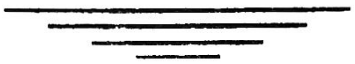
INSTRUCTION MANUAL

FOR THE

STARK

R.F. SIGNAL GENERATOR
MODEL 10-A



STARK

ELECTRONIC INSTRUMENTS LIMITED
TORONTO, CANADA

119A1

1M-10-46

STARK ELECTRONIC INSTRUMENTS LIMITED manufacture a complete line of Electrical Indicating Meters, Tube Testers, Circuit Analyzers and Signal Generators, in sizes and ranges to suit every purpose.

TUBE TESTERS are modern and up-to-date, accurate, and easily operated.

CIRCUIT ANALYZERS can be had in many designs from the handy pocket size to large de-luxe models and electronic analyzers. They cover an extremely wide range of all electrical measurements.

SIGNAL GENERATORS are accurately calibrated and well designed to operate efficiently over a wide frequency band.

ELECTRICAL INDICATING METERS incorporated in Stark Tube Testers and Circuit Analyzers are completely manufactured in our own plants.

All meter needs for AC or DC voltage and current measurements, both Panel Mounting and Portable, can be supplied in five distinctive styles, in round or rectangular, from 2" to 9" sizes.

See inside back cover for further details.

INSTRUCTION MANUAL

FOR THE

STARK

R.F. SIGNAL GENERATOR
MODEL 10-A

STARK

ELECTRONIC INSTRUMENTS LIMITED
TORONTO, CANADA

119A1

1M-10-46

R.F. SIGNAL GENERATOR MODEL 10-A

INDEX

1. GENERAL

The Stark Model 10-A R.F. Signal Generator is an accurate portable instrument which provides a wide range of radio frequency voltages controlled as to frequency, modulation, and output level. As such, the instrument may be used for (a) Accurate alignment of radio and television receivers (b) Determination of receiver sensitivity and selectivity (c) Trouble shooting in radio receivers and many electronic instruments (d) A source of audio or radio frequency voltage for bridge measurements.

To permit the accurate choice of any radio frequency voltage within its range, the generator is equipped with a rotary calibration dial, 7¾ inches in diameter which may be driven by either a large finger grip knob or a vernier drive situated at the lower edge of the dial.

The instrument comprises the following basic circuits:

(1) Power Supply.

(2) Variable Radio Frequency Oscillator.

(3) Audio Frequency Generator, which may be used as either a pure audio signal or to modulate the radio frequency signal.

(4) Attenuator Network.

2. GENERAL DESCRIPTION

2.1 POWER SUPPLY: Fig. 1.

2.11 CIRCUIT: Basically, the Model 10-A power supply consists of a transformer, with centre tapped secondary, supplying 150 volts to both plates of the 6X5 full wave rectifier. The power transformer also supplies the 6.3 volt filament potential to the heaters.

2.12 RADIO FREQUENCY FILTER: The AC power line is by-passed to ground by the electrolytic condensers C2, C8, to eliminate the possibility of radio frequency leakage. The output of the rectifier tube is filtered by a resistor - capacitor network.

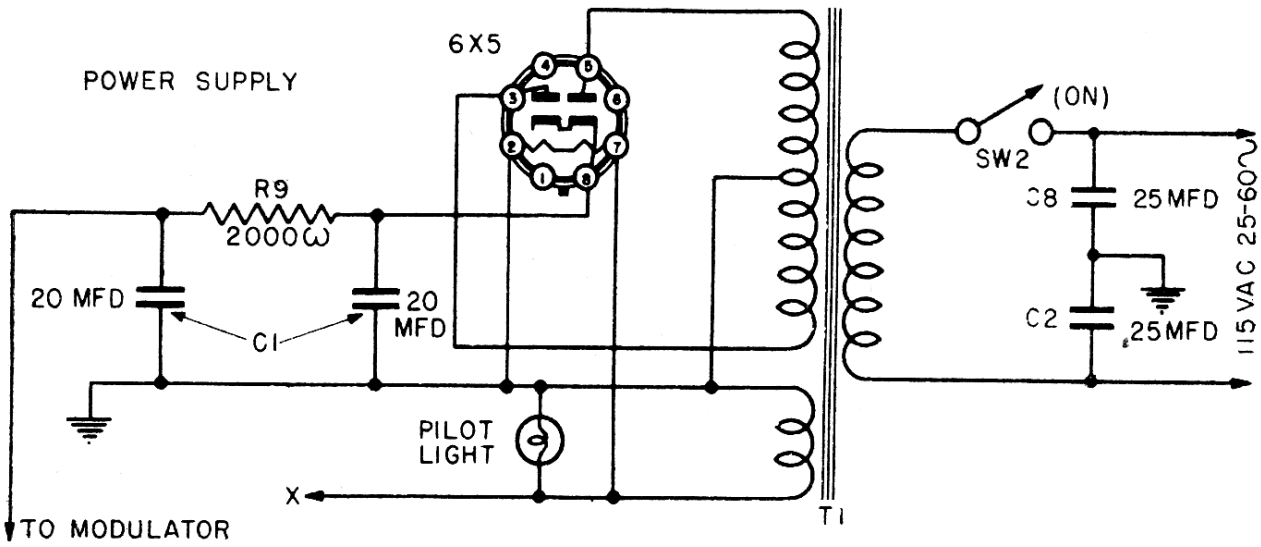


FIGURE 1

STARK MODEL 10-A POWER SUPPLY

2.2 VARIABLE RADIO FREQUENCY OSCILLATOR: Fig. 2.

2.21 CIRCUIT: A 6J5 is employed as the oscillator tube in a Colpitts oscillator circuit. Seven radio frequency coils are used to cover the frequency band of 95 kilocycles to 72 megacycles on fundamentals and an additional scale permits the second harmonic of the highest frequency range to be used, so that signals up to 144 megacycles may be obtained.

The range switch connects the necessary coil in the oscillator circuit to give the desired radio frequency band. Each coil is fitted with a variable iron core and a compensating trimmer condenser which permits accurate calibration and assures accurate dial tracking.

2.22 RANGES: The frequency range covered by each of the 7 bands is as follows:

Band A	95 KC	to	230 KC
Band B	230 KC	to	600 KC
Band C	600 KC	to	1600 KC
Band D	1.6 MC	to	4.4 MC
Band E	4.4 MC	to	12 MC
Band F	12 MC	to	30 MC
Band G1	30 MC	to	72 MC
*Band G2	60 MC	to	144 MC

*The second harmonic of Band G1.

2.23 MODULATION: Provision for modulating the radio frequency signal is supplied by the output selector switch, SW3. When this switch is in the R.F. Mod. position, the Radio Frequency signal is modulated approximately 30% (See paragraph 2.3).

2.24 OUTPUT VOLTAGE: The attenuator network provides a means of varying the output signal from a maximum of approximately 100,000 microvolts to zero (See paragraph 2.4).

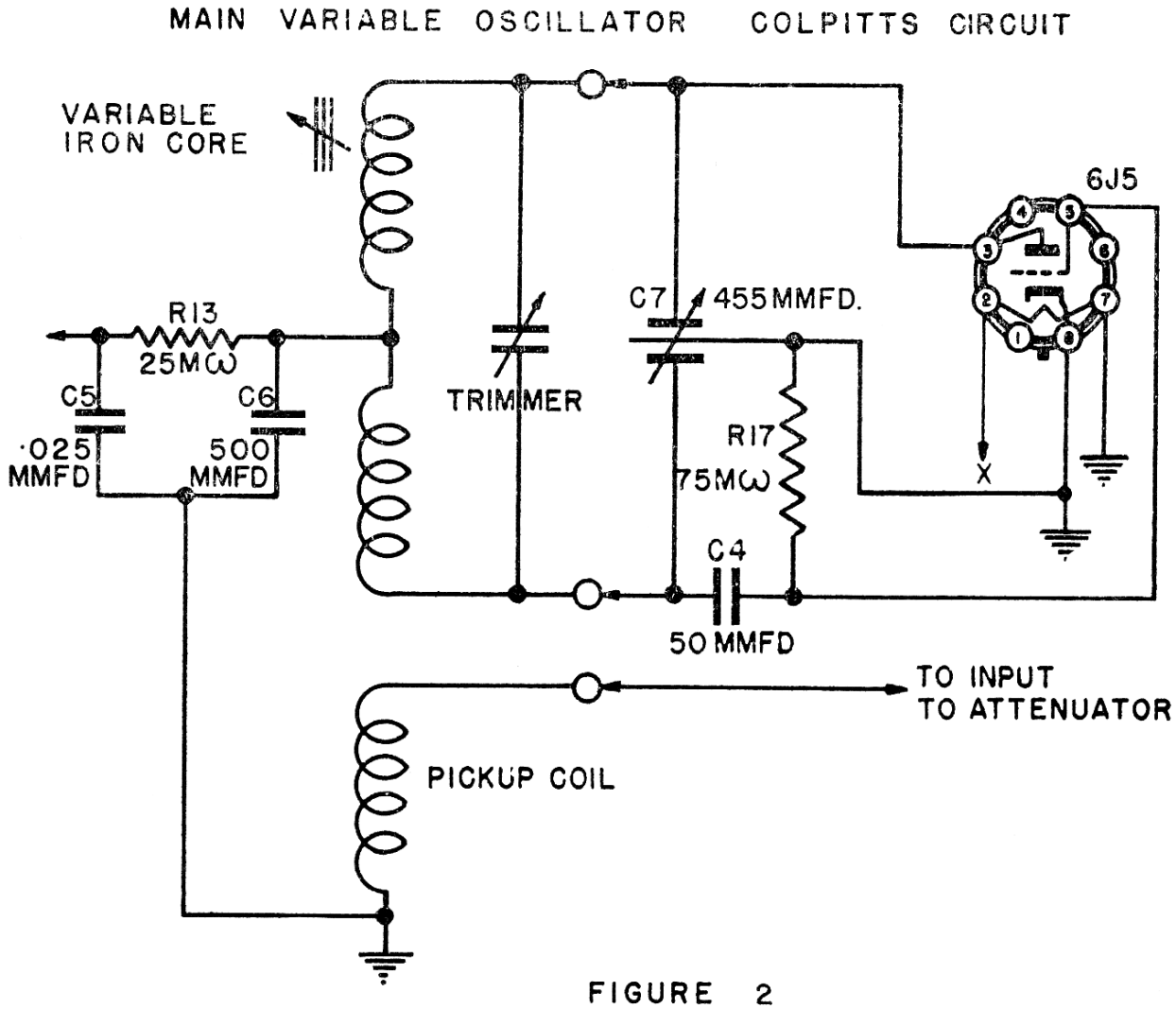


FIGURE 2

STARK MODEL 10-A R.F. OSCILLATOR

2.3 AUDIO FREQUENCY OSCILLATOR — MODULATION: Fig. 3.

2.31 CIRCUIT: A 6J5 serves as the audio oscillator in a tuned plate circuit generating a signal of approximately 400 cycles per second. The grid coil of the audio frequency transformer is tapped to provide the pure audio signal.

2.32 MODULATION: The 400 cycle note can be utilized to modulate the R.F. Signal by passing the plate current for the R.F. Oscillator through one coil of the audio frequency transformer. This is controlled by the Output Selector SW3.

400 CYCLE MODULATOR

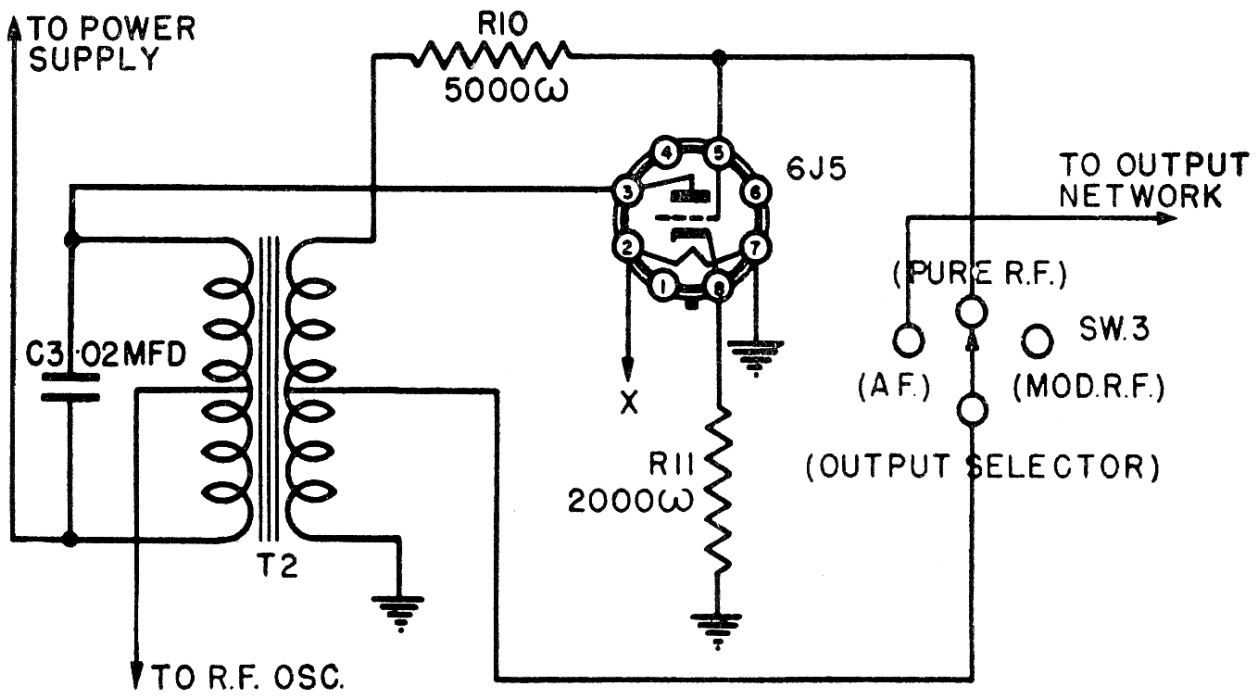


FIGURE 3

STARK MODEL 10-A AUDIO OSCILLATOR

2.4 ATTENUATOR NETWORK: Fig. 4.

2.41 CIRCUIT: The attenuator and multiplier network consists of a 5 stage ladder system and potentiometer vernier control. The system is designed to provide a multiplier arrangement which controls the voltage output in steps of 10. The signal amplitude in this way is reduced from maximum (100,000 microvolts) to one ten-thousandth of the maximum signal strength in 5 steps. Continuous smooth control is provided by the vernier fine adjustment (R15) which tunes the signal strength between the limits of each multiplier step.

The audio frequency output note can be controlled from zero to approximately 2 volts by employing the attenuator and multiplier system.

2.42 ATTENUATOR CHARACTERISTICS: To permit the efficient measurement of gain and sensitivity in radio receivers, the attenuator network has been designed as a low impedance unit. This eliminates any possibility of the output voltage level being affected by the radio receiver under test. Further, since the attenuator impedance is so small compared to that of the instrument under test the output signal is substantially independent of the load impedance into which it is feeding.

The attenuator system has the following impedance values, corresponding to the various steps of the multiplier switch Sw. 1.

x1	Range	5.0	ohms
x10	Range	5.0	ohms
x100	Range	5.0	ohms
x1000	Range	20.0	ohms
x10,000	Range	0-100	ohms,

depending on position of "Attenuator" control.

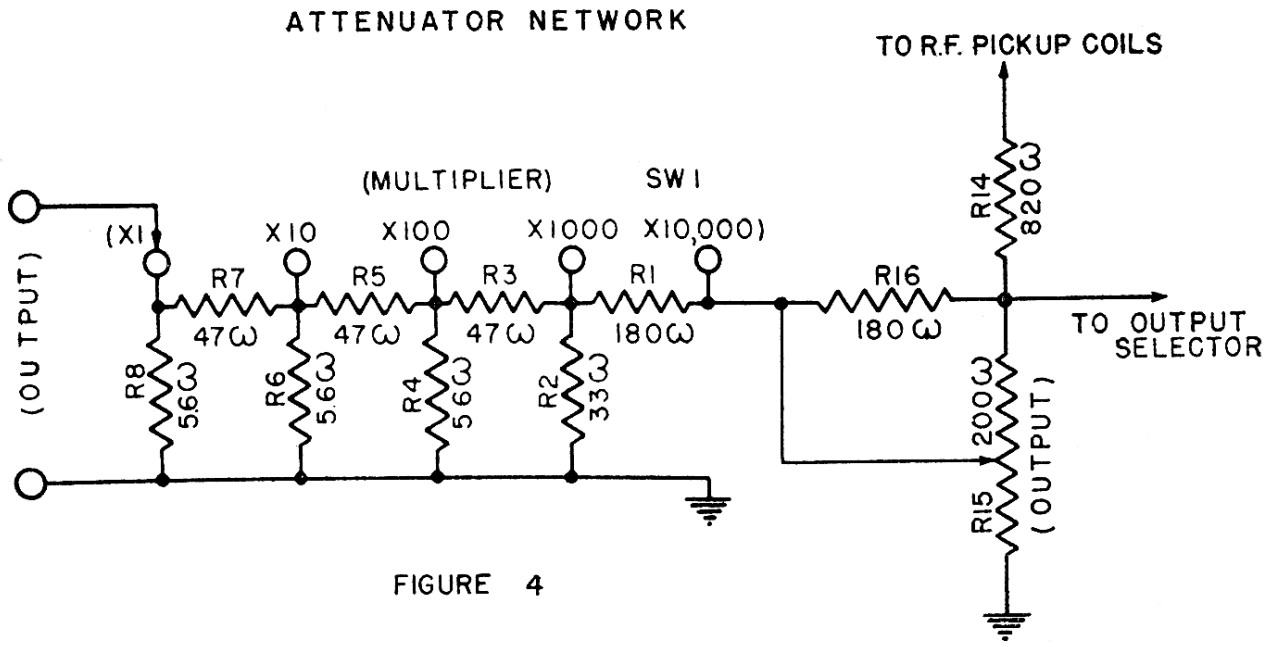


FIGURE 4

STARK MODEL 10-A ATTENUATOR NETWORK

3. PANEL CONTROLS

3.1 POWER SWITCH: The toggle switch, Sw. 2, in the lower left corner of the panel, is the A.C. line power switch, and the pilot lamp adjacent to this switch indicates when the power is on.

3.2 OUTPUT SELECTOR: This switch, Sw. 3, in the center left position of the panel selects the type of signal desired at the output terminal. This three position switch has the following functions:

(a) In the extreme left position, the oscillator will generate a 400 cycle audio note. The Band Selector Switch, Sw. 4, must be in the "OFF" position for this purpose (see paragraph 3.3).

(b) In the central position, the output signal is pure R.F., the exact frequency being determined by the dial position and the setting of the Band Selector, Sw. 4.

(c) In the extreme right position the main variable r.f. oscillator is modulated approximately 30%. The frequency of modulation is fixed at 400 cycles by the audio oscillator.

3.3 BAND SELECTOR: This eight position switch in the lower right corner of the panel serves as the frequency band selector. The extreme left position, "OFF", renders all radio frequencies inoperative, while the remaining positions allow the selection of various R.F. bands from 95 KC to 72 MC. Each band is appropriately identified by a letter which corresponds to the same letter on the main tuning dial, (see paragraph 3.7), and the frequency limits of each band are indicated at each position.

3.4 OUTPUT CONTROL: This potentiometer in the centre right position of the panel is calibrated from 0 to 10 units and provides an output voltage of approximately 0 to 10 microvolts. This control works in conjunction with the multiplier (see paragraph 3.5), to determine the actual signal output.

3.5 MULTIPLIER: This control consists of a series of resistance pads acting as an attenuator network which increases the output range in multiples of 10, to approximately 100,000 microvolts. A typical application in the use of this control follows: — with the output control set at 5 and the multiplier control at x100, the Radio Frequency output voltage is approximately 5x100=500 microvolts.

3.6 OUTPUT CONNECTOR: This connector is used for the shielded cable which connects the output of the generator to the test receiver.

3.7 FREQUENCY CONTROL DIAL: The tuning dial is operated in conjunction with the Band Selector Sw. 4, and tunes between limits determined by the Band Selector position. The large, accurately calibrated dial is controlled by either the main tuning knobs or the vernier drive at the edge of the dial which offers a fine adjustment.

4. OPERATING INSTRUCTIONS

4.1 GENERAL:

The generator employs as a power source 105-125 volts, 25-60 cycle alternating current. Special application instruments designed to operate from a 220 volt, 50 cycle source are appropriately marked on the panel.

NOTE: Under no condition must the generator output be connected directly to a source of appreciable voltage. As an aid in sensitivity measurements, the output attenuator has been designed as a low impedance network and if the output is applied across a relatively high potential the current flow through the attenuator system could possibly injure the circuit components. When it is necessary to connect the generator output across a source of A.C. or D.C. potential a small series condenser should be connected between the "high" side of the generator output and the point at which the output voltage is being applied.

4.2 PURE RADIO FREQUENCY OUTPUT:

The following procedure should be carried out in tuning the generator for a signal within the range of 95 KC to 144 MC and for an output which ranges from zero to approximately 100,000 microvolts.

(a) Operate Band Selector Sw. 4, to the position which covers the frequency range desired.

(b) Tune the Frequency Control Dial until the desired frequency is indicated under the hairline indicator. NOTE: the scale reading must correspond with the band indicated by position of Sw. 4.

(c) Operate the Output Selector, Sw. 3, to Pure R.F. position.

(d) Connect the output cable to the Output jack immediately below the dial. The shorter lead is grounded and should be clipped to the low potential point of the circuit under test.

(e) Control the signal level by adjusting the Output—attenuator and the Multiplier Sw. 1. When in doubt as to the exact sensitivity of the equipment under test, adjust these controls for maximum output to locate the signal.

4.21 EXAMPLE OF RADIO FREQUENCY SELECTOR:

If the desired frequency is 1,000 KC and the output voltage approximately 8,000 microvolts the following procedure should be followed. Set the Band Selector, Sw. 4, to band C, (600—1600 KC) and operate the Frequency Control dial to 1,000 on Band C. The output attenuator position should be at 8, and the multiplier control set at X1,000 position.

4.3 AUDIO FREQUENCY OUTPUT:

The following procedure should be carried out in tuning the generator for pure audio frequency (400 cycle) signal. The maximum audio output is approximately 2 volts.

(a) Operate the Band Selector, Sw. 4, to "OFF" position.

(b) Set the Output Selector, Sw. 3, to A.F. position.

(c) Connect the output cable to the Output jack immediately below the dial. The shorter lead is grounded and should be clipped to the low potential point of the circuit under test.

(d) The desired signal level is obtained by adjustment of the Multiplier and Output controls. When in doubt as to the exact sensitivity of the equipment under test, adjust these controls for maximum output.

4.31 EXAMPLE OF AUDIO FREQUENCY OUTPUT:

If the audio frequency of 400 cycles is desired the Band Selector, Sw. 4, should be set at the "OFF" position and the Output Selector, Sw. 3, at the A.F. position. The amplitude is controlled by the Multiplier and Output Attenuator controls.

4.4 MODULATED RADIO FREQUENCY OUTPUT:

The procedure outlined in paragraph 4.2 should be followed, but the Output Selector Sw. 3 should be operated to the Mod. R.F. position. Under these conditions the radio frequency signal is modulated approximately 30 per cent at 400 cycles per second.

5. LOCATING TROUBLE IN RECEIVERS USING THE STARK MODEL 10-A SIGNAL GENERATOR

The model 10-A proves invaluable in "trouble shooting" and checking radio receivers. The general method of procedure in locating trouble by employing the signal generator is outlined below.

5.1 GENERAL: The common practice is to begin the test at the output stage, working back towards the receiver input until the fault in the receiver is detected and isolated. Employing the general circuit of a super-hetrodyne receiver the procedure is as noted.

5.2 SPEAKER AND OUTPUT TRANSFORMER CHECK:

5.21 SPEAKER:

The 400 cycle signal from the Model 10-A should be connected directly to the voice coil of the speaker. The audio signal will be detected if the speaker is in good working order.

5.22 OUTPUT TRANSFORMER:

Connect the 400 cycle signal from the Model 10-A to the primary winding of the output transformer. Insert a blocking condenser between the output lead and the transformer connection. The resultant signal obtained at the speaker will be weak due to the step-down turns ratio of the output transformer.

5.3 AUDIO FREQUENCY AMPLIFIER CHECK:

The 400 cycle output of the Model 10-A should be applied to the grid of the audio amplifier tube. If there is more than one audio frequency amplifier stage the procedure should be repeated successively for each stage. When the audio stage is operating normally, a pronounced sginal will be heard at the speaker. If gain or gain per stage measurements are desired an output meter should be used in conjunction with the signal generator.

5.4 INTERMEDIATE FREQUENCY CHECK:

With the generator set at the proper I.F. value, apply the signal to the grid of the 2nd I.F. stage and listen for an output from the speaker. Repeat this procedure with the 1st I.F. stage. Detection of a signal indicates the normal operation of the stage.

5.5 RADIO FREQUENCY CHECK:

With the generator set at a radio frequency within the scope of the receiver band, apply the signal to either the antenna or the grid of the r.f. stage and listen for a speaker output.

5.6 MISCELLANEOUS:

The above is a very general description of the method employed to isolate faults in a receiver. For a more comprehensive procedure refer to the many books written on the subject, and radio manufacturers' service manuals.

6. ALLIED USES FOR THE STARK MODEL 10-A SIGNAL GENERATOR

The Model 10-A can be employed efficiently as stable source of either audio or radio frequency voltage for various measurement applications. Used in conjunction with measurement bridges it provides a wide range of signals, and where the voltage amplitude is insufficient the use of an allied amplifier is advisable.

7. MAINTENANCE OF THE STARK MODEL 10-A SIGNAL GENERATOR

The Model 10-A has been built under the exacting specifications demanded of all Stark instruments. The signal generator has been accurately calibrated and incorporates the finest standards of material, workmanship and design. Further, our engineering staff is readily available to reply to all enquiries regarding the operation of the instrument.

7.1 TUBE MAINTENANCE:

Failure of the instrument to operate efficiently can probably be attributed to tube deficiences. The tubes are all operated well below their normal current rating and should function satisfactorily for a long period.

7.11 POWER SUPPLY TUBE 6X5:

Failure of this tube would cause the entire Signal Generator to become inoperative, even though the pilot lamp continues to glow.

7.12 RADIO FREQUENCY OSCILLATOR TUBE 6J5:

Failure of this tube would prevent the possibility of obtaining any output voltage from the main variable oscillator.

7.13 AUDIO FREQUENCY OSCILLATOR TUBE 6J5:

Failure of this tube would cause the audio signal to become inoperative and would prevent the obtaining of a modulated radio frequency signal.

7.2 RE-ALIGNMENT OF RADIO FREQUENCY RANGES:

NOTE: Re-Alignmeint should not be attempted unless the following provisions are fulfilled:

(a) If it is imperative that higher accuracies be obtained.

(b) Suitable frequency standards and receivers are available for accurate re-alignment.

(c) The operator is capable of carrying out the re-alignment procedure.

When the 6J5 radio frequency oscillator is replaced, the internal characteristics of the tube may cause a slight mis-alignment and if re-alignment is required the following procedure is suggested.

7.21 NECESSARY EQUIPMENT:

The equipment requirements are as follows:

(a) One all wave receiver with band coverage from 500 KC to 42 MC or 72 MC if possible.

(b) An unmodulated 100 and 1,000 KC crystal standard.

(c) Hardware-insulated screw driver, wrench, etc., for adjusting the iron core coils and trimmer condensers.

7.22 PROCEDURE: Remove the main R.F. shield and view the R.F. coil assembly from the rear. Assuming that the coil assembly represents the face of a clock, coil A (many turns of fine wire) appears at 6 o'clock and travelling anti-clockwise coil F (few turns of heavy wire) appears at 12 o'clock. Each inductance is fitted with an adjustable iron core and a small ceramic trimmer condenser. The lock-nut associated with the iron core must be loosened before any adjustment can be made.

7.23 RE-ALIGNMENT EXAMPLE — BAND C, 600—1600 KC:

Adjust the hairline pointer so that it falls on the "line adjust" indicator with the tuning condenser plates fully closed.

Feed the unmodulated output of the 100 KC crystal standard into the receiver and tune the receiver to approximately 600 KC.

With the Range Selector of the Model 10-A in position C, feed the generator output into the receiver and adjust the iron core inductance until zero beat is obtained between the incoming signals, with 600 under the hairline.

Operate the generator dial to the 1600 KC position and again find zero beat between the 16th harmonic of the crystal standard and the generator output. The receiver should be at approximately 1600 KC and the generator adjustment at the high end must be carried out with the button type ceramic capacitor mounted on the coil.

Retune the low end (600 KC) and re-check until both ends of the band are aligned. Tighten the lock nuts and again check the alignment.

7.24 RE-ALIGNMENT OF OTHER BANDS:

The general procedure outlined above can be followed in aligning the other bands, with the following modification.

Bands E and F should be aligned at 5 and 12 megacycles respectively at the low end and 12 and 30 megacycles respectively at the high and using the 1000KC crystal standard.

Band A should be aligned by tuning to a harmonic in the receiver between 100 KC and the standard crystal 100 KC note at the 600 KC position on the receiver. The high end should be tuned for the 4th harmonic of the 225 KC signal from the Model 10-A and the 9th harmonic from the 100 KC crystal standard with the receiver at 900 KC.

Band G is adjusted similarly by mechanically spreading or contracting the few turns which make up the G coil, tuning to a zero beat with the crystal standard.

7.25 PRECAUTIONARY NOTES:

(a) In aligning at all frequencies, the precaution must be taken against tuning to harmonics other than those required for correct calibration. It is suggested that the calibration be checked along the band to recognize incorrect alignment.

(b) The replacement of the R.F. shield may cause a slight frequency shift in the A and B bands. This factor should be noted and allowance made by adjusting the iron cores before fastening the shield in place.

PARTS LIST FOR MODEL 10-A

STARK PART NO.	DESCRIPTION OF PART	QUANTITY
112A5	Condenser 20X20 mfd. 350 v. dry elect.....	1
112A13	Condenser .01 mfd. tubular 600 v.....	2
112D1	Condenser .02 mfd. tubular 400 v.....	1
112A12	Condenser 3-12 mmfd. trimmer, ceramic.....	6
112A6	Condenser 50 mmfd. mica	1
112A8	Condenser .25 mfd. tubular	1
112A7	Condenser 500 mmfd. mica	1
112A4	Condenser 2 gang variable 455 mmfd.....	1
132A1	Coil A	1
132A2	Coil B	1
132A3	Coil C	1
132A4	Coil D	1
132A5	Coil E	1
132A6	Coil F	1
132A7	Coil G	1
134A18	Potentiometer	1
R14	Resistor 820 ohms ½ watt	1
R17	Resistor 68000 ohms ½ watt	1
R1, R16	Resistor 180 ohms 5%	2
R2	Resistor 33 ohms 5%	1
R3, R5, R7	Resistor 47 ohms 5%	3
R4, R6, R8	Resistor 5.6 ohms	3
R9	Resistor 2200 ohms 2 watt.....	1
R11, R12	Resistor 2200 ohms ½ watt.....	2
R10	Resistor 5100 ohms ½ watt.....	1

STARK PART NO.	DESCRIPTION OF PART	QUANTITY
R13	Resistor 25000 ohms ½ watt	1
144H5	Switch—Attenuator 3 deck 5 position	1
144H4	Switch—3 position 1 deck	1
144A9	Switch—Toggle S.P.S.T.	1
144H3	Switch—Band Selector—8 position, 3 deck	1
148E1	Transformer Power 110 V., 25-60 cycle	1
148G1	Transformer—Audio Frequency	1
	Tube 6X5 Vacuum	1
	Tube 6J5 Vacuum	2
131B1	Pilot Light Assembly	1
131A1	Pilot Lamp 6-8 v.	1
152B2	Microphone Cable ¼" R.C.	1
110A1	Alligator Clip	1
110B1	Alligator Clip	1
155A1	Output Connector (Male)	1
155B1	Connector (Female)	1
128B18	Panel	1
119A1	Instruction Manual	1
121A8	Finger Grip Knob 1⅛"	1
121A7	Finger Grip Knob 3"	1
121A9	Pointer Knobs 1¼"	4
107C1	Cabinet	1
135A1	Dial Pointer	1
113A1A	Dial Plate	1
113A2A	Dial Back Plate	1

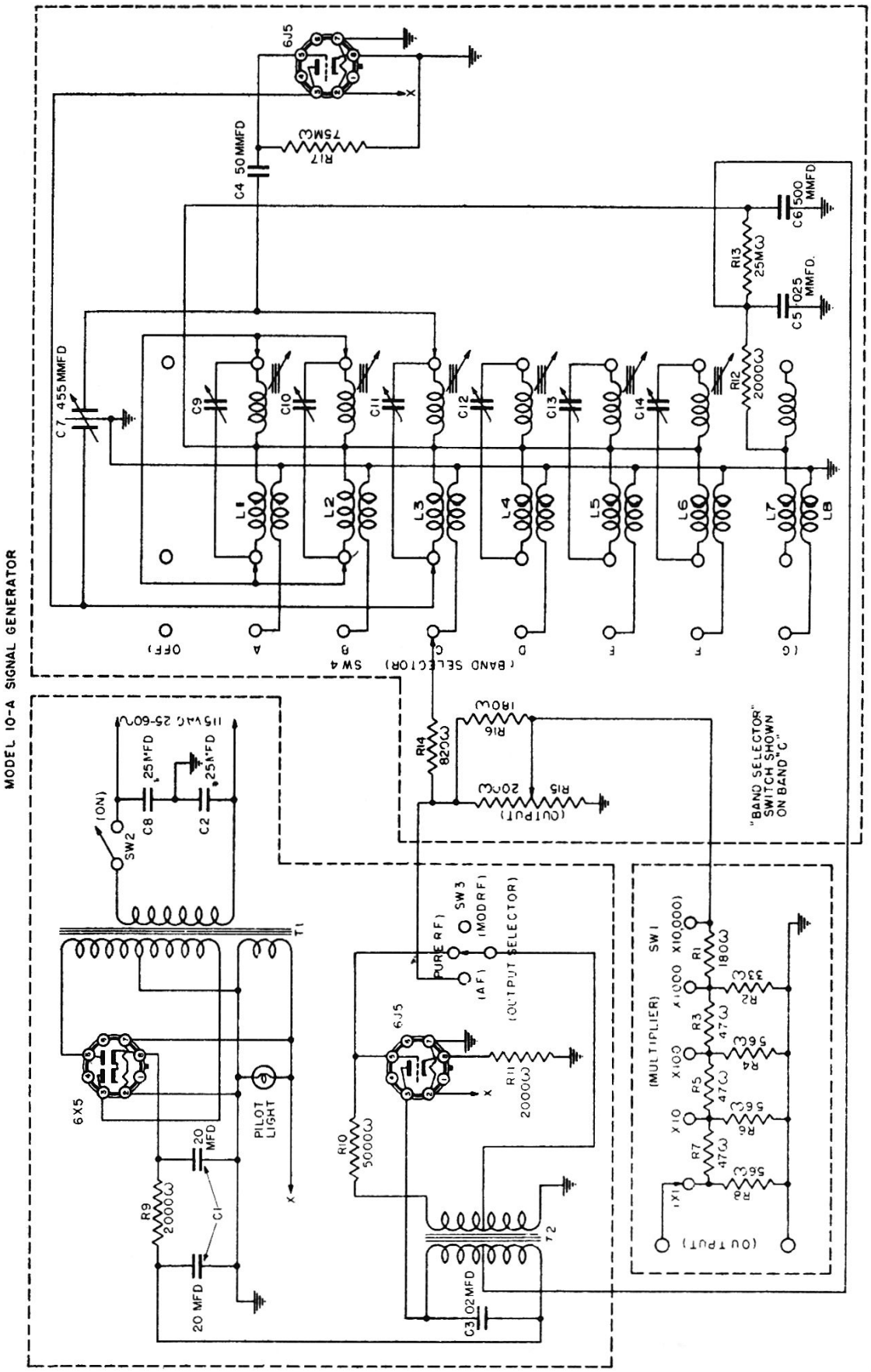


Figure 5 — STARK MODEL 10-A SCHEMATIC

STARK TUBE TESTERS: **(Packed)**

Model 9-11—Approx. 10½"x 9"x5"— 9 lbs.
Model 9-55—Approx. 13½"x12"x5"—11 lbs.
*Model 9-44—Approx. 10½"x 9"x5"— 9 lbs.

COMBINATION TUBE TESTERS & ANALYZERS: **(Packed)**

Model 9-54T — Approx. 15" x10"x5"—12 lbs.
*Model SY — Approx. 10½"x 9"x5"— 9 lbs.
*Self Powered—Independent of External Power Supply.

STARK ANALYZERS: **(Packed)**

DC 1,000 Ohms per Volt.
Model AF-2—Approx. 6½"x3¼"x3½"—1½ lbs.

AC & DC 5,000 Ohms per Volt.
Model SD-1—Approx. 6½"x3¼"x3½"—2 lbs.

AC & DC 5,000 Ohms per Volt.
Model TE-1—Approx. 8¾"x5¾"x3¼"—3½ lbs.

AC & DC 20,000 Ohms per Volt.
Model KM —Approx. 15"x 10"x 5"—10 lbs.

Electronic Volt—Ohm—Capacity—Milliammeter.
Model TA-1—Approx. 11"x8½"x5¼"—14 lbs.

STARK SIGNAL GENERATORS: **(Packed)**

R.F.—95 KC to 144 MC.
A.F.—400 Cycles.
Model 10-A—Approx. 15"x 11"x 6"—23 lbs.