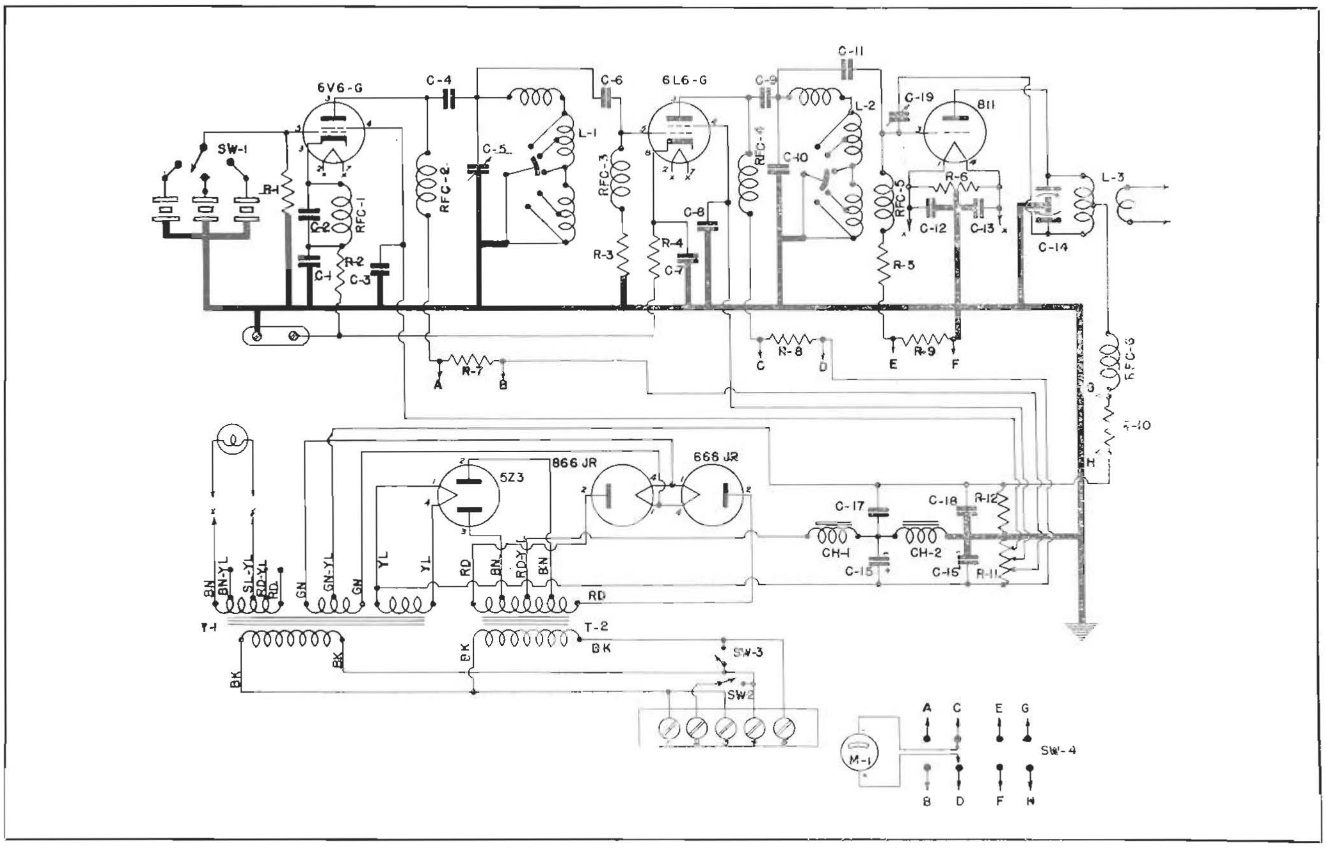
Since it is a high mu tube, the 811 requires no bias to protect it in the event of failure of excitation. In this exciter grid leak bias is used. With proper excitation the grid current should be 30 to 35 MA.

Two DC power supplies are mounted upon this chassis, one delivering 400 volts to supply the oscillator and buffer-doubler stages and the other delivering 1000 volts to the 811 tube. The low voltage rectifier uses a 5Z3 tube, and the high voltage rectifier uses two 866-JR tubes. These power supplies are filtered with the same chokes.

Filament supplies for the RF tubes and for the rectifier tubes are controlled by a single switch on the panel, and the two high voltage supplies by another switch. The terminal board on the rear of the chassis has three extra terminals so that other units associated with this exciter may be controlled by the exciter switches.

A single meter is mounted upon the panel, and under it a four-position switch permits the reading of the oscillator plate current, the buffer-doubler plate current, the final amplifier grid current and the final amplifier plate current.

The three crystal sockets are mounted on the chassis base. The selector switch is coupled to the panel switch by means of a flexible shaft, thus permitting the crystals to be located for best performance and retaining a convenient switch position on the panel.



Parts Required

THORDARSON TRANSFORMERS and CHOKES

T-1	T-19F77	Filament Transformer
T-2	T-19P57	Plate Transformer
CH-1	T-75C51	Filter Choke
CH-2	T-75C51	Filter Choke

Resistors:

R-1	20,000 Ohm 1 Watt Resistor
R-2	350 Ohm 10 Watt Resistor, Ohmite Brown Devil or Equivalent
R-3	100,000 Ohm 1 Watt Resistor
R-4	350 Ohm 10 Watt Resistor, Ohmite Brown Devil or Equivalent
R-5	2,500 Ohm 10 Watt Resistor, Ohmite Brown Devil or Equivalent
R-6	20 Ohm 10 Watt Center Tapped Resistor, Ohmite Brown Devil or Equivalent
R-7	50 Ohm 10 Watt Resistor, Ohmite Brown Devil or Equivalent
R-8	50 Ohm 10 Watt Resistor, Ohmite Brown Devil or Equivalent
R-9	50 Ohm 10 Watt Resistor, Ohmite Brown Devil or Equivalent
R-10	50 Ohm 10 Watt Resistor, Ohmite Brown Devil or Equivalent
R-11	25,000 Ohm 50 Watt Semi-Variable Resistor, Ohmite #0585 or Equivalent
R-12	100,000 Ohm 50 Watt Resistor, Ohmite or Equivalent

Condensers:

C-1	.002 Mfd. 1,000 Volt Mica Condenser, C-D 4-6D2 or Aerovox 1455
C-2	.0001 Mfd. 1,000 Volt Mica Condenser, C-D 4-6T1 or Aerovox 1455
C-3	.002 Mfd. 1,000 Volt Mica Condenser, C-D 4-6D2 or Aerovox 1455
C-4	.002 Mfd. 1,000 Volt Mica Condenser, C-D 4-6D2 or Aerovox 1455
C-5	100 Mmfd. Variable Condenser, Cardwell ZU-100-AS or Equivalent

Condensers: (Cont.)

C-6	.0001 Mfd. 1,000 Volt Mica Condenser, C-D 4-6T1 or Aerovox 1455
C-7	.002 Mfd. 1,000 Volt Mica Condenser, C-D 4-6D2 or Aerovox 1455
C-8	.002 Mfd. 1,000 Volt Mica Condenser, C-D 4-6D2 or Aerovox 1455
C-9	.002 Mfd. 1,000 Volt Mica Condenser, C-D 4-6D2 or Aerovox 1455
C-10	100 Mmfd. Variable Condenser, Cardwell ZU-100-AS or Equivalent
C-11	.0001 Mfd. 1,000 Volt Mica Condenser, C-D 4-6T1 or Aerovox 1455
C-12	.002 Mfd. 1,000 Volt Mica Condenser, C-D 4-6D2 or Aerovox 1455
C-13	.002 Mfd. 1,000 Volt Mica Condenser, C-D 4-6D2 or Aerovox 1455
C-14	210-210 Mmfd. Variable Condenser, Cardwell XT-210-PD or Equivalent
C-15	8 Mfd. 600 Volt Electrolytic Condenser, Mallory HS-693 or Equivalent
C-16	8 Mfd. 600 Volt Electrolytic Condenser, Mallory HS-693 or Equivalent
C-17	2 Mfd. 1,500 Volt Condenser, Mallory TX-808 or Equivalent
C-18	2 Mfd. 1,500 Volt Condenser, Mallory TX-808 or Equivalent
C-19	Neutralizing Condenser, E. F. Johnson #13G45 or Equivalent

Tubes:

1	6V6-G	Tube	1	811	Tube
1	6L6-G or 6L6GX	Tube	1	5Z3	Tube
			2	866-Jr.	Tubes

RF Chokes:

RFC-1	RF Choke, Millen #34101 or Equiv.
RFC-2	RF Choke, Millen #34101 or Equiv.
RFC-3	RF Choke, Millen #34101 or Equiv.
RFC-4	RF Choke, Millen #34101 or Equiv.
RFC-5	RF Choke, Millen #34101 or Equiv.
RFC-6	RF Choke, Millen #34101 or Equiv.

Miscellaneous Parts:

1		Punched Chassis 17" x 13" x 4"
1		Panel 19" x 12¼"
1	Pr.	Chassis Mounting Brackets
1		Condenser Mounting Bracket
2		Bushings
2		Octal Sockets
1		4-Contact Socket
1		5-Contact Socket, Steatite
3		4-Contact Sockets, Steatite
2		Feed-thru Insulators
1		Grid Grip
3		Crystal Sockets, Millen #33002 or Equiv.
1	SW-1	Single-Pole, 4-Throw Switch, Isolantite, Centralab #2543 or Equivalent
1	SW-2	SPST Switch, Arrow H & H #20992 (Nickel Plated) or Equivalent
1	SW-3	SPST Switch, Arrow H & H #20992 (Nickel Plated) or Equivalent
1	SW-4	2-Pole, 4-Throw Switch, Isolantite, Centralab #2543 or Equivalent
1	L-1	Band Switch Coil, Barker-Williamson Type 2AB or Equivalent
1	L-2	Band Switch Coil, Barker-Williamson Type 2AB or Equivalent
1	L-3	Coil Turret Assembly, Barker-Williamson Type BCL or Equivalent
1	M-1	0-200 MA DC Meter, 2" Square Case, Rear Illumination, Triplett #327-A or Equivalent
3		Control Wheels, 2¼" Diameter, Coto CI-45 or Equivalent
5		Knobs, Crowe #588 or Equivalent
1		Shaft Extension, Yaxley #RS-242 or Equivalent
1		Panel Bearing Assembly, Johnson #256 or Equivalent
1		Shaft Coupling, National TX-11

Miscellaneous nuts, bolts, soldering lugs, lockwashers, varnished tubing, cable and other hardware.

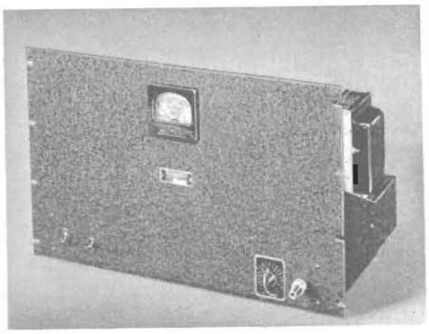
Circuit diagram, drawings and full size template of chassis available from Thordarson 15 cents net each, postpaid.

Band-Switch Transmitter

100 WATT MULTI-BAND

Complete Transmitter

RF Section



Modulator

THIS complete 100 watt transmitter consists of two units, each having its own power supply. The RF section may be modulated or may be used for CW only. Its final stage operates at 1000 volts with 100 watts input. The modulator provides sufficient power output to modulate 100% the RF section, and the speech amplifier is incorporated in the modulator chassis.

Any three pre-selected amateur bands in the range from 160 to 10 meters may be selected with panel switches.

The RF section is a three-stage circuit using a 6L6-G oscillator, a 6L6-G buffer-doubler stage and a TZ-40 final stage.

The oscillator stage has provision for switching in its plate tank circuit any one of three coils, and the same switching operation which selects the coils also selects the proper crystal. With 160 and 80 meter crystals, doubling can be accomplished in the oscillator stage, but crystals in the range from 160 to 20 meters may be used in the oscillator stage when working "straight through."

In the buffer stage provision is made for switching to any one of three tank coils. Because the 6L6-G buffer-doubler tube is not neutralized and since, when the second stage is used in frequency multiplying service, adequate drive is obtained on the TZ-40, it is recommended that doubling be carried on in this stage whenever possible. However, on the lower frequency bands, there is no tendency toward trouble when operating "straight through." In all cases the final stage is operated "straight through." For 10 meter output it is recommended that a 20 meter crystal be used and that doubling be carried on in the second stage.

The oscillator stage is capacity coupled to the buffer-doubler stage, and the latter is capacity coupled to the final grid.

Three Barker-Williamson center linked, center tapped tank coils, mounted in a type B coil turret, permit the selection of any one of these coils for use in the final tank. With this arrangement the link around the coil in use is connected to the antenna or to an antenna matching network.

With one meter and four meter switches provision is made for reading the oscillator cathode current, the buffer-doubler cathode current, the final grid current and the final plate current. The meter switches are of such a type that the circuit controlled by each switch may be opened by placing the switch in its "half way" position.

Two direct current supplies are installed in this chassis, one of which delivers approximately 400 volts to supply the plates of the 6L6-G's and the other which delivers 1000 volts to supply the plate of the TZ-40. The screen supply for the 6L6-G's is taken from taps on the 400 volt bleeder R-5, these taps being adjusted so that the voltage on the oscillator screen-grid is about 150 to 200 volts and on the buffer-doubler screen-grid it is about 200 to 250 volts. When the oscillator tube is operating properly, the cathode current should dip to a value of 50 MA or less, and the cathode current in the buffer-doubler stage at resonance, should be about 75 MA. The grid current on the final should be 25 MA or more; and for a 100 watt input to the final stage, the TZ-40 plate current should be 100 MA.

The removal of the high voltage for neutralizing the final stage may be done easily by removing the 866-JR tubes from their sockets and then making the neutralizing adjustment in the conventional manner with the antenna or antenna matching network connected to the link on the final tank coil.

For CW operation the key is connected between terminals 1 and 2 on the five-screw terminal board on the back apron of the chassis, the 115 volt line is connected to terminals 3 and 4 and the plate voltage is controlled by a switch connected between terminals 4 and 5. The terminals of the two No. 55 feed-thru insulators on the rear apron of the chassis are connected together.

Modulator Unit:

The modulator tubes are 6L6-G's in push-pull, Class AB_2. These tubes are connected to the Class C load through a Multi-Match modulation transformer. The connections to the modulation transformer are as follows: One 6L6-G plate is connected to terminal 1, and the other plate to 6. Terminals 2 and 5 are joined and connected to the plate supply. Terminals 9 and 10 are also joined, but no connection is made to them. The Class C load is connected to terminals 8 and 12.

The speech amplifier tube line-up is as follows: a pentode connected 6J7, a 6F5 and a 6F6, triode connected.

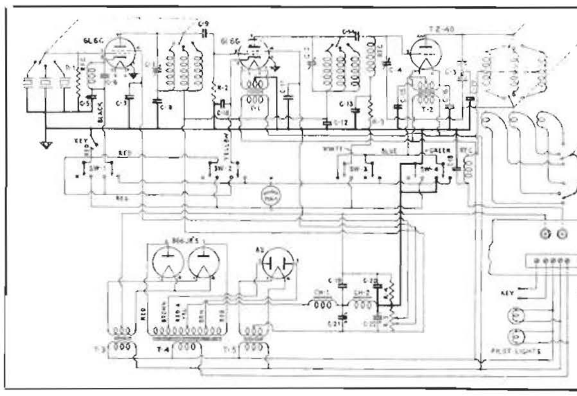
The power supply uses an 83 to supply high voltage to all tubes and an 82 in the bias supply for the 6L6-G's.

In preparing the modulator unit for operation, an adjustment must be made of the bias and the screen voltage on the 6L6-G's. For obtaining the correct bias adjust R-11 until the voltage across it is 25 volts. Then adjust R-12 until the screen voltage is 310 volts. It may be necessary to readjust R-11 to maintain the 25 volts of bias. The modulator plate current should be about 115 MA for two tubes, and with a sine wave signal of sufficient magnitude to modulate 100% the RF section the plate current will rise to approximately 225 MA. For speech waves having the same peak power plate current will kick up to about 170 MA.

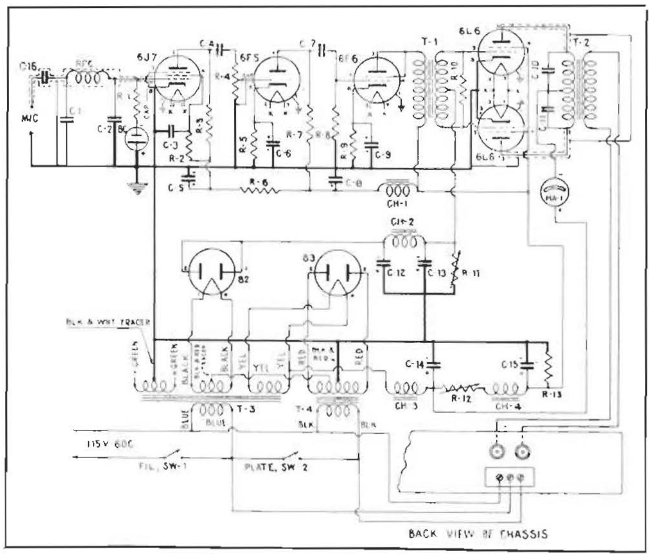
To connect the modulator to the RF section terminals 3, 4 and 5 on the RF

Band-Switch Transmitter

100 WATT MULTI-BAND



RF Unit



Modulator Unit

section should be connected to terminals 1, 2 and 3 on the modulator. Connection should be made from the terminals of the No. 55 feed-thru insulators on the modulator chassis to the corresponding insulators on the RF chassis. With the two chasses so interconnected the filament switch on the modulator chassis controls all the filaments, and the plate switch controls all plate supplies.

The RF section may be used alone as an exciter for transmitters having power inputs of almost one kilowatt.

BAND	TURNS	WINDING LENGTH
160	40	Close wound
80	22	Close wound
40	12	1⅜"
20	6	1⅜"
10	¾	

Osc. & Buf. coils are identical. Use No. 18E wire on 1½" Diam. form.

RF Unit

Parts Required

THORDARSON PARTS

1	T-17K21	Foundation Unit
T-1	T-19F97	Filament Transformer
T-2	T-19F93	Filament Transformer
T-3	T-19F88	Filament Transformer
T-4	T-19P57	Plate Transformer
T-5	T-19F91	Filament Transformer
CH-1	T-75C51	First Choke
CH-2	T-75C51	Second Choke

Tubes:

2 6L6-G or 6L6-GX Tubes
2 866-JR Tubes
1 TZ-40 Tube
1 83 Tube

Resistors:

R-1 50,000 Ohm 1 Watt Resistor, IRC BT-1
R-2 50,000 Ohm 10 Watt, Ohmite Red Devil
R-3 2,500 Ohm 25 Watt, Ohmite, Wirewound
R-4 100,000 Ohm 50 Watt, Ohmite Wirewound
R-5 20,000 Ohm 50 Watt, Ohmite Semi-Variable

Condensers:

C-1, C-2 Variable Condenser, National TMS-250
C-3 Variable Condenser, National TMC-200D
C-4 Neutralizing Condenser, Johnson 13G45
C-5, C-7, C-8, C-9, C-10, C-11, C-13, C-14, C-15, C-16 .001 Mfd. 1000 Volt Mica Condenser, Aerovox #1455 or C-D 4-6D1
C-6 .0001 Mfd. 1000 Volt Mica Condenser, Aerovox #1455 or C-D 4-6T1

RF Unit

Condensers: (Cont'd)

C-12 .005 Mfd. 1000 Volt Mica Condenser, Aerovox #1455 or C-D 4-6D5
C-17, C-18 .001 Mfd. 5000 Volt Mica Condenser, Aerovox #1457 or C-D 4-25D1
C-19, C-20 2 Mfd. 1500 Volt Oil Filled Condenser, Aerovox #1505 (2" Can)
C-21 4 Mfd. 600 V. Electrolytic, Aerovox GL-600
C-22 4 Mfd. 600 V. Electrolytic, Aerovox GL-600

Miscellaneous Parts:

3 5-Contact Sockets, Amphenol S5
5 4-Contact Sockets, Amphenol S4
2 Octal Sockets, Amphenol S8
5 4-Contact Isolantite Sockets, Amphenol SS4
8 Feed-thru Insulators, Johnson #55
4 Feed-thru Insulators, Johnson #42
3 RF Chokes, National R-100
1 4" Shaft Extension, Yaxley #RS243
1 2-Gang Band Switch, Centralab #2543
1 1-Gang Band Switch, Centralab #2542
1 Coil Turret, Barker-Williamson Model "B"
1 160 Meter Coil, Barker-Williamson 160BL — Center Linked
1 80 Meter Coil, B-W 80BL, Center Linked
1 40 Meter Coil, B-W 40BL, Center Linked
1 20 Meter Coil, B-W 20BL, Center Linked
1 10 Meter Coil, B-W 10BL, Center Linked
3 2¼" Coto-Coil Wheels CI-45 With Indicator Plates CI-47 Marked "OSC. PLATE," "BUFFER PLATE," "PWR. AMP. PLATE."
4 Indicator Plates, Marked "OSC. PLATE," "BUFFER PLATE," "PWR. AMP. PLATE," "PWR. AMP. GRID," Coto-Coil CI-47.
4 Meter Switches, Yaxley #762
1 0-200 MA Meter, Simpson #27S or Triplett #327-A (Illum.)
3 1¼" Bar Knobs, Black
1 Grid Cap, Large, National Type 12
2 SPST 6 Ampere Toggle Switches, H & H #26993
6 Coil Forms, National XR-4
1 Cone Insulator, Johnson #601
1 Cabinet, Bud #697 or Par Metal #SC2613
1 Variable Resistor Lug, Ohmite #0358

Modulator Unit

Parts Required

THORDARSON PARTS

1	T-17K22	Foundation Unit
T-1	T-67D78	Driver Transformer
T-2	T-11M75	CHT Modulation Transformer
T-3	T-79F84	Filament Transformer
T-4	T-84P60	Plate Transformer
CH-1	T-74C30	Third Choke
CH-2	T-75C49	Bias Choke
CH-3	T-75C51	First Choke
CH-4	T-68C07	Second Choke

Modulator Unit

Tubes:

1 6J7 Tube
1 6F5 Tube
1 6F6 Tube
2 6L6-G or 6L6-GX Tubes
1 82 Tube
1 83 Tube

Resistors:

R-1 5 Megohm ½ Watt Resistor, IRC BT-½
R-2 3 Megohm 1 Watt Resistor, IRC BT-1
R-3, R-8 250,000 Ohm 1 Watt Resistor, IRC BT-1
R-4 500,000 Ohm Volume Control, IRC 13-133
R-5 2000 Ohm 1 Watt Resistor, IRC BT-1
R-6 20,000 Ohm 1 Watt Resistor, IRC BT-1
R-7 100,000 Ohm 1 Watt Resistor, IRC BT-1
R-9 750 Ohm 10 Watt Resistor, IRC Type AB
R-10 10,000 Ohm 2 Watt Resistor, IRC BT-2
R-11 1500 Ohm 25 Watt Semi-Variable, Ohmite
R-12 2500 Ohm 25 Watt Semi-Variable, Ohmite
R-13 25,000 Ohm 50 Watt Wirewound, Ohmite

Condensers:

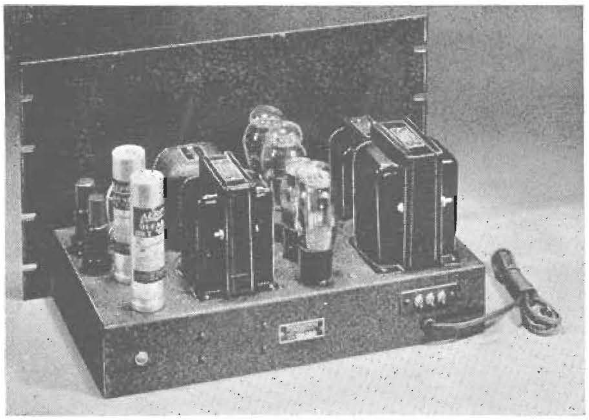
C-1, C-2 .0001 Mfd. 500 Volt Mica Condenser, Aerovox #1467 or C-D 5W-5T1
C-3 .04 Mfd. 400 Volt Paper Condenser, Aerovox 484 or C-D DT-4S4
C-4, C-7 .1 Mfd. 400 Volt Paper Condenser, Aerovox #484 or C-D DT-4P1
C-5 8 Mfd. 450 Volt Electrolytic Condenser, Aerovox PBS-450 or C-D JR508
C-6 10 Mfd. 25 Volt Electrolytic Condenser, Aerovox PR-25 or C-D ED-2100
C-8, C-15 8-8 Mfd. 450 V. Dual Elect., Aerovox 2G
C-9 10 Mfd. 50 V. Elect., Aerovox PR-50
C-10, C-11 0.002 Mfd. 1000 Volt Mica Condenser Aerovox #1455 or C-D 4-6D2
C-12, C-13 8 Mfd. 200 Volt Electrolytic Condenser, Aerovox PBS-200 or C-D JR208
C-14 8 Mfd. 600 V. Elect., Aerovox GL-600
C-16 0.01 Mfd. 400 Volt Paper Condenser, Aerovox #484 or C-D DT-4S1

Miscellaneous Parts:

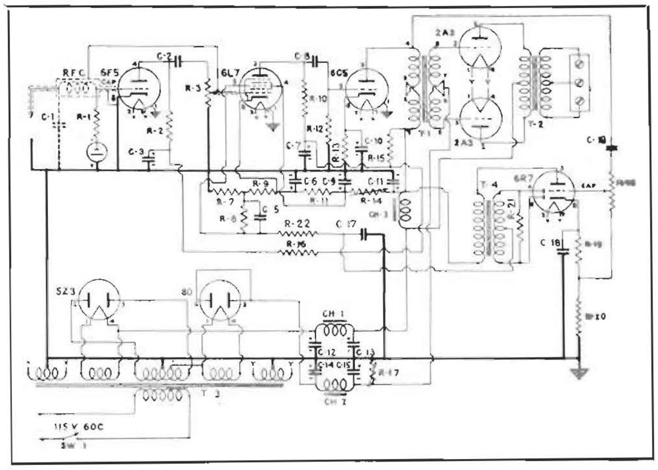
1 RF Choke, National R-100
1 Mic. Connector, Amphenol MC-1F
1 Mic. Connector, Amphenol PC-1M
1 Bias Cell, Mallory #F7
1 Bias Cell Holder, Mallory #GB-1A
1 1¼" Bar Knob, Black Streamlined
1 AC Line Cord and Plug, Belden #1725
5 Octal Sockets, Amphenol S8
2 4-Contact Sockets, Amphenol S4
2 Metal Tube Grid Caps
1 Dial Plate, Crowe #566
2 Feed-thru Insulators, Johnson #55
1 0-300 MA Meter, Simpson #27S or Triplett #327-A (Illuminated)
2 Metal Tube Shields, ARHCO #92
1 Red Jewel and Candelabra Bracket, ARHCO #93 or Drake Mfg. Co. #10C
1 Green Jewel and Candelabra Bracket, ARHCO #93 or Drake Mfg. Co. #10C
2 110 Volt Carbon Lamps Type G6

Complete Instruction Book SD-386-A giving full details of building data, photos, diagrams and layout available at 25 cents postpaid.

Amateur Speech Amplifier



Chassis View



USING low plate resistance output tubes, this amplifier is capable of easily delivering 10 watts of audio power for driving the largest modulators used by amateurs. Its low internal output impedance provides the excellent regulation required in Class B driver service, and its high gain makes it usable with crystal microphones.

The circuit shown is that incorporating the peak limiting feature, but this amplifier is also available with a circuit for overmodulation control or as a conventional amplifier. The punched chassis is designed to fit either the regular type amateur transformers or the C.H.T. Series of transformers, which give better frequency response and less distortion. The amplifier may be adapted to rack and panel mounting, or a cover may be obtained for use on an operating table.

For T-2, a driver transformer may be used to couple the 2A3 plates directly to the Class B grids; or, if it is desired to locate the amplifier remotely from the modulator, an output transformer may be installed to couple the 2A3 plates to a 500 ohm line.

Specifications showing the different circuits, together with a complete parts list, are shown on the Thordarson SD-389 bulletin, available at all jobbers.

Thordarson Parts

1	T-17K20 Foundation Unit
T-1	T-15A74
T-2	T-15S90 or T-67S54 for 500 ohm output or T-15D76, T-15D77, T-15D78 or T-15D79 or T-19D01, T-19D02, T-19D03 or T-19D04
T-3	T-15R05 or T-87R85
T-4	T-78D46
CH-1	T-15C54 or T-74C29
CH-2	T-75C49
CH-3	T-74C30

Tubes:

1—6F5 1—6C5 1—5Z3 1—6R7 1—6L7 2—2A3 1—80

Resistors:

R-1	5 Megohm, ½ Watt, IRC BT-½
R-2	250,000 Ohms, 1 Watt, IRC BT-1
R-3	500,000 Ohms, Volume Control, IRC 13-133
R-7	350 Ohms, 10 Watts, Ohmite Brown Devil
R-8	500,000 Ohms 1 Watt, IRC BT-1
R-9	150 Ohms, 10 Watts, Ohmite Brown Devil
R-10	100,000 Ohms, 1 Watt, IRC BT-1
R-11	4,000 Ohms 10 Watts, Ohmite Brown Devil
R-12	250,000 Ohms 1 Watt, IRC BT-1
R-13	500 Ohms, 1 Watt, IRC BT-1
R-14	12,000 Ohms, 25 Watts, Ohmite Semi-Variable
R-15	20,000 Ohms, 1 Watt, IRC BT-1
R-16	20,000 Ohms, 1 Watt, IRC BT-1
R-17	2,500 Ohms, 25 Watts, Ohmite Semi-Variable
R-18	500,000 Ohms, Volume Control, IRC 13-133
R-19	1,000 Ohms, 1 Watt, IRC BT-1
R-20	2,500 Ohms, 1 Watt, IRC BT-1
R-21	10,000 Ohms, 1 Watt, IRC BT-1
R-22	100,000 Ohms, 1 Watt, IRC BT-1

Condensers:

C-1	0.0001 Mfd., 500 V Mica Aerovox 1467 or C-D 5W-5T1
C-2	0.1 Mfd., 400 V Paper Aerovox 484 or C-D DT-4P1
C-3	8 Mfd., 450 V Elect. Aerovox PBS-450 or C-D JR508
C-5	0.5 Mfd., 400 V Paper Aerovox 484 or C-D DT-4P5
C-6	8 Mfd., 450 V Elect. Aerovox PBS-450 or C-D JR508
C-7, C-11	8-8 Mfd., 450 V Dual Elect. Aerovox 2G
C-8	0.1 Mfd., 400 V Paper Aerovox 484 or C-D DT-4P1
C-9	8 Mfd., 450 V Elect. Aerovox PBS-450 or C-D JR508
C-10	10 Mfd., 25 V Elect. Aerovox PR-25 or C-D ED-2100
C-12, C-13	8-8 Mfd., 450 V Dual Elect. Aerovox 2G
C-14	8 Mfd., 200 V Elect. Aerovox PBS-200 or C-D JR208
C-15	8 Mfd., 200 V Elect. Aerovox PBS-200 or C-D JR208
C-17	0.1 Mfd., 400 V Paper Aerovox 484 or C-D DT-4P1
C-18	10 Mfd., 25 V Elect. Aerovox PB-25 or C-D ED-2100
C-19	0.1 Mfd., 400 V Paper Aerovox 484 or C-D DT-4P1

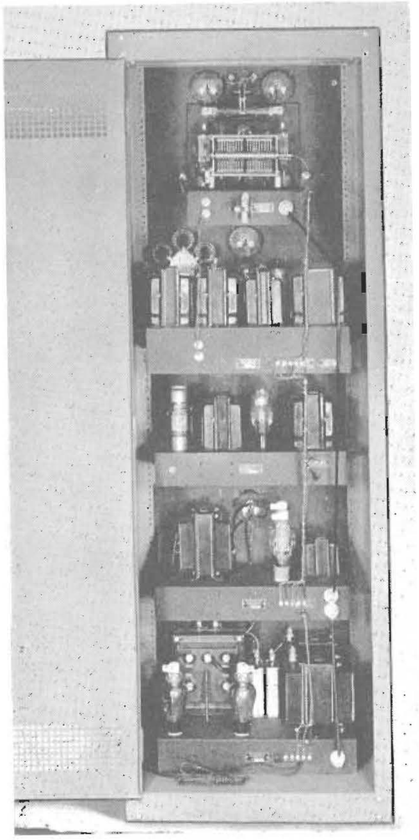
Miscellaneous Parts:

1	Mic. Input Connector, Amphenol MC1F
1	Mic. Input Connector, Amphenol PC1M
1	Red Jewel and Bracket, Yaxley No. 310R
1	Bias Cell, Mallory No. F7
1	Bias Cell Holder, Mallory No. GB-1A
1	1¼" Bar Knob, Black Streamlined
1	SPST Toggle Switch, H & H No. 20992
1	AC Line Cord and Plug, Belden No. 1725
3	Metal Tube Grid Caps
2	Metal Tube Shields, ARHCO No. 92
1	Dial Plate, Crowe No. 566
1	RF Choke, National R-100
4	Octal Sockets, Amphenol S8
4	4-Contact Sockets, Amphenol S-4
1	6.3 Volt Pilot Light, Mazda No. 40

The parts list shown is for the amplifier with either the over-modulation control or the peak limiting circuits; complete drawings, photos, parts lists and instructions for easy assembly of either of the above circuits are contained in Instruction Book SD-387, 15 cents postpaid.

250 Watt Phone Transmitter

450 WATT CW — 160 TO 10 METERS



High Efficiency Final Stage

★

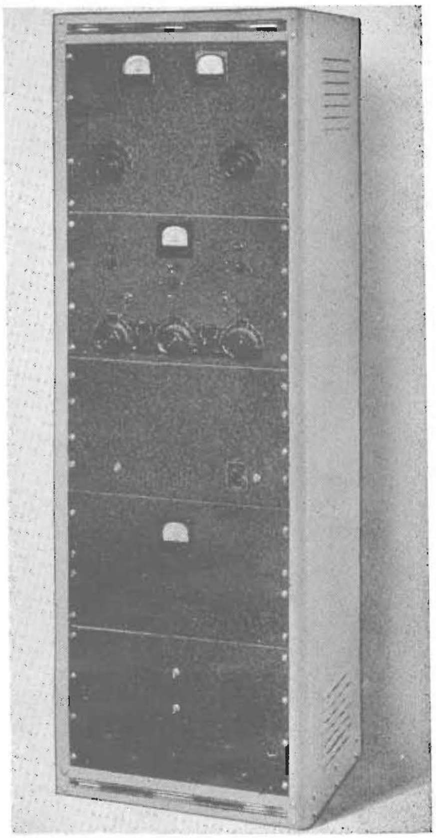
Multi-Match Modulator

★

1250 and 1500 Volt Power Supply

★

Up to 150 Watts Modulator Output



PARTICULARLY designed for use with the new RCA-811 and 812 tubes, this transmitter, with its unusual mechanical layout and carefully planned wiring, gives superior performance on the five amateur bands from 160 to 10 meters. With an input of 250 watts for phone operation, a carrier output of 190 watts is easily obtained; and with 450 watts input for CW, 350 watts may be delivered to the antenna. Higher than usual plate efficiencies are obtained by careful attention to mechanical layout and by the selection of high quality parts.

In addition to the RCA-812 the transmitter will also operate satisfactorily with other tubes such as the Taylor TZ-40, Taylor T-55, or the Eimac 35T. It is only necessary to use the correct filament transformer and to adjust the grid bias resistor.

A semi-fixed swinging link grid tank coil of the plug-in type is used in the grid circuit. This allows not only close adjustment for optimum excitation but also permits the coil to be removed without changing the link setting. This latter feature is particularly desirable for the amateur who wishes to avoid time-consuming operations when changing bands. The plate tank coil is also of the swinging link type, which permits quick adjustment of the amplifier loading. The Class C amplifier is easily driven by the Thordarson 40 watt Band-Switch Exciter unit, this combination affording the advantage of quick band changing without involving costly coil switching parts in the high power stage.

The Class C amplifier requires 200 MA at 1250 volts for a phone input of 250 watts. For a 450 watt CW input the plate current is 300 MA at 1500 volts. The grid current for the Class C tubes depends upon the choice of tubes and whether CW or phone operation is desired. For 812's it is 50 MA for two tubes. To meet the various bias requirements of the different tube types, an adjustable grid resistor is provided.

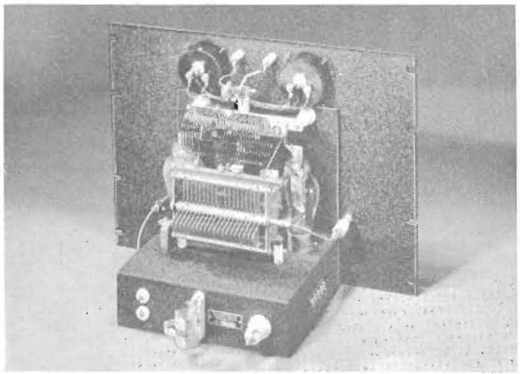
Should the amateur wish to install an external fixed bias supply for CW, provision has been made for its easy connection. If external bias is used, the negative of the bias supply connects to terminal No. 1 and the positive to No. 2. If external bias is not desired terminals No. 1 and No. 2 on the Class C amplifier chassis are connected together. About 30 volts of fixed bias are required to maintain the tubes within their rated plate dissipation without excitation.

Both the grid and the plate currents are metered, the meters being in the cathode return leads. This places both meters at a low DC potential with respect to the chassis, thus eliminating any tendency toward deflection of the needle due to electrostatic effects and removing the possibility of flash-over from the meter terminals to the pilot lamp mounting.

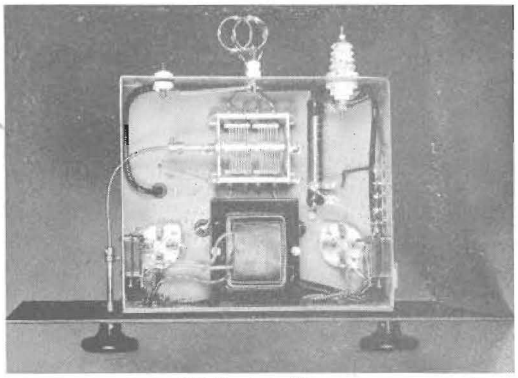
The modulator uses the new 811 tubes and easily delivers the required 125 watts of audio frequency power with very little distortion. It is designed to operate from a "500 ohm" line. The modulation transformer is of the Multi-Match type so that it may be used to modulate any Class C stage of 300 watts input power. The no-signal plate current of the 811's is 60 MA, and the current with a 125 watt sine wave output is 177 MA. For speech signals having the same peak power the plate current should swing to about 90 or 100 MA.

The required driving power is very small, being on the order of 4 peak watts. If 2A3's are used as the driver tubes, an unusually high step-down ratio from the plates of the 2A3's to the grids of the 811's may be used to obtain excellent driving regulation. The Thordarson Amateur Speech Amplifier is an excellent unit to furnish the driving power required by this modulator.

The power supply, with its tapped plate transformer, is rated at 300 MA at 1250 or 1500 volts. The load requirements of the Class C amplifier and the modulator are such that the power supply is fully loaded for both phone and CW so that regardless of the type of operation the amateur chooses, he is not investing in a power supply which is not being loaded up to its rating at all times. The power supply is entirely self-contained with separate plate and filament switches, making it an ideal power supply for other equipment of similar load requirements.

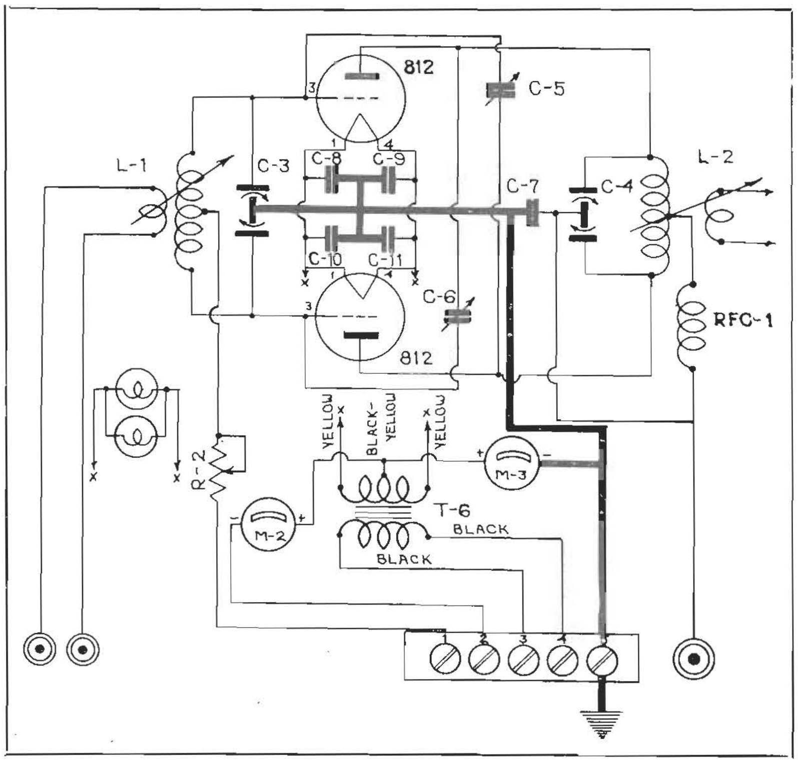


RF Chassis View



RF Bottom View

RF Section



Parts Required

THORDARSON TRANSFORMER

T-6	T-19F85	Filament Transformer

Resistor:

R-2	4,000 Ohm 50 Watt Wirewound Ohmite Semi-Variable or Equivalent

Condensers:

C-3	Variable Air Condenser, Cardwell MR-150-BD or Equivalent
C-4	Variable Air Condenser, Cardwell XP-165-KD or Equivalent
C-5	Neutralizing Condenser, Hammarlund N-10 or Equivalent
C-6	Neutralizing Condenser, Hammarlund N-10 or Equivalent
C-7	.001 Mfd. 3,500 Volt Mica Condenser Aerovox 1653 or Equivalent
C-8	.002 Mfd. 1,000 Volt Mica Condenser CD-4-6D2 or Aerovox 1455
C-9	.002 Mfd. 1,000 Volt Mica Condenser CD-4-6D2 or Aerovox 1455
C-10	.002 Mfd. 1,000 Volt Mica Condenser CD-4-6D2 or Aerovox 1455
C-11	.002 Mfd. 1,000 Volt Mica Condenser CD-4-6D2 or Aerovox 1455

Tubes:

2	812 Tubes

Miscellaneous Parts:

1		Punched Chassis 8 ½" x 10" x 3"
1		Panel 19" x 14"
1		Sub-Panel
1		Terminal Board
4		Bushings
3		Feed-thru Insulators
2		4-Contact Isolantite Sockets
2		Stand-off Insulators
2		Shaft Couplings, National TX-11 or Equivalent
1		Shaft Coupling, Johnson No. 252 or Equivalent
2		Panel Bearing Assemblies, Johnson No. 256 or Equivalent
1	M-2	0-200 MA DC Meter, 3" Square Case, Rear Illumination, Triplett No. 327-A or Equivalent
1	M-3	0-300 MA DC Meter, 3" Square Case, Rear Illumination, Triplett No. 327-A or Equivalent
2		Control Wheels, Complete, Coto CI-45 or Equivalent
1		Indicator Plate Marked "PWR AMP GRID" Coto CI-47 or Equivalent
1		Indicator Plate Marked "PWR AMP PLATE" Coto CI-47 or Equivalent

Misc. Parts: (Cont'd)

1		Coil Socket, National Type XB-16 or Equivalent
1	L-1	160 Meter Coil, National Type AR16-160C or Equivalent
1	L-1	80 Meter Coil, National Type AR16-80S or Equivalent
1	L-1	40 Meter Coil, National Type AR16-40S or Equivalent
1	L-1	20 Meter Coil, National Type AR16-20S or Equivalent
1	L-1	10 Meter Coil, National Type AR16-10S or Equivalent
1	L-2	Swinging Link & Jack Bar Assembly, B-W Type TV or Equivalent
1	L-2	160 Meter Coil, B-W 160 TVL or Equivalent
1	L-2	80 Meter Coil, B-W 80 TVL or Equivalent
1	L-2	40 Meter Coil, B-W 40 TVL or Equivalent
1	L-2	20 Meter Coil, B-W 20 TVL or Equivalent
1	L-2	10 Meter Coil, B-W 10 TVL or Equivalent
2		Grid Grips, National Type 12 or Equivalent
1	RFC-1	RF Choke, National Type R-154U or Equivalent

Miscellaneous screws, nuts, bolts, lock-washers, required hook-up wire and other hardware.

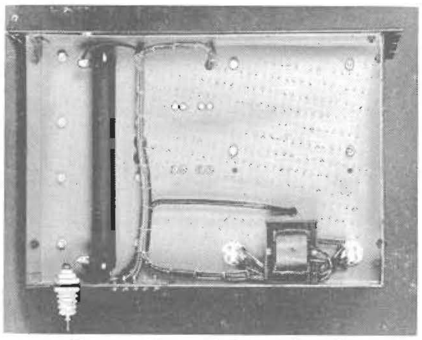
Circuit diagram, drawings and full size template of chassis available from Thordarson 15 cents net each, postpaid.

250 Watt Phone Transmitter

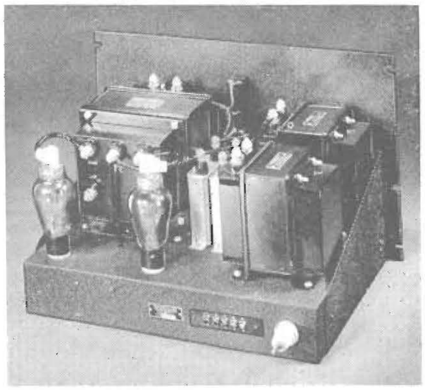
450 WATT CW — 160 TO 10 METERS

Modulator and Power Supply

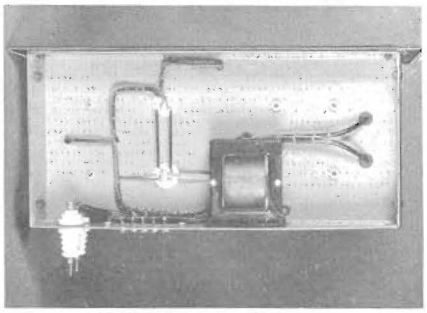
Modulator



Bottom View of Power Supply



Power Supply



Bottom View of Modulator

Modulator Parts Required

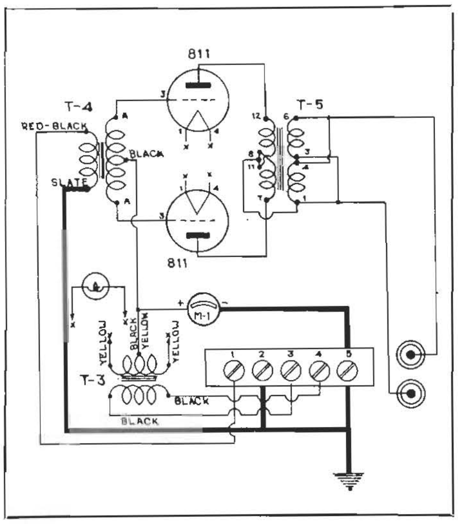
THORDARSON TRANSFORMERS and CHOKES

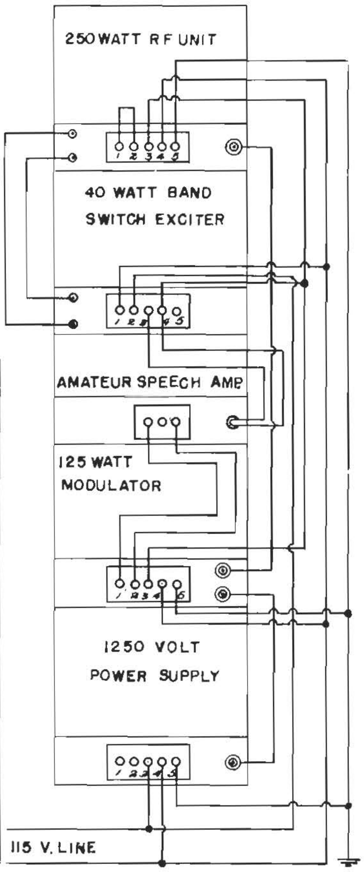
T-3	T-19F99	Filament Transformer
T-4	T-19D05	Driver Transformer
T-5	T-19M16	Modulation Transformer

Miscellaneous Parts:

2	811 Tubes
1 M-1	0-200 MA DC Meter, 3" Square Case, Rear Illumination, Triplett #327A or Equivalent
1	Punched Chassis 17" x 8" x 3"
1	Panel 19" x 10½"
1 Pr.	Chassis Mounting Brackets
1	5-Lug Terminal Board
2	Feed-thru Insulators
2	4-Contact Sockets, Steatite
2	Isolantite Plate Caps

Miscellaneous nuts, bolts, lock-washers, grommets, soldering lugs and other hardware.





Power Supply Parts Required

THORDARSON TRANSFORMERS and CHOKES

T-1	T-19F90	Filament Transformer
T-2	T-19P60	Plate Transformer
CH-1	T-19C37	Input Choke
CH-2	T-19C44	Smoothing Choke

Resistor:

R-1 40,000 Ohm 200 Watt Wirewound Resistor, Ohmite 1370 or Equivalent

Condensers:

C-1	2 Mfd. 1,500 Volt Condenser, GE #23F21 or Equivalent
C-2	2 Mfd. 1,500 Volt Condenser, GE #23F21 or Equivalent

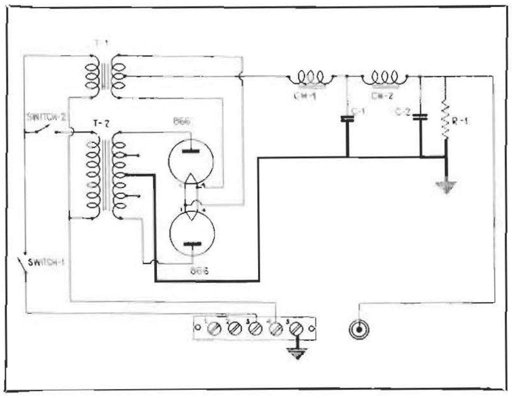
Tubes:

2 866 Tubes

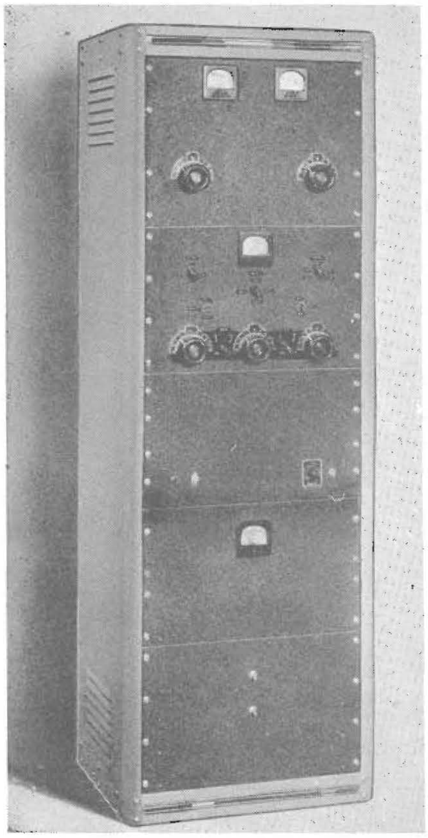
Miscellaneous Parts:

1	Punched Chassis 17" x 12" x 3"
1	Panel 19" x 12¼"
1 Pr.	Chassis Mounting Brackets
2	4-Contact Sockets, Steatite
1	Feed-thru Insulator
2	Isolantite Plate Caps
1 SW-1	Switch, Arrow H & H Type HDT or Equivalent
1 SW-2	Switch, Arrow H & H Type HDT or Equivalent

Miscellaneous nuts, bolts, lock-washers, soldering lugs and other hardware.



Circuit diagram, drawings and full size template of chassis available from Thordarson 15 cents net each, postpaid.



Wide Choice of Class C Tubes

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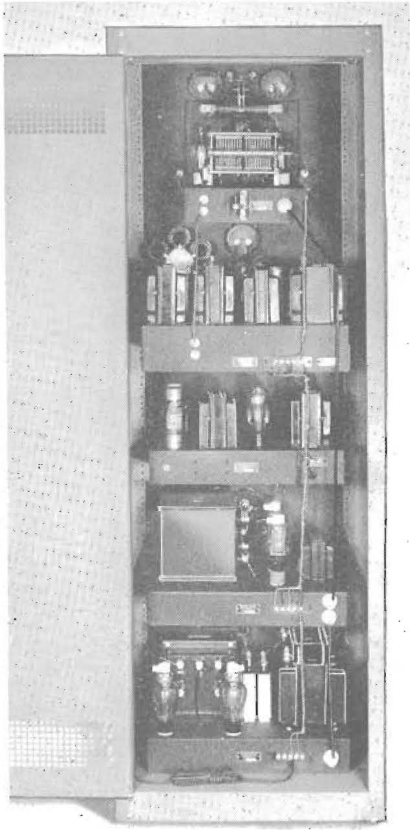
Adjustable Excitation

★

Adjustable Loading

★

Multi-Match Modulator



High Efficiency with Adjustable Loading

THIS 400 watt phone transmitter has the same construction and superior features of the transmitter shown on pages 24, 25 and 26. It is suitable for operation on all bands from 160 to 10 meters. It is easily driven by any exciter having an output of 20 watts; an ideal exciter for this transmitter is the Thordarson 40 Watt Band-Switch Exciter.

The transmitter is supplied with panels finished in black wrinkle, and the chassis and chassis mounting brackets are in gray flat enamel.

RF Section:

The unusual mechanical construction of the RF Section results in improved electrical performance. Flexible shafts are used to couple the grid and plate tuning condensers to the panel controls. The tubes used in the RF section are Heintz and Kaufman HK-54's or Taylor T-55's. The HK-54's require a T-19F85 filament transformer, and the T-55's, a T-19F94 filament transformer. Holes are provided on the chassis for either of these types.

A swinging link which couples the plate tank coil to the antenna, permits the amateur to adjust the loading of the final stage to the desired power input. For 400 watts input, the Class C plate current is 267 MA at 1500 volts. A plate efficiency of between 75% and 80% may be obtained when the transmitter is in proper adjustment.

The grid tank coils are the plug-in type, having link coupling to the exciter. The coils for the 80, 40, 20 and 10 meter bands have semi-fixed swinging links, and the 160 meter coil has a fixed link. Excitation should be adjusted so that the total grid current for both Class C tubes is 40 MA. The value of the grid resistor used with the HK-54's is 3750 ohms; with the T-55's, 5000 ohms.

Since the RF unit was designed primarily for phone operation, no attempt was made to install a fixed bias supply on the RF chassis. However, for CW, provision has been made on the terminal board for the connection of an external bias supply. About 45 volts of bias is required to hold the tubes at their rated dissipation with no excitation. When external bias is not used terminals No. 1 and No. 2 are connected together. If external bias is used, the negative of the bias supply connects to terminal No. 1 and the positive to No. 2.

Both the grid and the plate currents are metered. The meters are in the cathode return leads, thus placing both meters at a low DC potential with respect to the chassis, and thereby avoiding any possibility of flash-overs from the meter terminals to the pilot lamp mounting and any likelihood of deflection of the movements due to electrostatic effects.

Modulator:

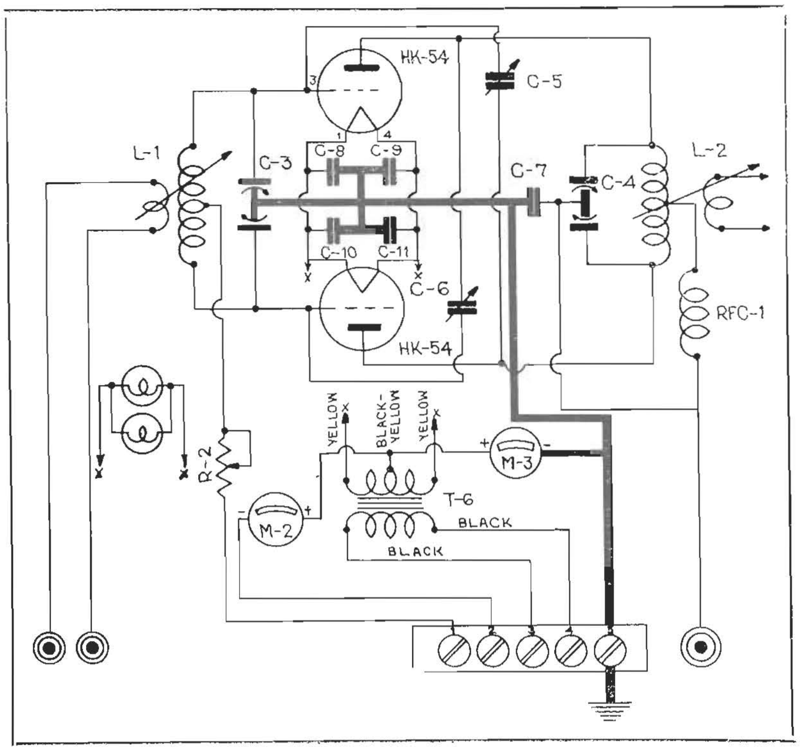
The modulator, using 811's with 1500 volts on the plates, has a power output of 200 watts. The no-signal plate current for two tubes is about 70 MA. With a 200 watt sine-wave output the plate current rises to 217 MA. For speech signals of sufficient magnitude to modulate the Class C stage 100%, the average plate current is about 125 MA. The modulation transformer, as well as the driver transformer, is of the Multi-Match type so that a large variety of Class C loads and sources of driving power may be accommodated. The primary of the driver transformer is designed to couple from a "500 ohm" line. Very little driving power (3.5 watts) is needed to obtain

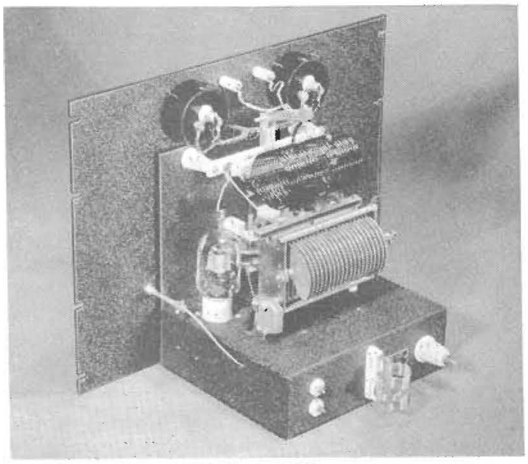
200 watts output; thus the large excess of power output capability of the usually chosen pair of 2A3's serving as driver tubes can be turned to good advantage in obtaining a driving voltage of exceptionally good regulation. The plate-to-plate load on the modulator tubes is 15,500 ohms.

Power Supply:

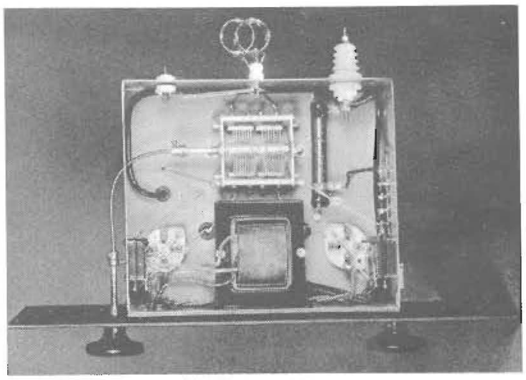
The power supply for this transmitter uses two 866's and has a rating of 500 MA at 1500 volts DC. On its 14" panel are mounted two switches: one for controlling filaments and the other for controlling the plate transformer. Having well insulated line terminals and high voltage terminals mounted on the rear apron of the chassis, the power supply matches in appearance and construction the modulator and RF units with which it was designed to operate. Its simplicity and completeness make it an excellent general purpose power supply.

RF Section





RF Chassis View



RF Bottom View

RF Section Parts Required

THORDARSON TRANSFORMER

T-6	T-19F99 Filament Transformer

Resistor:

R-2	4,000 Ohm 50 Watt Wirewound Ohmite Semi-Variable or Equivalent

Condensers:

C-3	150-150 Mmfd. Variable Condenser, Cardwell MR-150-BD or Equivalent
C-4	165-165 Mmfd. Variable Condenser, Cardwell XP-165-KD or Equivalent
C-5	Neutralizing Condenser, Hammarlund N-10 or Equivalent
C-6	Neutralizing Condenser, Hammarlund N-10 or Equivalent
C-7	.001 Mfd. 3,500 Volt Mica Condenser Aerovox 1653 or Equivalent
C-8	.002 Mfd. 1,000 Volt Mica Condenser CD4-6D2 or Aerovox 1455
C-9	.002 Mfd. 1,000 Volt Mica Condenser CD4-6D2 or Aerovox 1455
C-10	.002 Mfd. 1,000 Volt Mica Condenser CD4-6D2 or Aerovox 1455
C-11	.002 Mfd. 1,000 Volt Mica Condenser CD4-6D2 or Aerovox 1455

Tubes:

2	HK-54 Tubes

Miscellaneous Parts:

1		Punched Chassis 8½" x 10" x 3"
1		Panel 19" x 14"
1		Sub-Panel
1		Terminal Board
4		Bushings
3		Feed-thru Insulators
2		4-Contact Isolantite Sockets
2		Stand-off Insulators
2		Shaft Couplings, National TX-11 or Equivalent
1		Shaft Coupling, Johnson #252 or Equiv.
2		Panel Bearing Assemblies, Johnson #256 or Equivalent
1	M-2	0-200 MA DC Meter, 3" Square Case, Rear Illumination, Triplett #327-A or Equivalent
1	M-3	0-300 MA DC Meter, 3" Square Case, Rear Illumination, Triplett #327-A or Equivalent
2		Control Wheels, Complete, Coto CI-45 or Equivalent
1		Indicator Plate Marked "PWR AMP GRID" Coto CI-47 or Equivalent
1		Indicator Plate Marked "PWR AMP PLATE" Coto CI-47 or Equivalent

Misc. Parts: (Cont'd)

1		Coil Socket, National Type XB-16 or Equivalent
1	L-1	160 Meter Coil, National Type AR16-160C or Equivalent
1	L-1	80 Meter Coil, National Type AR16-80S or Equivalent
1	L-1	40 Meter Coil, National Type AR16-40S or Equivalent
1	L-1	20 Meter Coil, National Type AR16-20S or Equivalent
1	L-1	10 Meter Coil, National Type AR16-10S or Equivalent
1	L-2	Swinging Link & Jack Bar Assembly, B-W Type TV or Equivalent
1	L-2	160 Meter Coil, B-W 160 TVL or Equiv.
1	L-2	80 Meter Coil, B-W 80 TVL or Equiv.
1	L-2	40 Meter Coil, B-W 40 TVL or Equiv.
1	L-2	20 Meter Coil, B-W 20 TVL or Equiv.
1	L-2	10 Meter Coil, B-W 10 TVL or Equiv.
2		Grid Grips, National Type 12 or Equiv.
1	RFC-1	RF Choke, National Type R-154U or Equivalent

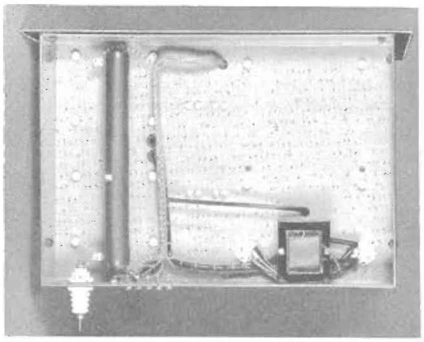
Miscellaneous screws, nuts, bolts, lock-washers, required hook-up wire and other hardware.

Circuit diagram, drawings and full size template of chassis available from Thordarson 15 cents net each, postpaid.

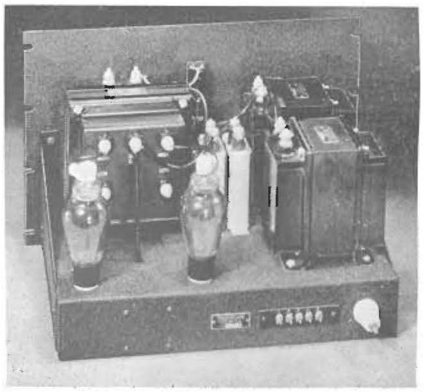
400 Watt Transmitter

Modulator and Power Supply

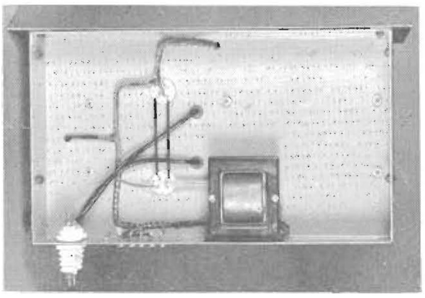
Modulator



Bottom View of Power Supply



Power Supply



Bottom View of Modulator

Modulator Parts Required

THORDARSON TRANSFORMERS and CHOKES

T-3	T-19F99	Filament Transformer
T-4	T-19D05	Driver Transformer
T-5	T-19M17	Modulation Transformer

Tubes:

2 811 Tubes

Miscellaneous Parts:

1	M-1	0-300 MA DC Meter, 3" Square Case Triplett 327-A or Equivalent
1		Punched Chassis 17" x 10" x 3"
1		Panel 19" x 10½"
1 Pr.		Chassis Mounting Brackets
2		Feed-thru Insulators
2		4-Contact Sockets, Steatite
2		Isolantite Plate Caps

Miscellaneous nuts, bolts, lock-washers, grommets and other hardware.

Power Supply Parts Required

THORDARSON TRANSFORMERS and CHOKES

T-1	T-19F90	Filament Transformer
T-2	T-19P64	Plate Transformer
CH-1	T-19C37	Input Choke
CH-2	T-19C44	Smoothing Choke

Resistor:

R-1 40,000 Ohm 200 Watt Wirewound Resistor, Ohmite 1370 or Equivalent

Condensers:

C-1 2 Mfd. 2,000 Volt Condenser GE #23F31 or Equivalent

C-2 2 Mfd. 2,000 Volt Condenser GE #23F31 or Equivalent

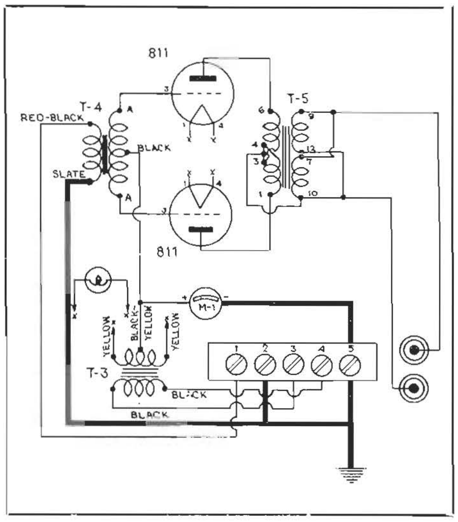
Tubes:

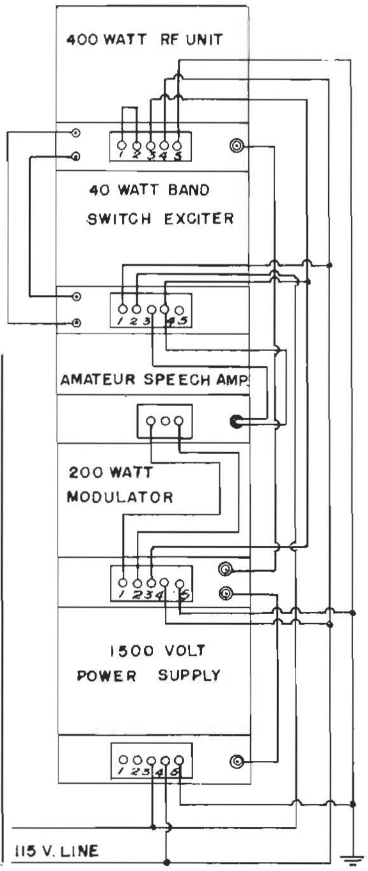
2 866 Tubes

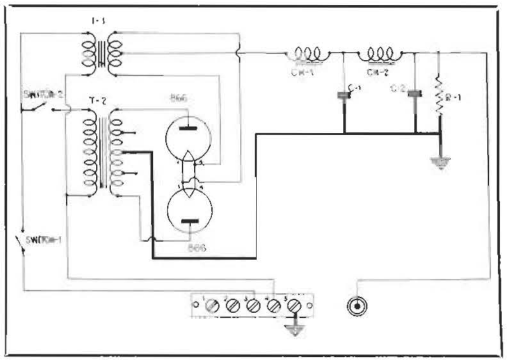
Miscellaneous Parts:

1	SW-1	Switch, Arrow H & H Type HDT or Equivalent
1	SW-2	Switch, Arrow H & H Type HDT or Equivalent
1		Punched Chassis 17" x 12" x 3"
1		Panel 19" x 14¼"
1 Pr.		Chassis Mounting Brackets
1		Terminal Board
2		4-Contact Sockets, Steatite
1		Feed-thru Insulator
2		Isolantite Plate Caps

Miscellaneous nuts, bolts, lock-washers and other hardware.

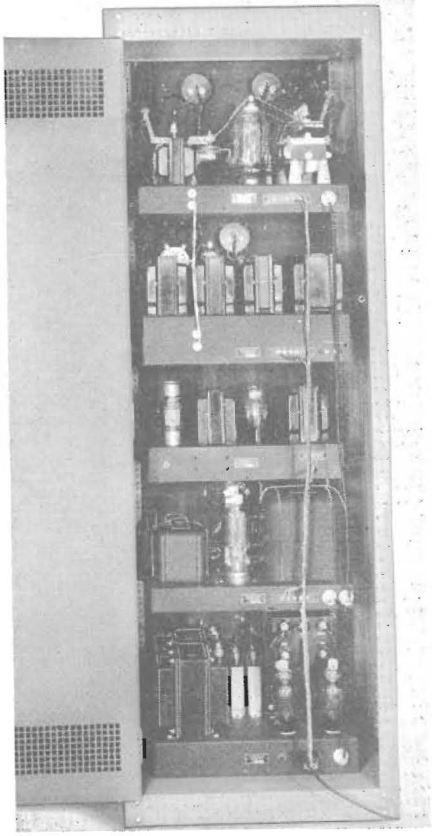






Circuit diagram, drawings and full size template of chassis available from Thordarson 15 cents net each, postpaid.

600 Watt Transmitter



Completely Relay Controlled

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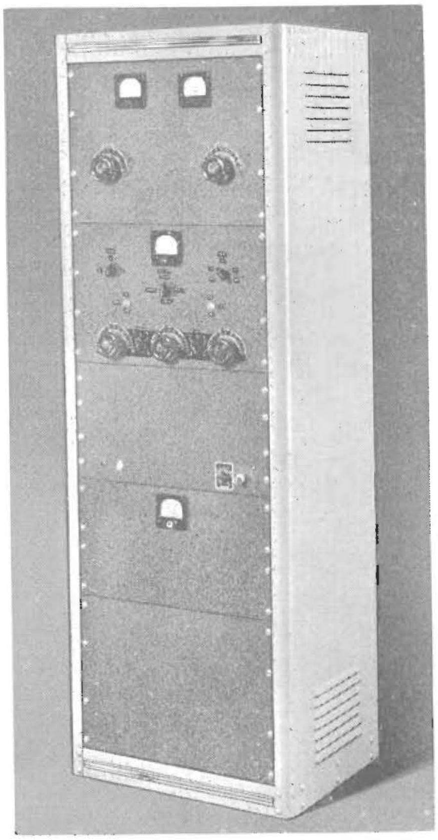
Under Excitation Protection

★

High Quality Audio System

★

Multi-Match Modulator



THIS transmitter consists of a Class C amplifier of 600 watts input, a modulator capable of delivering 300 watts of audio frequency power and a 1750 volt power supply of sufficient capacity to furnish the current required by both the RF stage and the modulator. Operation may be obtained on all five amateur bands from 160 to 10 meters. Relay switching is incorporated in this transmitter, thus not only permitting complete control of the transmitter with a single switch but also protecting the Class C amplifier from under-excitation and preventing the possibility of abuse to the modulation transformer by underloading it.

The Class C amplifier may be operated with any one of three types of tubes, namely Taylor TW-150's, Eimac 100TH's or Heintz and Kaufman HK-254's. The modulator tubes are Taylor 805's, and the rectifier tubes are 866's.

The panels are supplied in a black wrinkle finish; and the chassis, chassis mounting brackets and other small metal fixtures in a gray flat enamel.

RF Unit:

The Class C amplifier circuit is of the conventional push-pull type operating with 600 watts input at 1750 volts. It requires from 30 to 40 watts of driving power. The Thordarson 120 watt Band-Switch Exciter or the Thordarson 100 Watt Multi-Band Transmitter are ideal exciters. These units are described on pages 18 and 20. Plate and grid coils are of the plug-in type with a swinging link and jack bar assembly, thus permitting close adjustment of grid excitation and plate loading. Provision is made on the chassis for using either the UX sockets required by the TW-150's and the 100TH's, or the 50 watt sockets needed for use with HK-254's. The grid resistor is of the semi-variable type so that the correct bias requirements for various tubes may be met. The plate tuning condenser is of the split-stator type, having each stator section divided into two parts. This permits a very favorable L/C ratio to be obtained on all bands. The coils specified for the plate tank circuit have such a base construction that the correct stator combination is automatically obtained on each band when the coil is plugged in.

With 600 watts input the Class C plate current is 343 MA at 1750 volts. Plate efficiencies on the order of 75% are easily obtainable. When the amplifier is unloaded the plate current at resonance dips to about 25 MA on the 160, 80 and 40 meter bands; and to about 40 and 50 MA when operation is on the 20 and 10 meter bands respectively. The grid current is about 100 MA (for two tubes), and the grid resistor should be adjusted to about 1200 ohms.

Modulator:

The modulator has a "500 ohm" input and can be easily driven by the Thordarson Amateur Speech Amplifier. A rectified AC bias supply is installed on the modulator chassis. It uses a type 83 tube, which furnishes 20 volts of bias. This bias not only prevents the plate dissipation of the 805's from rising to an abnormal value during periods of no-signal but also tends to reduce distortion in the output of the modulator.

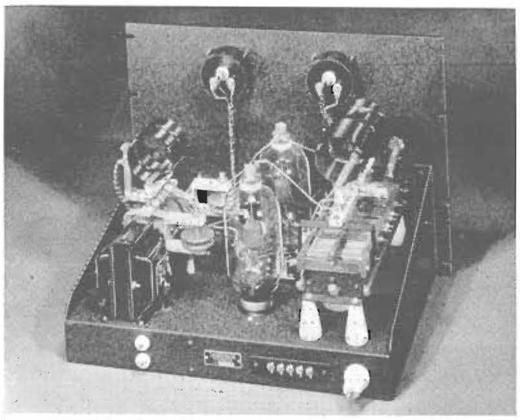
With no-signal on the grids of the 805's the plate current (two tubes) is about 80 MA. This current rises to 345 MA with a sine wave signal of magnitude sufficient to cause 100%

modulation, but for speech the same degree of modulation can be obtained when the modulator current rises to about 150 MA.

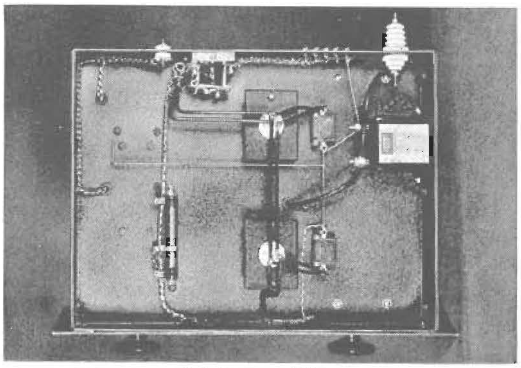
When the "500 ohm" input to the modulator grids is supplied by a Thordarson Amateur Speech Amplifier, the driver transformer ratio should be 1 to 1.4, primary to half the secondary. The turns ratio of the modulation transformer is 1.4 to 1, and the plate-to-plate load on the modulators is 10,000 ohms.

The driver and modulation transformers are of the Multi-Match type so that not only may a variety of Class C loads be accommodated but also different driving tubes may be used.

(Continued on Page 31)

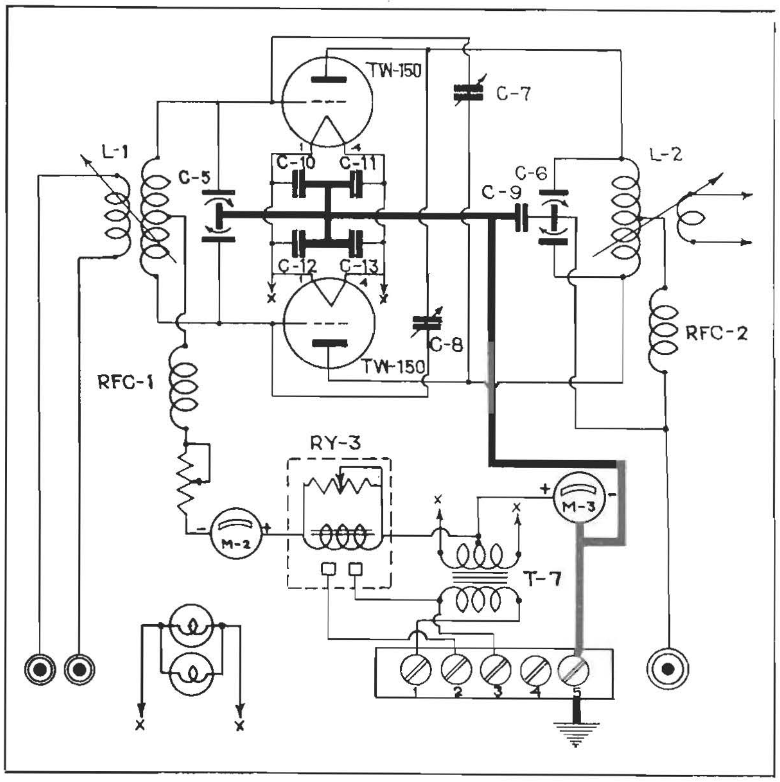


RF Chassis View



RF Bottom View

RF Section



RF Section Parts Required

THORDARSON TRANSFORMER

T-7	T-74F23	Filament Transformer

Resistor:

R-3	2,500 Ohm 50 Watt Semi-Variable Resistor, Ohmite or Equivalent

Condensers:

C-5	260-260 Mmfd. Variable Condenser, Cardwell MR-260-BD or Equivalent
C-6	160-160 Mmfd. Variable Condenser, Cardwell XE-160-70-XQ or Equivalent
C-7	Neutralizing Condenser, Hammarlund N-10 or Equivalent
C-8	Neutralizing Condenser, Hammarlund N-10 or Equivalent
C-9	.001 Mfd. Mica Condenser, CD-21C-86 or Equivalent
C-10	.002 Mfd. Mica Condenser, CD-4-6D2 or Aerovox 1455
C-11	.002 Mfd. Mica Condenser, CD-4-6D2 or Aerovox 1455
C-12	.002 Mfd. Mica Condenser, CD-4-6D2 or Aerovox 1455
C-13	.002 Mfd. Mica Condenser, CD-4-6D2 or Aerovox 1455

Tubes:

2	TW-150 or HK-254 or 100TH

Miscellaneous Parts:

1		Punched Chassis 17" x 13" x 2½"
1		Panel 19" x 14"
1	Pr.	Chassis Mounting Brackets
2		Socket Mounting Plates
4		Condenser Mounting Brackets
2		Coil Mounting Brackets
8		Bushings
1		Feed-thru Bushing
2		Feed-thru Insulators
2		4-Contact Sockets, Steatite
2		50 Watt Sockets
4		Grid Grips
4		Cone Insulators
1	RY-3	SPST Underload Relay, Ward-Leonard 507-514A or Equivalent
1	M-2	0-200 MA DC Meter, 3" Square Case, Rear Illumination, Triplett #327A or Equivalent
1	M-3	0-500 MA DC Meter, 3" Square Case Rear Illumination, Triplett #327A or Equivalent
1	L-1	Swinging Link & Jack Bar Assembly, B-W Type BVL or Equivalent
1	L-1	160 Meter Coil, B-W Type 160 BVL or Equivalent
1	L-1	80 Meter Coil, B-W Type 80 BVL or Equivalent
1	L-1	40 Meter Coil, B-W Type 40 BVL or Equivalent

Miscellaneous Parts: (Cont.)

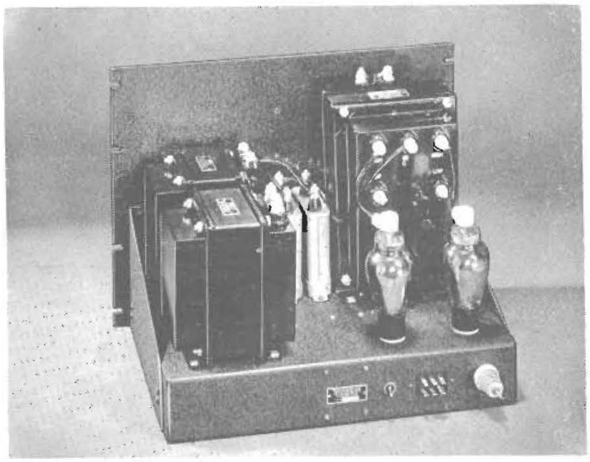
1	L-1	20 Meter Coil, B-W Type 20 BVL or Equivalent
1	L-1	10 Meter Coil, B-W Type 10 BVL or Equivalent
1	L-2	160 Meter Coil, B-W Type 160 TVH or Equivalent
1	L-2	80 Meter Coil, B-W Type 80 TVH or Equivalent
1	L-2	40 Meter Coil, B-W Type 40 TVH or Equivalent
1	L-2	20 Meter Coil, B-W Type 20 TVH or Equivalent
1	L-2	10 Meter Coil, B-W Type 10 TVH or Equivalent
1	L-2	Swinging Link & Jack Bar Assembly, B-W Type TVH or Equivalent
1	RFC-1	RF Choke, National Type R-100-U or Equivalent
1	RFC-2	RF Choke, National Type R-154 or Equivalent
2		4" Shaft Extensions, Yaxley RS-242 or Equivalent
2		2¼" Control Wheels, Coto CI-45 or Equivalent
1		Indicator Plate Marked "PWR AMP GRID," Coto CI-47 or Equivalent
1		Indicator Plate Marked "PWR AMP PLATE," Coto CI-47 or Equivalent

Miscellaneous screws, nuts, bolts, lock-washers, required hook-up wire and other hardware.

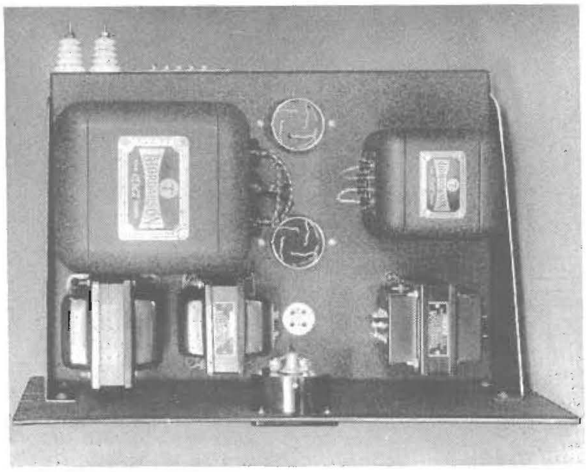
Circuit diagram, drawings and full size template of chassis available from Thordarson 15 cents net each, postpaid.

Modulator and Power Supply

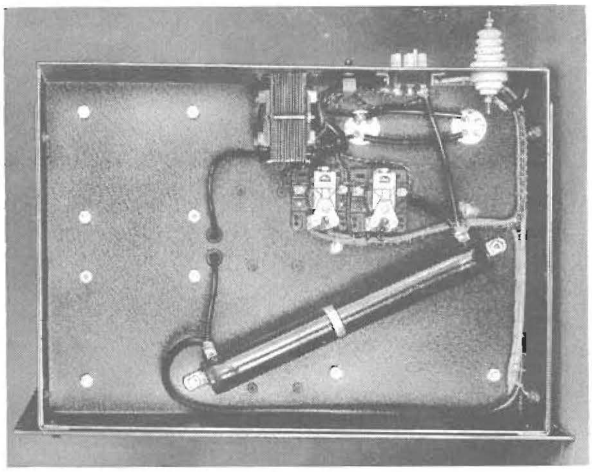
Modulator



Power Supply



Top View of Modulator



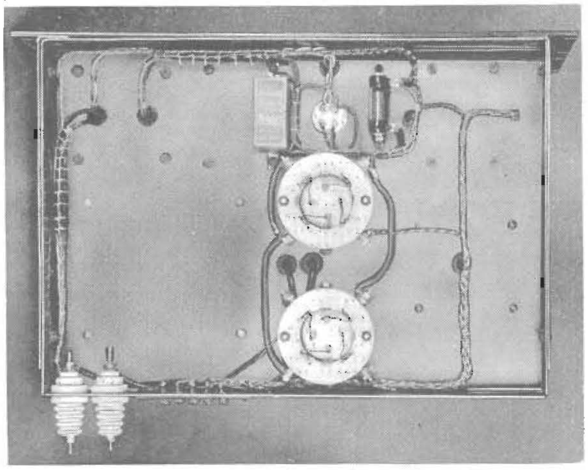
Bottom View of Power Supply

Power Supply:

FOR BOTH the convenience of the operator and the protection of the equipment, relay switching was chosen. When the filament switch on the exciter is closed, RY-1 closes, causing the application of voltage to the speech amplifier and the filaments of the rectifiers, modulator tubes and Class C amplifier tube. In addition, this operation places bias voltage on the modulator grids and prepares RY-2 for closing. Turning on the plate switch of the exciter results in the grid current in the Class C amplifier closing RY-3, which in turn causes RY-2 to apply primary voltage to the plate transformer. The opening of SW-1 prevents the operation of RY-2 even though RY-3 may be closed. This feature makes neutralizing convenient, and in addition affords more protection to the operator.

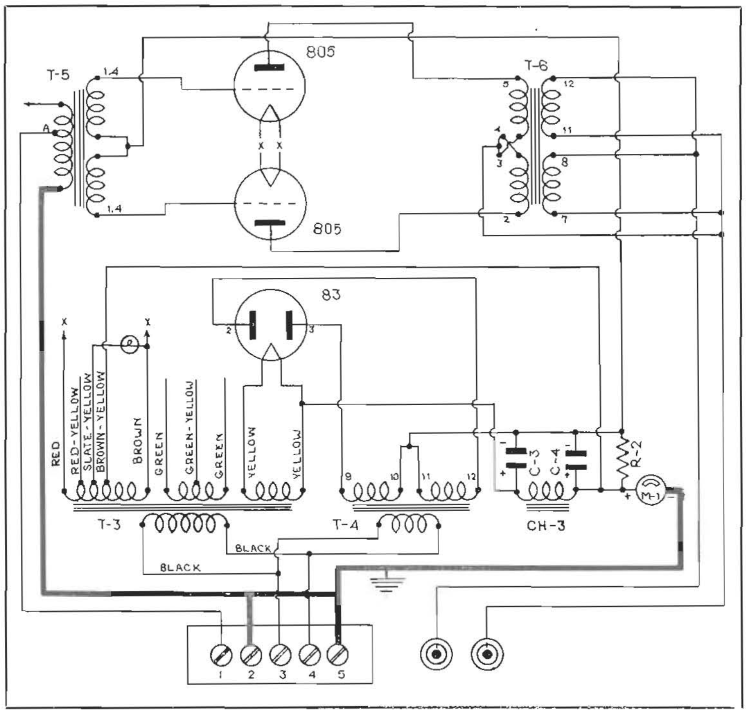
For CW operation it is only necessary to place a jumper between terminals 2 and 3 at the back of the RF chassis and insert a 22.5 volt battery at point A.

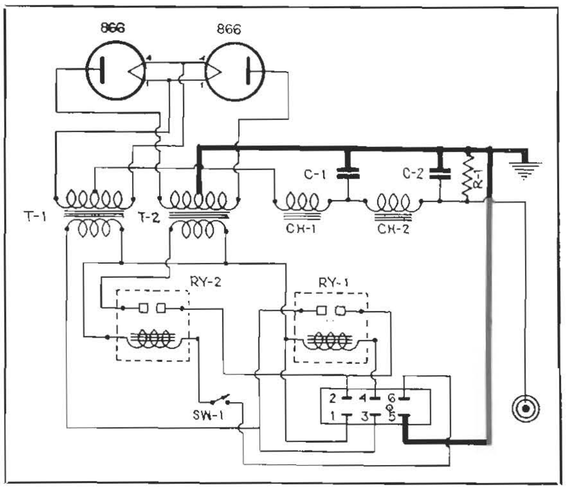
Since the power supply is rated at 1750 volts at 500 MA, 700 watts CW operation may be carried on by operating with a Class C plate current of 400 MA.



Bottom View of Modulator

Modulator and Power Supply





Modulator Parts Required

THORDARSON TRANSFORMERS and CHOKES

T-3	T-19F77	Filament Transformer
T-4	T-19R31	Bias Transformer
T-5	T-15D82	Driver Transformer
T-6	T-11M77	Modulation Transformer
CH-3	T-19C42	Filter Choke

Resistor:

R-2 100 Ohm 25 Watt Semi-Variable Resistor Ohmite #0368 or Equivalent

Condensers:

C-3, C-4 Double 16 Mfd. 250 Volt Condenser, Aerovox Type PBS or Equivalent

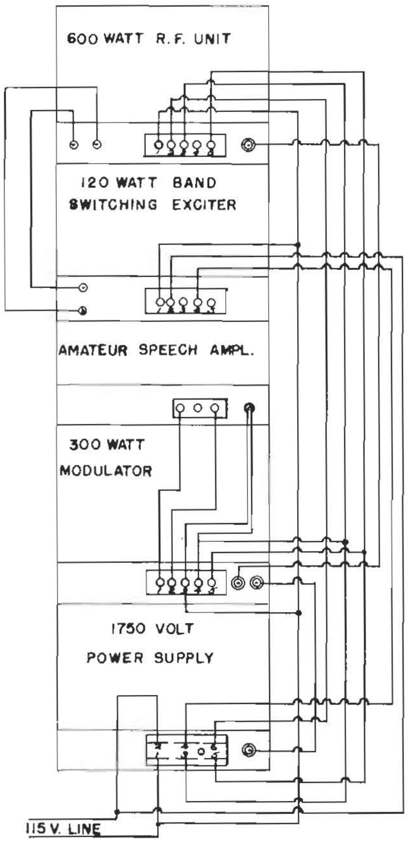
Tubes:

1	83	Tube
2	805	Tubes, Taylor or Equivalent

Miscellaneous Parts:

1	0-500 MA DC Meter, 3" Square Case, Rear Illumination, Triplett #327-A or Equivalent
1	Punched Chassis 17" x 12" x 2½"
1	Panel 19" x 10½"
1 Pr.	Chassis Mounting Brackets
4	Bushings
1	Terminal Board
2	50 Watt Sockets
1	4-Contact Socket, Steatite
2	Lead-in Bushings
2	Grid Grips

Miscellaneous screws, nuts, bolts, lock-washers, required hook-up wire and other hardware.



Power Supply Parts Required

THORDARSON TRANSFORMERS and CHOKES

T-1	T-19F90	Filament Transformer
T-2	T-19P66	Plate Transformer
CH-1	T-19C38	Choke
CH-2	T-19C45	Choke

Resistor:

R-1 75,000 Ohm 200 Watt Wirewound Resistor, Ohmite No. 0924 or Equivalent

Condensers:

C-1 2 Mfd. 2000 Volt Condenser, Mallory TX-811 or Equivalent

C-2 2 Mfd. 2000 Volt Condenser, Mallory TX-811 or Equivalent

Tubes:

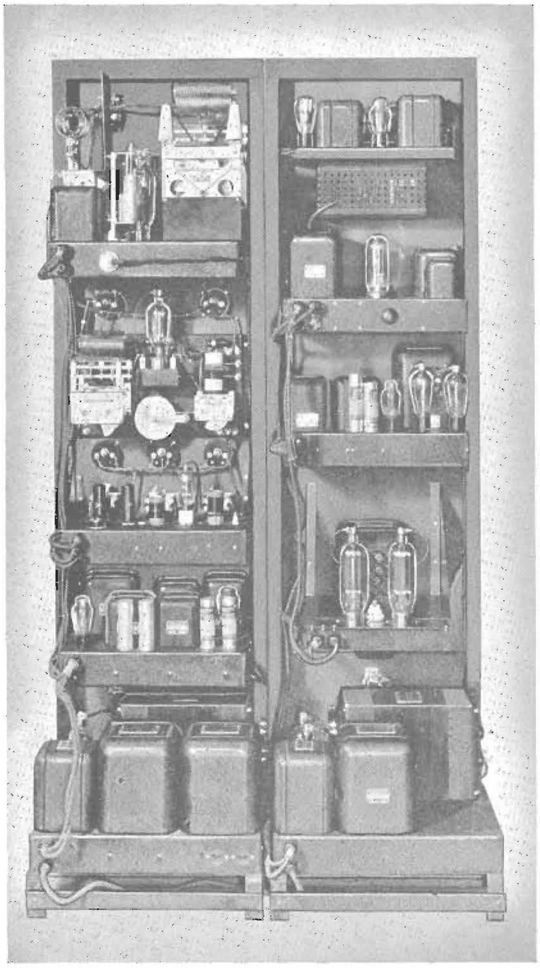
2 866 Tubes

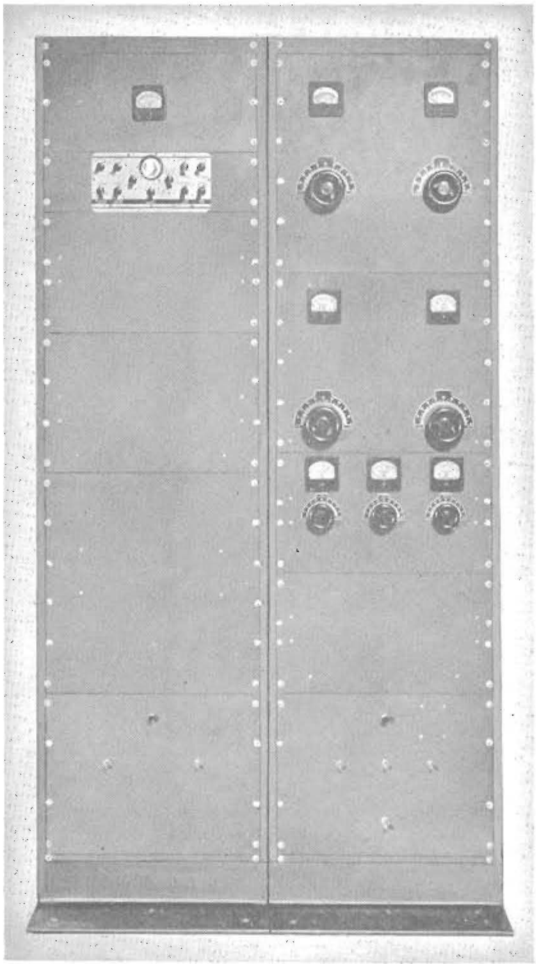
Miscellaneous Parts:

1	RY-1	Relay, SPST, Ward-Leonard No. 507-510 or Equivalent
1	RY-2	Relay, SPST, Ward-Leonard No. 507-518 or Equivalent
1	SW-1	SPST Switch N.P., Arrow H and H No. 20992 or Equivalent
1		Punched Chassis 17" x 13" x 2½"
1		Panel 19" x 14"
1 Pr.		Chassis Mounting Brackets
1		Switch Plate
2		4-Contact Sockets, Steatite
2		Isolantite Plate Caps
1		Lead-in Bushing
1		6-Contact Socket
1		6-Prong Plug

Miscellaneous screws, nuts, bolts, lock-washers, required hook-up wire and other hardware

Circuit diagram, drawings and full size template of chassis available from Thordarson 15 cents net each, postpaid.





HERE is a conservatively rated transmitter which is designed to handle the maximum allowable input of 1 kilowatt. The transmitter is built up in two racks, one containing the R.F. section with associated power supplies and the other the speech equipment, drivers, modulators, and necessary power equipment.

The exciter unit is built up on a separate chassis. Three stages are provided so that there is ample excitation on all bands. It may be found necessary to neutralize the 6L6 and the RK-39, especially if they are operated as straight buffers on the higher frequencies. These neutralizing condensers (NC-1, NC-2) may consist simply of a few turns of twisted wire. The RK-39 is link coupled to the T125 buffer; this stage should always be operated as a straight amplifier and all doubling should be done in the preceeding low power stages. The buffer in turn is link coupled to the final stage, which consists of a pair of T-200's in push-pull. The plate voltage is 2500 volts and the plate current 400 M.A.; the grid current should be 125 M.A.

No pre-amplifier is incorporated in the transmitter proper. It is far more desirable, both from the standpoint of convenience and performance, to place the low level speech stages some distance from the transmitter. The impedance of the speech input is 500 ohms and the level appriximately zero db. The first stage consists of a pair of 6F6's, triode connected, which provide ample grid swing for the 845's. The 845 drivers operate at 1250 volts, and the necessary bias is obtained from a resistor in the filament return. The 822 modulators operate at 2000 volts and provide ample power to modulate the 1 kilowatt input.

An important feature of high power equipment which has not been overlooked is the installation of an underload and two overload relays.

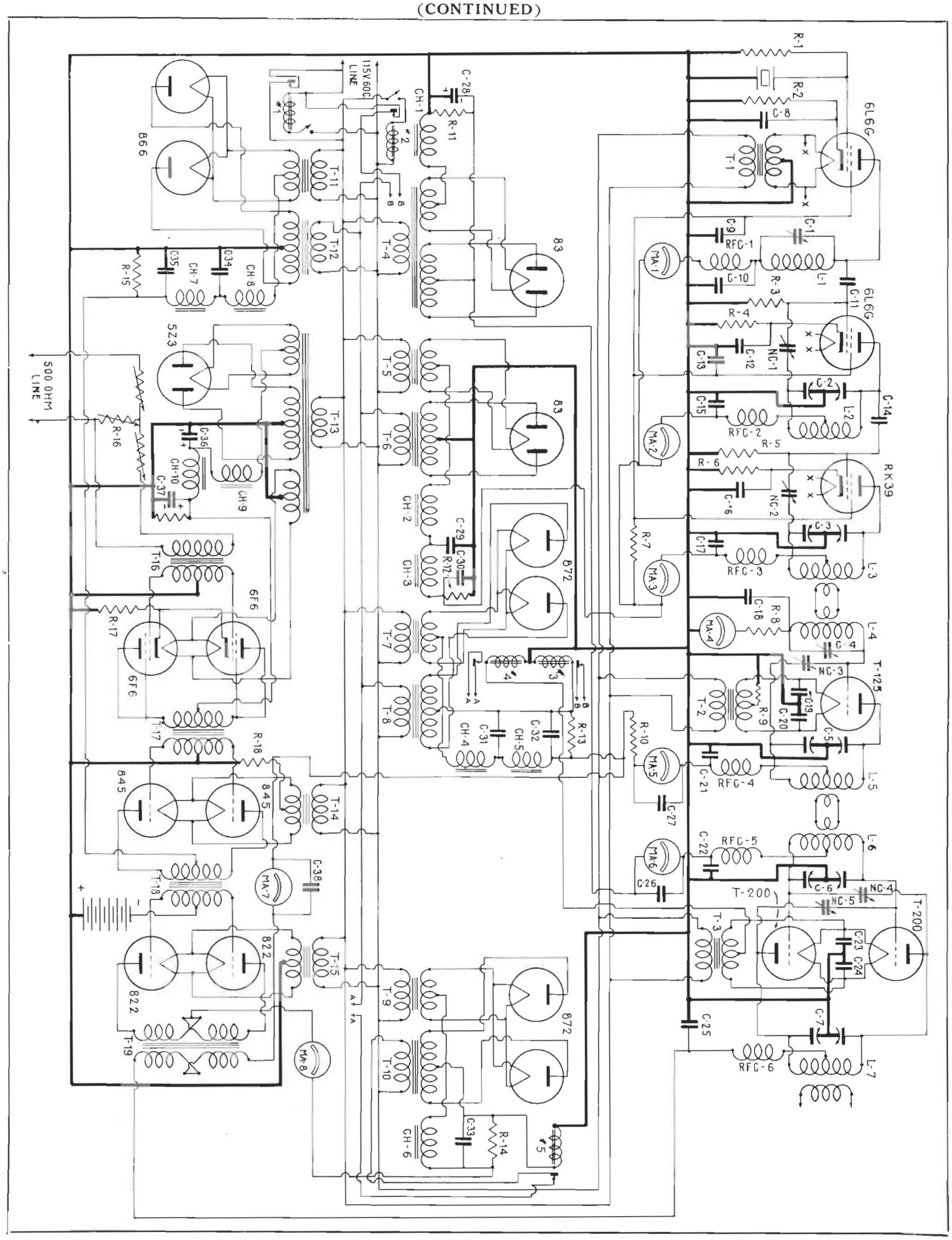
The underload relay is so connected that the Class C current must be 250 M.A. before the modulator plate supply is turned on. Possible damage to the modulation transformer is avoided in the event that excitation to the final fails with a signal applied to the modulators. If the current of either the Class C stage or the buffer should become excessive, the overload relay will automatically turn off all plate supplies. Another overload relay is installed in the modulator plate supply, however this relay controls only the modulators. In order to simplify operation, relays are also used to control the filaments and plate supplies. The wiring is so arranged that it is impossible to turn on the plate supplies without having the filament relay closed. This relay operation of both filament and plate supplies enables the transmitter to be controlled from the operating table simply by extending the light leads connected to the relay switches.

The correct bias for the 822 modulators is —67.5, and this is shown as battery bias in the diagram, although in the photograph an experimental bias supply is shown. This bias supply has not yet been fully developed and it is felt that it should be with-held until its performance is proven satisfactory.

The pre-amplifier is shown on page 37. It is mounted in a metal cabinet and if remote control is desired the filament and plate relay switches may be mounted on this panel.

1000 Watt Transmitter

(CONTINUED)



(CONTINUED)

Parts Required

Thordarson Transformers and Chokes

T-1	T-19F97	CH-1	T-15C36
T-2	T-19F95	CH-2	T-15C36
T-3	T-11F51	CH-3	T-15C45
T-4	T-15R60	CH-4	T-15C39
T-5	T-19F91	CH-5	T-15C48
T-6	T-15P11	CH-6	T-15C39
T-7	T-11F54	CH-7	T-15C45
T-8	T-15P21	CH-8	T-15C36
T-9	T-11F54	CH-9	T-15C36
T-10	T-15P21	CH-10	T-15C45
T-11	T-19F89		
T-12	T-15P15		
T-13	T-15R03		
T-14	T-19F96		
T-15	T-11F51		
T-16	T-15A67		
T-17	T-15D76		
T-18	T-18D19		
T-19	T-11M78		

Resistors:

R-1	50,000 Ohm 1 Watt IRC BT1 or Equiv.
R-2	200 Ohm 10 Watt Ohmite or Equiv.
R-3	10,000 Ohm 10 Watt Ohmite or Equiv.
R-4	200 Ohm 10 Watt Ohmite or Equiv.
R-5	10,000 Ohm 10 Watt Ohmite or Equiv.
R-6	50 Ohm 10 Watt Ohmite or Equiv.
R-7	5,000 Ohm 25 Watt Ohmite or Equiv.
R-8	2,000 Ohm 25 Watt Ohmite or Equiv.
R-9	2,000 Ohm 50 Watt Ohmite or Equiv.
R-10	10,000 Ohm 50 Watt Ohmite or Equiv.
R-11	1,000 Ohm 75 Watt Ohmite or Equiv.
R-12	25,000 Ohm 50 Watt Ohmite or Equiv.
R-13, R-14	100,000 Ohm 200 Watt Ohmite or Equiv.
R-15	50,000 Ohm 100 Watt Ohmite or Equiv.
R-16	500 Ohm 25 Watt T Pad Utah or Equiv.
R-17	750 Ohm 10 Watt Ohmite or Equiv.
R-18	2,000 Ohm 50 Watt Ohmite or Equiv.

CONDENSERS

Variable Condensers

C-1	150 Mmfd. Cardwell MR150BS or Equiv.
C-2, C-3	260 Mmfd. Cardwell MR260BD or Equiv.
C-4	150 Mmfd. National TMC150 or Equiv.
C-5	100 Mmfd. National TMA100DA or Equiv.
C-6	200 Mmfd. National TMC200D or Equiv.
C-7	200 Mmfd. National TMC200DA or Equiv.

Fixed Condensers:

C-8 to C-10	.001 Mfd. 1000 Volt Mica Aerovox 1450 or Equiv.
C-11	.0001 Mfd. 1000 Volt Mica Aerovox 1450 or Equiv.
C-12, C-13	.001 Mfd. 1000 Volt Mica Aerovox 1450 or Equiv.
C-14	.0001 Mfd. 1000 Volt Mica Aerovox 1450 or Equiv.
C-15 to C-20	.001 Mfd. 1000 Volt Mica Aerovox 1450 or Equiv.
C-21	.001 Mfd. 5000 Volt Mica Aerovox 1652 or Equiv.
C-22 to C-24	.001 Mfd. 1000 Volt Mica Aerovox 1450 or Equiv.
C-25	.001 Mfd. 10,000 Volt Mica Aerovox 1654 or Equiv.
C-26, C-27	.001 Mfd. 1000 Volt Mica Aerovox 1450 or Equiv.
C-28	16 Mfd. 450 Volt Elec. Aerovox G475 or Equiv.
C-29, C-30	2 Mfd. 1000 Volt Aerovox 1010 or Equiv.
C-31 to C-33	2 Mfd. 3000 Volt Aerovox 3009 or Equiv.
C-34, C-35	2 Mfd. 2000 Volt Aerovox 2009 or Equiv.
C-36, C-37	8 Mfd. 450 Volt Elect. Aerovox G475 or Equiv.
C-38	.001 Mfd. 1000 Volt Mica Aerovox 1450 or Equiv.

Neutralizing Condensers:

NC-1	See note in copy
NC-2	See note in copy
NC-3	12 Mmfd. 8000 Volt National NC-150 or Equiv.
NC-4, NC-5	13 Mmfd. 12,000 Volt Johnson N375 or Equiv.

Meters:

MA-1	0-100 M.A. Simpson 27S (Illum.) or Equiv.
MA-2, MA-3	0-150 M.A. Simpson 27S (Illum.) or Equiv.
MA-4	0-100 M.A. Simpson 27S (Illum.) or Equiv.
MA-5	0-500 M.A. Simpson 27S (Illum.) or Equiv.
MA-6	0-250 M.A. Simpson 27S (Illum.) or Equiv.
MA-7, MA-8	0-750 M.A. Simpson 27S (Illum.) or Equiv.

See page 37 for Pre-Amplifier

RF Chokes:

RFC-1 to RFC-3	125 M.A. National R100 or Equiv.
RFC-4	600 M.A. National R154U or Equiv.
RFC-5	125 M.A. National R100 or Equiv.
RFC-6	600 M.A. National R154U or Equiv.

Relays:

#1, #2	Guardian B100 or Equiv.
#3	Guardian L500 or Equiv.
#4	Guardian (special) or Equiv.
#5	Guardian L500 or Equiv.

Miscellaneous Parts:

5 Pr.	Chassis Mounting Brackets
4	3¼" Wheels Coto or Equiv.
3	2¼" Wheels Coto or Equiv.
3	Coil Forms National XR-4 or Equiv.
1	Coil Assembly National UR-13 or Equiv.
2	Coils Coto-Coil 80 BTVL or Equiv.
1	Coil Coto-Coil 80 TVL or Equiv.
11	Sockets Johnson type 211 or Equiv.
2	C-1 Bases Coto-Coil 6BTLM or Equiv.
1	C-1 Base Coto-Coil 8TLM or Equiv.
2	Cone Insulators Johnson #604 or Equiv.
4	Bee Hive insulators Johnson #45 or Equiv.
8	Feed-thru insulators Johnson #42 or Equiv.
4	1" Cone insulators Johnson #601 or Equiv.
2	Insulators National #GS-2 or Equiv.
3	Insulators National #GS-1 or Equiv.
6	SPST Toggle Switches H & H or Equiv.
4	Steatite Sockets Amphenol or Equiv.
2	Steatite Octal Sockets Amphenol or Equiv.
23	Bakelite Sockets Amphenol or Equiv.
2	Bakelite Octal Sockets Amphenol or Equiv.
18	Plugs Amphenol or Equiv.
1	Bakelite Knob
14	Large Grid Grips

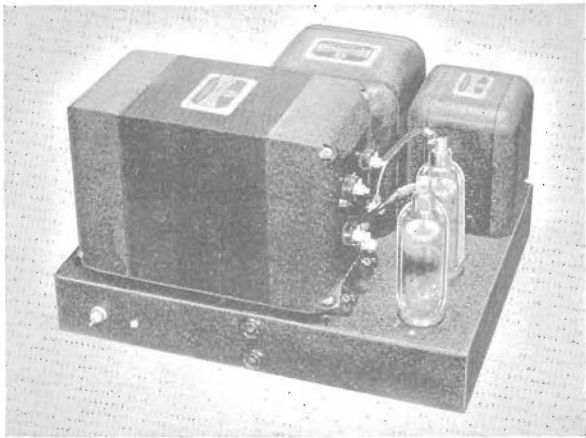
Tubes:

1	RK39	1	T-125
2	T-200	4	872
2	866	2	83
1	5Z3	2	6F6
2	845	2	822
2	6L6-G or 6L6GX		

COIL DATA

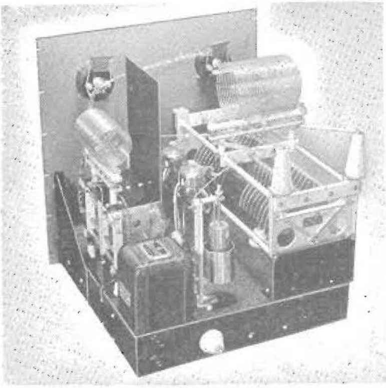
BAND	160	80	40	20	10
L1, L2, L3, L4	40T #18	26T #16	12T #16	8T #16	3T #16
L5, L6	36T #16 4⅛" Diam.	34T #16 2⅞" Diam.	22T #16 2⅞" Diam.	16T #14 2⅞" Diam.	4T #14 2⅞" Diam.
L7	42T #14 5⅛" Diam.	30T #10 4⅛" Diam.	20T #10 3¼" Diam.	10T #10 3¼" Diam.	4T #10 3¼" Diam.
Link for L3, L4, L5, L6	4T #18C.C.	3T #18C.C.	2T #18C.C.	2T #18C.C.	2T #18C.C.

L1, L2, L3 wound on 1½" Diam. winding length 1¾". L4 wound on 1¾" Diam. winding length 2". Winding length of L5, L6, 4½". Winding length of L7, 6½".

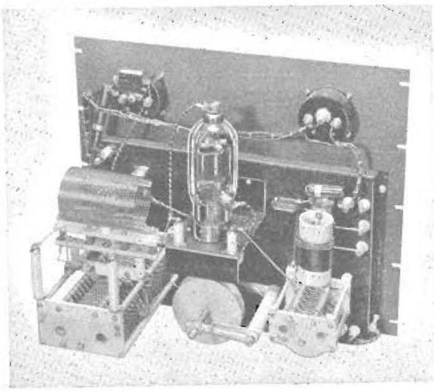


MODULATOR POWER SUPPLY
Chassis: 20" x 15" x 3¼"; Panel: 14"

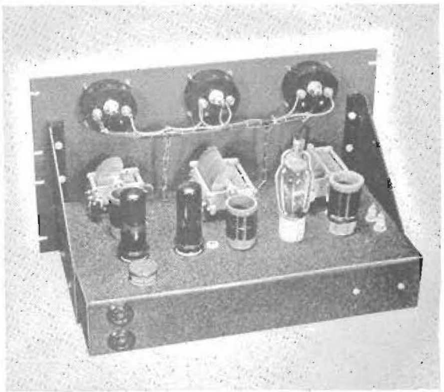
Circuit diagram, drawings and full size template of chassis available from Thordarson 15 cents net each, postpaid.



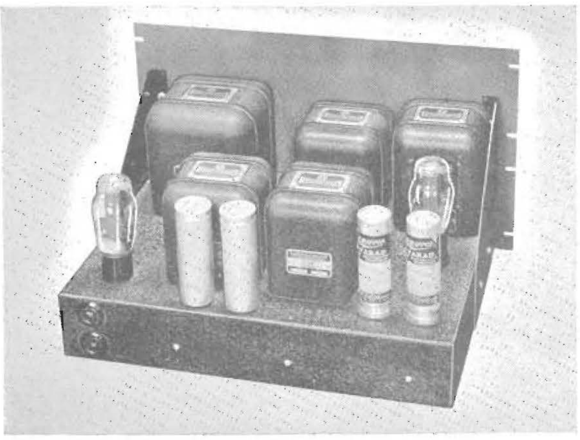
R. F. POWER AMPLIFIER
Chassis: 17" x 17" x 3"; Panel: 19¼"



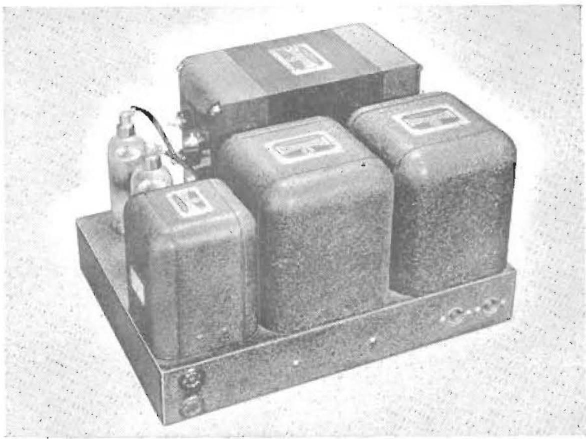
BUFFER
Chassis: 17" x 10" x 1"; Panel: 15¾"



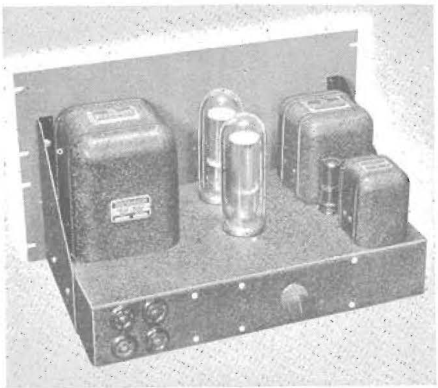
EXCITER UNIT
Chassis: 17" x 10" x 3"; Panel: 10½"



BIAS AND EXCITER POWER SUPPLIES
Chassis: 17" x 13" x 3"; Panel: 10½"

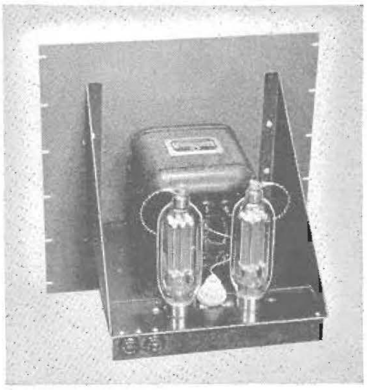


R.F. POWER SUPPLY
Chassis: 20" x 15" x 3¼"; Panel: 14"



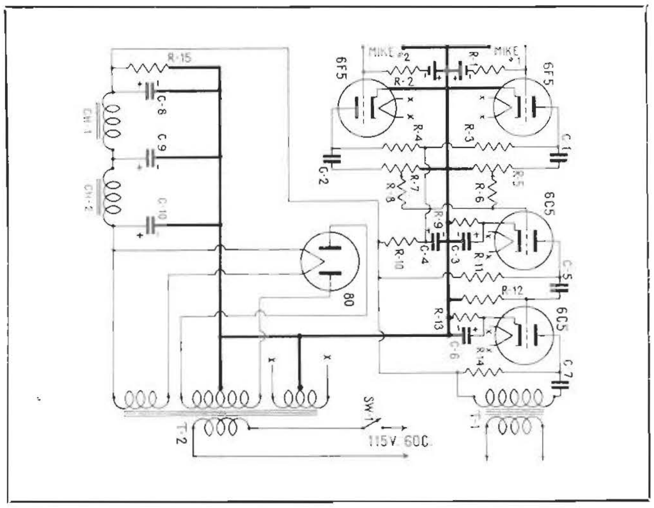
DRIVER AND SPEECH AMPLIFIER
Chassis: 17" x 10" x 3"; Panel: 10½"

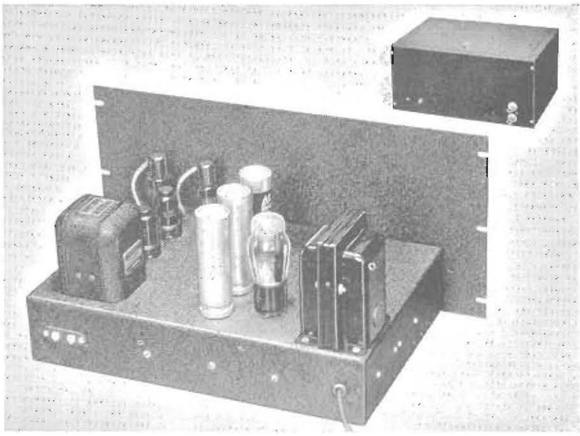
DRIVER AND SPEECH POWER SUPPLY
Chassis: 17" x 12" x 3"; Panel: 12¼"



CLASS B MODULATOR
Chassis: 13" w. x 13½" d.; Panel: 19¼"

Transmitter Pre-Amplifier





PRE-AMPLIFIER CHASSIS AND ASSEMBLY
Chassis: 17" x 10" x 3"; Case: 19" x 13" x 8¾"

PRE-AMPLIFIER PARTS REQUIRED

Thordarson Transformers and Chokes:

T-1	T-15A71	CH-1	T-13C26
T-2	T-70R78	CH-2	T-13C26

Resistors:

R-1, R-2	5 Meg. ½ Watt IRC BT ½ or Equiv.
R-3	100,000 Ohm 1 Watt IRC BT1 or Equiv.
R-4	100,000 Ohm 1 Watt Ohmite or Equiv.
R-5	500,000 Ohm Volume Control IRC or Equiv.
R-6	500,000 Ohm ½ Watt IRC BT ½ or Equiv.
R-7	500,000 Ohm Volume Control IRC or Equiv.
R-8	500,000 Ohm ½ Watt IRC BT ½ or Equiv.
R-9	2,000 Ohm 1 Watt Ohmite or Equiv.

Resistors: (Cont'd)

R-10	20,000 Ohm 1 Watt Ohmite or Equiv.
R-11	50,000 Ohm 1 Watt IRC BT1 or Equiv.
R-12	250,000 Ohm 1 Watt IRC BT1 or Equiv.
R-13	2,000 Ohm 1 Watt Ohmite or Equiv.
R-14	50,000 Ohm 1 Watt IRC BT1 or Equiv.
R-15	10,000 Ohm 25 Watt Ohmite or Equiv.

Condensers:

C-1, C-2	.1 Mfd. 400 Volt paper Aerovox 484 or Equiv.
C-3	10 Mfd. 25 Volt Elect. Aerovox PB25 or Equiv.
C-4	8 Mfd. 450 Volt Elect. Aerovox G475 or Equiv.
C-5	.1 Mfd. 400 Volt paper Aerovox 484 or Equiv.

Condensers: (Cont'd.)

C-6	10 Mfd. 25 Volt Elect. Aerovox PB25 or Equiv.
C-7	.1 Mfd. 400 Volt Paper Aerovox 484 or Equiv.
C-8 to C-10	8 Mfd. 450 Volt Elect. Aerovox G475 or Equiv.

Miscellaneous Parts:

2	Mike Connectors Amphenol or Equiv.
1	Bakelite Socket Amphenol or Equiv.
4	Bakelite Octal Sockets Amphenol or Equiv.
2	Bakelite Knobs
1	Terminal Strip

Tubes: 1-80, 2-6F5, 2-6C5

Thordarson Technical Literature

No. 333 — Amateur Radio . . . . .75c Postpaid
Mr. Fortune, Thordarson engineer and a prominent amateur radio enthusiast, spent over twelve months in preparing this text-book. There are approximately 160 pages, and matters covered include Learning the Code, Receiver Theory and Construction, Crystal Oscillator Transmitter, Two-stage Transmitter, Three-stage Transmitter, Constuction of the Modulator and reference notes on receivers, inductance, capacity and many other elecrrical and radio terms. It is a book recommended to all experimenters, beginning amateurs and even to amateurs of long experience. Amateur net price 75c. Profusely illustrated with over 100 comprehensive photographs and drawings. Heavy cover finished in wear-resistant blue cloth, with attractive gold stamping. This is a cloth covered case bound text-book.

No. 340 — Complete Transformer Manual 35c Postpaid
The Thordarson Transformer Manual is a complete book, containing the Replacement Transformer Encyclopedia and Servicing Guide, the Transmitter Guide, and the Sound Amplifier Guide, plus current Thordarson catalogs. It is bound in a strong attractive blue and orange cover with loose-leaf arrangement, giving the user opportunity to keep the Manual up-to-date by adding later Thordarson releases. A book that has proven to be most popular in the technical library.

No. 352—Replacement Encyclopedia, Service Guide, Free
Thordarson Replacement Transformer Encyclopedia and Service Guide No. 352 recommends proper transformer and choke replacement for receivers listed in Rider's Manuals. This handy, useful time-saver, originated by Thordarson is now used by good service engineers the world over. In addition, it contains a new edition of the popular Service Guide giving practical solutions to everyday service problems, including useful charts and tables.

No. 346 — Amplifier Guide . . . . . 15c Postpaid
P. A. men and experimenters interested in building high quality amplifiers find the Thordarson Amplifier Guide No. 346 a worthwhile source of information. It contains laboratory designed and tested circuits of amplifiers from 8 to 120 watts output. Complete parts list, mechanical chassis drawings, and comprehensive illustrations enable the constructor to obtain superior results with matched transformer and choke components. Data is included for pre-amplifiers, dual tone controls, speaker impedance matching and testing.

No. 500 — Broadcast Components Catalog . . . Free
Thordarson offers a complete line of transformers and chokes for broadcast use, each capable of meeting and surpassing the most rigid broadcast tolerances. These transformers are listed and described in the new Broadcast Catalog, No. 500. Broadcast stations, experimenters, laboratories or air craft stations are urged to secure a copy of this valuable listing.

No. 600 — Amplifier Catalog . . . . Free
The finest amplifiers are built by Thordarson — pioneers in producing quality audio components. Absolute fidelity is assured by accurate laboratory design and rigid inspection during production. New models from 8 to 900 watts satisfy practically every sound requirement. Pre-amplifiers and boosters round out a truly complete line of equipment for sound technicians. Fully described in Catalog 600.

No. 400 — Complete Transformer Catalog . . . Free
A catalog of transformers and reactors for every radio use. Contains full physical and electrical descriptions.

Obtainable from your radio parts distributors or direct from factory.

Class B Audio Frequency Amplifiers

CLASS B modulators are usually used in transmitters having plate modulated Class C inputs of more than 50 or 60 watts. For audio frequency power outputs of more than 30 watts, the increased cost and size of tubes which can be used in Class A amplifiers, and the power supply components used to supply these tubes make Class B systems economically justifiable.

The principal differences between Class A and Class B audio amplifiers are as follows:

1. The plate dissipation of the tubes in a Class B amplifier increases with increasing signals and is a maximum at some level near full power output. In a Class A amplifier the plate loss of the tubes is a maximum at no-signal.
2. The excitation of a Class B amplifier is carried into the positive grid region of the tube characteristics, causing grid current to flow, with the resultant requirement that the source of audio frequency excitation is called upon to deliver an appreciable amount of power. Class A amplifiers, in general, are not designed to operate with a positive grid in any condition of normal excitation.
3. In a Class B amplifier the changing plate current requires better regulation of the power supply than does the Class A amplifier.
4. Class A amplifiers usually require negative bias on the grids. In many Class B amplifiers there are conditions of operation in which no bias is required.
5. Class B audio frequency amplification requires the use of two tubes, whereas Class A amplification can be obtained with one tube.

Class B Audio Frequency Output Calculations

The amateur has many occasions in which it is desirable to have more data concerning the operation of given tubes in Class B service than are given by the tube manufacturers. The data which are given usually show typical operating characteristics at a given plate voltage, showing the plate load which delivers a given amount of power with nominal distortion, driving power, and tube losses.

In a particular installation there often arise circumstances in which operation in some condition other than the "typical" case is desirable. For example: (1) the plate supply voltage may be other than that listed; (2) more or less distortion may be tolerated; (3) greater tube losses may be permissible at full-signal or at no-signal; (4) the regulation of the source of driving voltage may be poor; (5) the voltage or power output capabilities of the driving source may be limited; (6) the output power requirements may be different; (7) the wave form of the signal may be unusual; (8) the operation may be intermittent; and (9) space and weight requirements may justify overloading.

So that the amateur may take full advantage of the possibilities of varying the plate load on his Class B tubes by changing connections on the Multi-Match modulation transformers, an example of Class B output calculations is shown below:

Suppose that a Class C amplifier of 330 watts input is to be 100% modulated by the tubes having the characteristics shown in Fig. 1. The plate

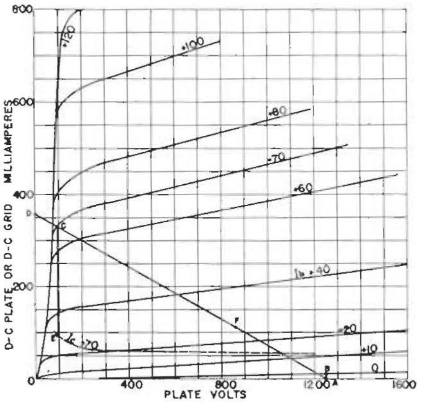


Fig. 1

supply voltage is 1250 V., the rated maximum tube dissipation is 40 watts, and the maximum plate current is 125 MA.

The audio frequency requirement is that 165 average watts of output power be delivered to the Class C stage. This figure is based on a sine wave signal. The maximum allowable power input to the modulator (two tubes) is 1250 x 0.125 x 2 = 312.5 watts. Thus an overall efficiency of at least

$$100 \times \frac{165}{312}$$

or 52.5% is required. This is not at all unreasonable for a Class B audio frequency stage; in an amplifier of power output capabilities of 150 watts an overall efficiency of 60 to 65% is easily obtainable.

Practice has shown that to allow for transformer losses and the deviation of tube characteristics from average values, the value of power delivered by the tubes as calculated from their average characteristics should be, for outputs of this order of magnitude, about 16% higher than the power required to be delivered from the secondary of the modulation transformer. In this case, the calculations should be based on a power output from the tubes of 165 x 1.16 or 192 watts output.

Since the maximum plate loss in a Class B amplifier occurs at a level slightly below maximum power output, an allowance of 35 average watts loss per tube at full signal is reasonable in this example. Considerable leeway may be taken with this in cases where speech waves of 330 watts peak power are required at the output of the modulation transformer. However, in this example, it is assumed that sine wave modulation will occur.

The power input to the two tubes at full-signal will then be the sum of power output and tube losses. This is 192 + (2 x 35) or 262 watts. A check now shows that the Class B plate efficiency, that is, the efficiency of conversion from DC energy supplied to the plate to audio frequency energy, is

$$100 \times \frac{192}{262} \text{ or } 73\%.$$

This is a reasonable value, for the maximum possible efficiency of a Class B stage is 78.5%.

For a power input of 262 watts at 1250 volts the direct current supplied is $\frac{\text{watts}}{\text{volts}}$ or $\frac{262}{1250}$ or 210 MA. The average current in each tube is half of this amount, or 105 MA. With the tubes biased to a value near cut-off, the shape of the current wave in each tube very nearly approximates that of a half-sine wave.

The average value of current in a series of half-sine wave pulses is 31.8% of the peak value of the current. Therefore, the peak value of the current in the tube is $\frac{105}{0.318}$ or 330 MA.

At the time the peak power occurs, only one of the two modulator tubes is working, and, therefore, it alone is delivering this power. The peak power is twice the average AC power developed or 2 x 192 or 384 watts. The peak AC voltage across the load is

$$\frac{\text{peak watts}}{\text{peak current}} = \frac{384}{0.330} = 1160 \text{ volts.}$$

The AC load on the tube is the peak voltage divided by the peak current or $\frac{1160}{0.330} = 3500$ ohms. On the family of curves shown in figure 1, the oblique straight line AD is known as the load line. It is a plot of the instantaneous voltage and current relations for one Class B tube when working into a resistive load of 3500 ohms. The location of the line is found by locating any two sets of simultaneous values of plate voltage and plate current. The value of 1160 peak volts across the load and 330 MA in the tube corresponds to a value of 1250 — 1160 or 90 volts across the tube. Thus e = 90 volts and i = 330 MA is one set of points. It is located at point C. Then, knowing the load, any other set of points can be found. At one-ninth power output the peak current and the peak voltage are one-third of that occurring at full power output. At this power level, then, the peak current is 110 MA, and the peak voltage across the load is $\frac{1160}{3}$ or 387. This corresponds to a peak voltage across the tube of 1250 — 387 or 863 V. Thus another point on the load line is e = 863 volts and i = 110 MA. This point is shown at F. A straight line through C and F locates the load line.

A simpler way of locating the load line is to draw a line through the point 1250 volts on the abscissae axis, which is shown at point A, and the point $\frac{1250}{R}$ or $\frac{1250}{3500}$ or 0.357 ampere on the ordinate axis. This latter point is designated as D. Then the points A, C, D and F are on the load line, and any two of them might have been used to obtain its position on the family of curves shown.

It will be seen that the point C falls on the curve corresponding to a grid voltage of +70 V. This voltage of +70 is the voltage on the grid at the instant of minimum plate voltage and peak power output. It (+70 volts) is the most positive value of grid voltage required for this condition of operation. It is to be noted that the maximum grid voltage and the minimum plate voltage occur at the same instant; furthermore, the minimum plate voltage of 90 V. is only slightly greater than the maximum grid voltage of 70 V.

The load of 3500 ohms on the plate of one audio tube represents a plate-to-plate load of four times this or 4 x 3500 = 14,000 ohms. This plate-to-plate impedance is of no particular value in the calculation of Class B performance by the method outlined above, but it is useful in describing the characteristics of the required Class B output transformer.

The calculation shown has been that for the solution of the operating characteristics for a given power output with a given tube loss. Where it is desired to find operating conditions to meet other requirements, such as a specified plate load or a specified peak driving voltage, a different order of procedure must be used. A study of the above example will be a guide in other solutions.

Whether or not the tubes are to be operated at zero bias involves the consideration of the plate loss at no-signal and the tolerable distortion. In the example given the value of no-signal plate current for zero bias voltage may be found at the intersection of the 1250 volt ordinate and the curve for Ec = 0. This is shown at the point B. Here the current for one tube is 10 MA, and the plate loss per tube is 1250 x 0.010 or 12.5 watts, well below the allowable limit.

The dotted curve represents the relation of grid current to plate voltage for a grid voltage of +70 volts. If from the coordinates Ep = 90, Ip = 330, a vertical line is passed which intersects the dotted line at E, the ordinate (90 MA) at this point represents the peak value of grid current. The peak grid driving power required to obtain full output under the conditions specified may now be obtained. It is Eg x Ig = 70 x 0.090 = 6.3 watts. The ratio of peak driving power to average driving power depends mainly upon the plate load, the type of tube, and the peak grid voltage and its relation to the minimum plate voltage. For some conditions of operation the average power is one-half the peak power, and for other conditions it may be only one-third or one-fourth the peak power.

The following characteristics have thus been obtained for two tubes in a Class B stage:

Plate voltage — 1250 volts
Average no-signal plate current — 20 MA
Average full-signal plate current — 210 MA.
DC grid volts — 0
Peak grid-to-grid voltage — 140 volts
No-signal plate loss — 25 watts
Full-signal plate loss — 70 watts
Load resistance (per tube) — 3500 ohms
Plate-to-plate load — 14,000 ohms
Peak driving power — 6.3 watts
Plate efficiency — 73%
Stage efficiency — 65%
Power output — 165 watts

The maximum efficiency of a Class B amplifier is 78.5%. This value is realized only when the instantaneous plate voltage swings to zero and the half-sine wave shape of current in each tube is retained.

In the example given, if such a condition could be obtained, the average plate current (two tubes) would be 0.357 x 0.318 x 2 = 0.227 ampere. The power output would be 0.357 x $\frac{1250}{2}$ = 223 watts, and the power input would be 1250 x 0.227 = 284 watts for an efficiency of 100 x $\frac{223}{284}$ or 78.5%.

Considerations in Selecting Driver Transformer Ratios

Although the driving power for a Class B stage is usually obtained from a Class A amplifier, ordinary Class A amplifier design for maximum power output does not suffice. Most Class A amplifiers not intended for driver service are planned to deliver the maximum possible undistorted power into a given fixed load.

Unfortunately, the load on Class A tubes in driver service is not constant throughout the cycle. This is due to the fact that the grids of the modulator tubes do not have a constant resistance over the audio cycle. In the positive grid region the grid current increases more rapidly than the grid voltage, thus exhibiting the characteristic of a decreasing grid resistance with increasing voltage. The degree to which the resistance changes depends mainly upon the relation between minimum plate voltage and maximum grid voltage. For tubes operated with zero bias the resistance change in most cases is, fortunately, not large. In a Class B stage working into a resistance load, the maximum instantaneous grid voltage and the minimum instantaneous plate voltage occur at the same time. During the part of the cycle that the minimum plate voltage and the maximum grid voltage are not greatly different, the change in grid-to-cathode resistance is most apparent. It is well to plan to have the ratio of minimum plate voltage to maximum grid voltage exceed two in cases where low driver distortion is desired. In instances where more driver distortion can be tolerated, or in cases where the apparent internal-output impedance of the driver is very low, as compared with the minimum Class B grid resistance, this ratio may be reduced to 1.0 or 1.5. With tubes having negative grid bias the resistance changes from a very high value to a very low value within a small per cent of the time required for a complete cycle.

If a driving voltage of perfect regulation were available, this change in resistance would not be of such serious consequence. However, all practical drivers have some internal impedance, and in delivering energy to a varying load, harmonic distortion will occur. If the internal output impedance of the driver has an appreciable reactance, extremely disagreeable distortion can result. This is especially true if the Class B grids are biased. It is important to have a driver transformer having a low leakage reactance.

Driver Transformer Ratios

AN IMPORTANT problem in the selection of a driver is to obtain a source of adequate voltage of good regulation without prohibitive amounts of driver tube capacity. Fortunately, there are receiving tubes (2A3's) which will supply driving power for most modulators having power outputs up to several hundred watts.

In general, for amateur work, the amateur should use tubes which in normal Class A amplifier service will deliver an average power output of at least one-half as much as the peak power required to supply the Class B grids. It is preferable in nearly all cases to have the average power output capabilities of the driver be one to two times as great as the peak power requirements of the Class B grids. This corresponds to peak power capabilities of two to four times the peak power which is required at the driver grids. The ratio of average power capacity of driver to peak power required at the Class B grids may approach the lower value when the Class B tubes are operated at zero bias and the ratio of minimum plate voltage to maximum grid voltage is large (two or more). In such a case, the grid resistance is substantially constant during the cycle.

The installation of driving tubes having power output capabilities greater than required allows the changing of the plate load from that which is optimum for maximum undistorted output to a higher value which delivers less power, but which lowers the internal impedance of the driving source as seen from the Class B grids.

In selecting the turns ratio of a driver transformer, it is desirable to make the step-down ratio as high as possible from the driver plates to the Class B grids and yet be able to develop the required peak driving voltage on the Class B grids without overloading the driver tube.

The determination of the correct driver transformer ratio can be studied by reference to the following discussion. In figure 2, Eg is the peak value of the AC voltage required on the Class B grid. Rg is the grid resistance at this value of voltage. (This is the lowest value of grid resistance.) R_D is the internal resistance of the source of driving energy, and E_D is the peak open circuit voltage developed by the driver source. The transformer ratio is N to 1, primary to secondary. Figure 3 is a simplified version in which the secondary voltage and resistance are

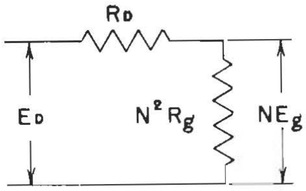


Fig. 3

reflected to the primary side of the transformer. The secondary voltage is stepped up N times and appears across the primary as NEg. The secondary load, in accordance with regular transformer theory, is stepped up N^2 times and appears to the primary as N^2Rg.

At all instants the ratio of the voltages is equal to the ratio of the resistances across which they occur. Thus:

$$\frac{E_D}{NE_g} = \frac{R_D + N^2R_g}{N^2R_g}$$

There are two solutions, one giving a turns ratio which gives relatively good regulation and the other giving a turns ratio with poor regulation. For either solution there is adequate driving voltage. The desired solution is given by the formula:

$$N = \frac{E_DR_g + \sqrt{E_D^2R_g^2 - E_g^2R_gR_D}}{2E_gR_g}$$

Example:

Assume a pair of push-pull 2A3's with 300 volts on the plates, 60 volts bias and an available signal of 53 peak volts on each 2A3 grid. The Class B grid minimum resistance is 780 ohms at +70 volts. The Class B tubes are at zero bias. The 2A3 tubes have a mu of 4.2 and a plate resistance of 1050 ohms.

Solution:

The open circuit driving voltage of two 2A3's in series is 2 x 4.2 x 53 or 445 volts. This voltage may be considered as that in a generator of internal resistance Rp x 2 or 1050 x 2 or 2100 ohms. Then:

$$N = \frac{445 \times 780 + \sqrt{(445)^2(780)^2 - (70)^2(780)(2100)}}{2 \times 70 \times 780}$$

Solving:

N = 6.25, which is the turns ratio from the total primary to one-half the secondary. In this case, the 780 ohm grid load is reflected as a 30,500 ohm plate-to-plate load on the 2A3's, much higher than the 5000 ohm plate-to-plate load often encountered.

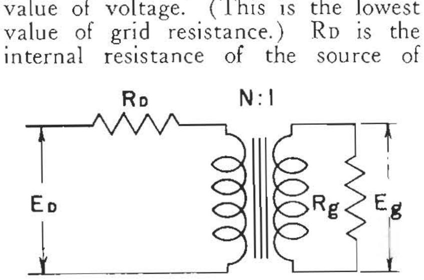


Fig. 2

Line to Class B Grid Driver Ratio

In selecting the driver transformer to transfer energy from a so-called "500 ohm" line to Class B grids, the fact is often overlooked that the "500 ohm" line is usually not of 500 ohms internal output resistance. Its internal output resistance (when the source of energy to it is not "padded down") is usually far from being 500 ohms. This is of considerable consequence in calculating driver transformer ratios.

Suppose, for example, that the "500 ohm" line had been fed from two 2A3's having an amplification factor of 4.2, a plate resistance of 1050 ohms and a maximum available signal voltage on their grids of 53 peak volts. If the 2A3 output transformer was designed to place a 5000 ohm plate-to-plate load on the tubes when a 500 ohm load was connected to the secondary, the turns ratio of total primary to total secondary would be 3.16 to 1. The 500 ohm line would then have an internal impedance of $\frac{2 \times 1050}{(3.16)^2}$ or 210 ohms, and the maximum available open circuit voltage on the line side of the transformer would be $2 \times 53 \times \frac{4.2}{3.16}$ or 140 peak volts. This voltage and the source resistance of 210 ohms should be used in calculating the line to Class B grid ratio.

For the Class B grid condition previously given, the solution yields:

$$N = \frac{140 \times 780 + \sqrt{(140)^2(780)^2 - (70)^2(210)(780)}}{2 \times 70 \times 780}$$

which gives N = 1.97 as the ratio from the line to one grid (that is, the primary to one-half the secondary). It is to be noted that this ratio (1.97) multiplied by the ratio of the transformer with which it is associated (3.16) gives 1.97 x 3.16 = 6.25, which is the ratio obtained for the solution of turns ratio for a driver transformer coupling the 2A3 plates directly to the grids.

In the calculation of driver ratio shown, no allowance has been made for transformer losses or for deviations of the driver tube characteristics from the average values given by tube manufacturers. Furthermore, it is not well to have a peak signal on the driver tube grids which reduces that grid voltage to zero. It is better to limit the maximum peak grid voltage on the driver to about 95% of the bias voltage. Allowance for these three factors can be made by reducing the step-down ratio of the driver transformer 10 to 15%.

Matching Class C Loads to Modulators

HAVING selected the proper load resistance into which the modulator should deliver energy it is necessary to couple the modulator to its Class C load through a transformer of the proper turns ratio.

It is characteristic of a transformer that the resistance to which the secondary delivers energy can appear as a different value of resistance at the primary terminals. The degree to which this actual load resistance and the reflected load resistance differ depends upon the turns ratio of the transformer. Of the total energy supplied to the primary of a transformer almost all is available for delivery to the load on the secondary. Thus, the actual load resistance presented by the Class C amplifier may be made to appear as the desired load on the modulator tubes, and all of the alternating current energy developed in the modulator stage can be delivered to the Class C amplifier and its load. In general, then, a transformer may be thought of as an impedance changing device in which very little of the energy supplied to it is lost. In amateur work, the transformers are of such size and construction that the efficiency is good enough that little attention need be given to the losses; that is, for most calculations it may be assumed to behave as an ideal transformer.

To show how a transformer acts as an impedance changing device the following demonstration is given:

Referring to Figure 4 a transformer is shown having a turns ratio of primary to secondary of 1 to N. The load

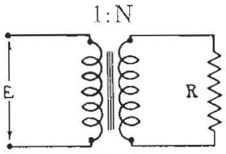


Fig. 4

on the secondary is R ohms, and the voltage impressed on the primary is E.

Ordinary transformer theory indicates that the voltage across each winding is proportional to the number of turns on the winding. Thus, with E volts across the primary, the voltage across the secondary is N times as much, or NE. The power at the load resistance R is equal to the square of the voltage across it divided by the resistance. Thus, in this case the power at the secondary load is $\frac{(NE)^2}{R}$.

With a perfect transformer the power at the primary is the same value as it is at the secondary. Thus, the power at the primary is also $\frac{(NE)^2}{R}$.

For the moment, assume the secondary load resistance, R, appears at the primary terminals as another resistance, R_1. It is desired to find the value of the turns ratio of secondary to primary in terms of these resistances, R and R_1. The power at the primary of the transformer is $\frac{E^2}{R_1}$. But this value is also equal to $\frac{(NE)^2}{R}$. Therefore,

$$\frac{E^2}{R_1} = \frac{(NE)^2}{R} \text{ or } \frac{1}{R_1} = \frac{N^2}{R} \text{ and } N^2 = \frac{R}{R_1}.$$

Thus, it is to be seen that the reflected resistance is equal to the secondary resistance divided by the square of the turns ratio from secondary to primary. Stated in another manner, the reflected resistance is equal to the secondary resistance multiplied by the square of the turns ratio from primary to secondary. It is important not to become confused by the indiscriminate use of the terms "turns ratio," "step-up ratio" and the like. These terms are used interchangeably, but they are not necessarily equal to each other.

Suppose, for example, that it is desired to calculate the turns ratio of the full primary to the full secondary of a modulation transformer used under the following conditions:

Power input to Class C amplifier— 330 watts.

Plate voltage on Class C amplifier— 1250 volts.

Modulator plate-to-plate load desired — 14000 ohms.

The Class C plate current is $\frac{W}{E}$ or $\frac{330}{1250}$ or 0.264 amperes. The Class C load on the secondary of the modulation transformer is then $\frac{E}{I}$ or $\frac{1250}{0.264}$ or 4740 ohms. This is equal to R.

Then, if $N^2 = \frac{R}{R_1}$, $N^2 = \frac{4740}{14000} =$ 0.338 and N is equal to the square root of this value, or 0.58. In this case N is the ratio of secondary turns to primary turns. The value of 0.58, being less than unity, indicates that the secondary has less turns than the primary. This is as it should be when a given Class C load is less than the plate-to-plate load which it is desired be reflected on the primary side of the modulation transformer. The amateur may avoid making the mistake of obtaining a turns ratio which is the inverse of the proper value by always making an estimate of which winding, primary or secondary, has the greater number of turns, this estimate to be made before the start of calculations.

MULTI-MATCH MODULATION TRANSFORMER RATIOS

Tapped double winding coils as used in Multi-Match modulation transformers make possible a large number of impedance ratios, so many in fact that it is not practical to list in table form all the combinations possible. However, there are occasions when the modulator plate-to-plate load, or the Class C load, are of values not shown in the table and yet are within the range covered by the transformer. The chart shown on the opposite page may be used to determine the correct modulation transformer connections when the desired turns ratio is known. The transformer connections may then be found from the list of ratios in the adjoining table. As an example, to match a 10,000 ohm plate-to-plate load to a Class C load of 5000 ohms, a turns ratio of $\sqrt{\frac{10,000}{5,000}}$ or 1.41 is necessary. The connections shown in the table should be used to secure this ratio. In this particular case these connections are:

For the primary, connect the modulator plates to terminals 2 and 5; 3 and 4 are joined and connected to the modulator plate supply. For the secondary, join terminals 7-11 and 8-12. Connect the Class C load to terminals 7 and 8.

Since only part of the winding is used for some combinations, the maximum allowable value of plate-to-plate load is necessarily variable. This maximum value is shown in the last column of the table and should not be exceeded.

Care should be taken that the DC secondary current does not exceed the maximum rating of the transformer. A parallel connected secondary will carry twice the current of a series connection, and in the event that the Class C current is greater than the allowable current of the series connection, a parallel connection must be used.

Turns Ratio Primary to Secondary	PRIMARY			SECONDARY				Maximum Allowable Plate to Plate Load
				SERIES		PARALLEL		
	Plate	B +	Plate	Join Together	Connect Class "C" Load To	Join Together	Connect Class "C" Load To	
3.14	2	3–4	5			8–9 10–11	8–10	12000 Ohms
2.88	7	8–11	12			2–3 4–5	2–4	16000 Ohms
2.8	1	3–4	6	9–10	8–11			20000 Ohms
2.61	7	9–10	12	2–5	1–6			20000 Ohms
2.5	1	2–5	6			8–9 10–11	8–10	10000 Ohms
2.5	1	3–4	6			7–11 8–12	7–8	20000 Ohms
2.32	7	9–10	12			1–3 4–6	1–4	20000 Ohms
2.07	7	9–10	12	3–4	2–5			20000 Ohms
1.8	7	8–11	12	2–5	1–6			16000 Ohms
1.73	1	3–4	6			7–9 10–12	7–10	20000 Ohms
1.61	8	9–10	11			2–6 1–5	1–2	8000 Ohms
1.60	7	8–11	12			1–3 4–6	1–4	16000 Ohms
1.59	7	9–10	12	2–3	1–6			20000 Ohms
1.57	2	3–4	5	9–10	8–11			12000 Ohms
1.49	7	9–10	12	3–4	2–6			20000 Ohms
1.44	7	8–11	12	3–4	2–5			16000 Ohms
1.4	2	3–4	5			7–11 8–12	7–8	12000 Ohms
1.32	1	3–4	6	9–10	8–12			20000 Ohms
1.28	8	9–10	11			2–3 4–5	2–4	8000 Ohms
1.25	1	3–4	6	8–11	7–12			20000 Ohms
1.25	1	2–5	6	9–10	8–11			10000 Ohms
1.15	7	9–10	12	3–4	1–6			20000 Ohms
1.11	1	2–5	6			7–11 8–12	7–8	10000 Ohms
1.1	7	8–11	12	2–3	1–6			16000 Ohms
1.03	7	8–11	12	3–4	2–6			16000 Ohms
1.02	1	3–4	6	8–9	7–12			20000 Ohms
.967	2	3–4	5			7–9 10–12	7–10	12000 Ohms
.866	1	3–4	6	9–10	7–12			20000 Ohms
.8	7	8–11	12	3–4	1–6			16000 Ohms
.77	1	2–5	6			7–9 10–12	7–10	10000 Ohms
.742	2	3–4	5	9–10	8–12			12000 Ohms
.714	8	9–10	11			1–3 4–6	1–4	8000 Ohms
.7	2	3–4	5	8–11	7–12			12000 Ohms
.639	8	9–10	11	3–4	2–5			8000 Ohms
.588	1	2–5	6	9–10	8–12			10000 Ohms
.575	2	3–4	5	8–9	7–12			12000 Ohms
.555	1	2–5	6	8–11	7–12			10000 Ohms
.495	8	9–10	11	2–3	1–6			8000 Ohms
.483	2	3–4	5	9–10	7–12			12000 Ohms
.458	8	9–10	11	3–4	2–6			8000 Ohms
.455	1	2–5	6	8–9	7–12			10000 Ohms
.385	1	2–5	6	9–10	7–12			10000 Ohms
.357	8	9–10	11	3–4	1–6			8000 Ohms

Thordarson Multi-Match Transformer Ratings

Type No.	Max. Audio Watts	Max. Pri. M.A. Each Side	Max. Sec. M.A. Series	Max. Sec. M.A. Parallel
T-11M74	40	100	80	160
T-11M75	75	145	145	290
T-11M76	125	210	160	320
T-11M77	300	250	250	500
T-11M78	500	320	320	640
T-19M13	15	50	50	100
T-19M14	30	75	75	150
T-19M15	60	125	125	250
T-19M16	100	175	175	350
T-19M17	250	225	225	450

Matched Power Supplies

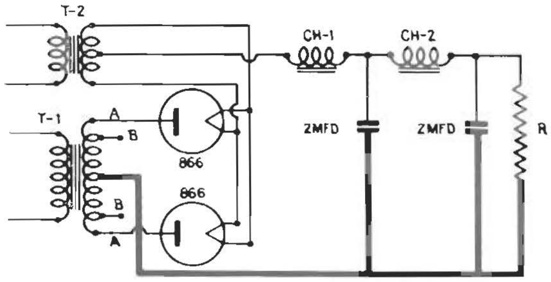
THESE matched power supplies provide the amateur with any of the direct current voltages ordinarily encountered in amateur radio work. The dual transformers T-19P57, T-19P70 and T-19P71 are especially useful for transmitters having low voltage exciter and high voltage final amplifier stages on the same chassis. The transformer T-19P58 is especially useful in transmitters with a Class B modulator and Class C amplifier having slightly different plate voltage requirements. All of them may be depended upon to give the rated direct current voltage and current when using the prescribed chokes.

For CW work or for use in transmitters where the Class B modulator and Class C amplifier plate voltage are to be taken from one supply, the excellent regulation of these matched units is desirable. When the bleeder, R, is of such magnitude as to drain approximately 10% of the rated current, the regulation of these supplies is approximately 15% and the ripple is approximately 1%.

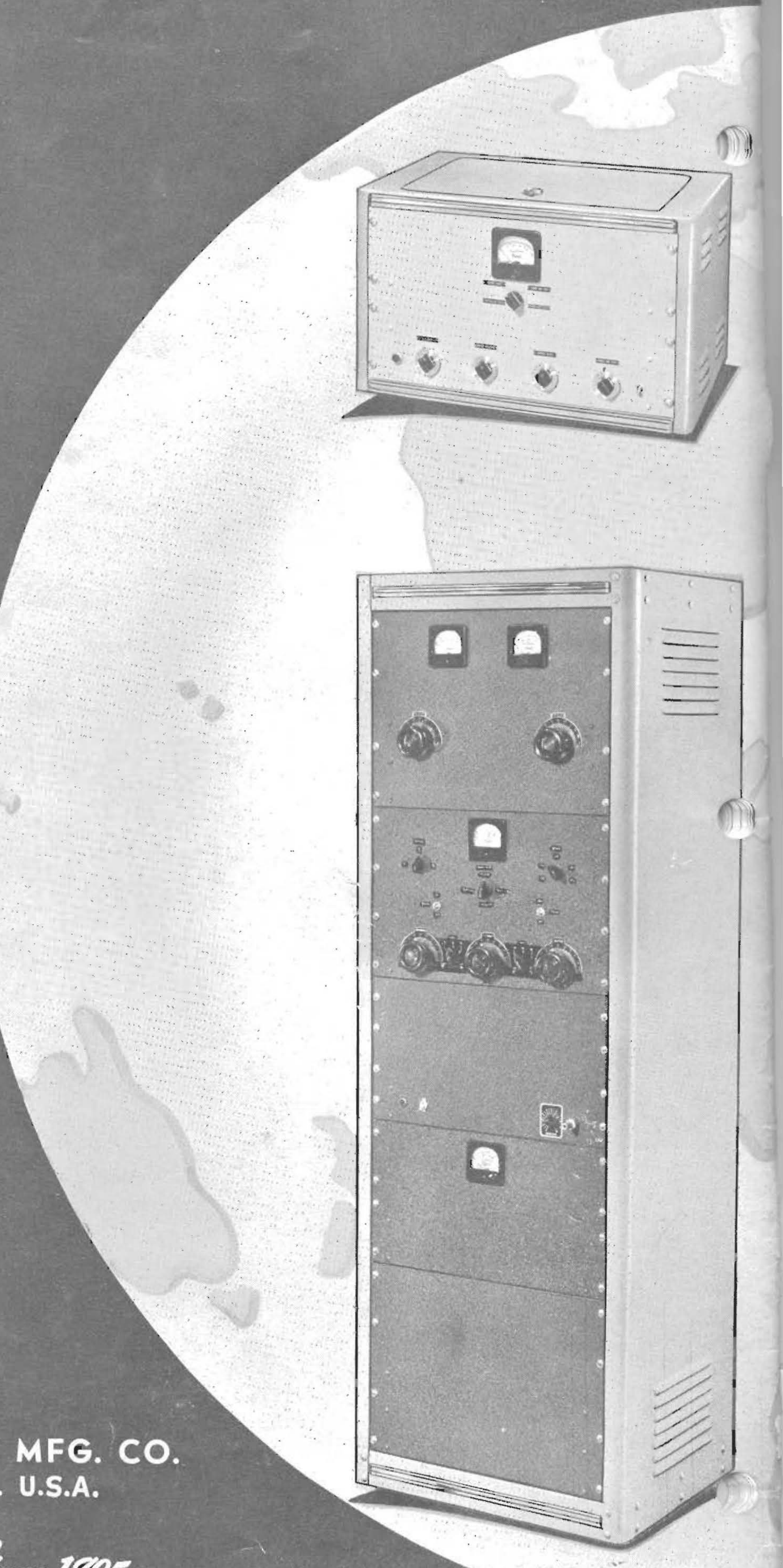
The power supplies using the transformer T-1, marked with an asterisk, are dual supplies; that is, power is supplied at two direct current voltages simultaneously. The dual supplies using the transformers T-19P58 and T-19P71 use two chokes in each B+ lead, and the proper chokes are specified opposite these transformers. For the dual supplies using the transformers T-19P57 and T-19P70, two chokes in the high voltage center tap connection provide filtering for both the direct current voltages obtainable. The rated secondary load currents of each of these four dual plate transformers may be delivered simultaneously. But, when it is desired to use only the low voltage tap on any one of these dual units, the current rating of this tap is then equal to the sum of the current ratings of the two sections.

The filament transformer chosen for each plate supply is designed for mounting underneath the chassis. The plate transformers and chokes are supplied with black cases to provide not only matched electrical performance but also matched appearance in the rig.

The T-19F83 filament transformer supplies the filament of a 5Z3, the T-19F88 is for 866JR's and the T-19F90 is for 866's. The T-19F78 filament transformer is to be used with a 5Z3 and 866JR's.



Power Trans. T-1	DC Volts from Tap A	DC Volts from Tap B	DC MA	Input Choke CH-1	Smoothing Choke CH-2	Fil. Trans. T-2
T-19P54	400		150	T-19C39	T-19C46	T-19F83
T-19P55	500	400	250	T-19C36	T-19C43	T-19F88
T-19P70*	750		100	T-19C36	T-19C43	T-19F88
		400	225			T-19F83
T-19P56	750	600	225	T-19C36	T-19C43	T-19F88
T-19P57*	1000		125	T-75C51	T-75C51	T-19F78
		400	150			
T-19P58*	1000		200	T-19C35	T-19C42	T-19F90
		750	150	T-19C39	T-19C46	T-19F88
T-19P69	1000	750	300	T-19C36	T-19C43	T-19F90
T-19P71*	1250		125	T-19C39	T-19C46	T-19F90
		400	200	T-19C35	T-19C42	T-19F83
T-19P59	1250	1000	300	T-19C36	T-19C43	T-19F90
T-19P60	1500	1250	300	T-19C36	T-19C43	T-19F90
T-19P61	1750	1500	300	T-19C36	T-19C43	T-19F90
T-19P62	2000	1750	300	T-19C36	T-19C43	T-19F90
T-19P63	1250	1000	500	T-19C38	T-19C45	T-19F90
T-19P64	1500	1250	500	T-19C38	T-19C45	T-19F90
T-19P65	2500	2000	300	T-19C36	T-19C43	T-19F90
T-19P66	1750	1500	500	T-19C38	T-19C45	T-19F90
T-19P67	2000	1750	500	T-19C38	T-19C45	T-19F90
T-19P68	2500	2000	500	T-19C38	T-19C45	T-19F90



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