OPERATING
ALIGNMENT & SERVICING
INSTRUCTIONS FOR
SKYRIDER "23"

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OPERATING INSTRUCTIONS

SUPER SKYRIDER MODEL SX23

The laboratories of the Hallicrafters, Inc., have achieved in the SKYRIDER model SX23, new standards of communications receiver performance - in selectivity, low image ratio, improved crystal action, and numerous other qualifications which have been prerequisites of the receiver you have wanted. If studied and then carefully followed, this instruction manual will help you to better understand your SKYRIDER 23 to the end that you will obtain all of the characteristics of excellent performance that have been built into this receiver.

It is recommended that, upon receipt, the owner of the SX23 receiver carefully inspect the carton and then the receiver for any damage which might have occurred in transit. Should any signs of damage be apparent immediately file claim with the carrier accurately stating the extent of the damage.

ANTENNA:

The SKYRIDER 23 has an antenna input circuit which will allow the use of either a doublet or Marconi (inverted "L") antenna. The approximate antenna input impedance of the SKYRIDER 23 is 400 ohms.

A very serviceable antenna will be the inverted "L", or Marconi type. This antenna should be approximately 75 feet long overall, including the lead-in to the set. Satisfactory operation of the SKYRIDER 23 is obtained throughout its tuning range with this type of antenna and because of that fact as well as its ease of construction it is highly recommended.

With the inverted "L" type of antenna A_2 must remain connected to G for best operation. While a ground connection is usually not necessary it might prove to be helpful. A cold water pipe or 6' foot rod driven in moist soil will be a very satisfactory ground when connected to the G terminal on the receiver. Connections to a radiator or gas piping are not recommended.

Should a doublet antenna be used it is suggested that a transmission line of 400 ohms value of impedance be constructed so that a most efficient transfer of energy is obtained. The commercially available all wave doublet antennas are usually provided with a coupling transformer which matches the transmission line to the receiver. This transformer connects to the A_1 and A_2 terminals on the antenna strip. The half-wave length-doublet antenna cut for a particular frequency can be computed by the following formula:

$$\text{Length in feet} = \frac{463}{\text{Frequency in megacycles}}$$

or for example, a half wave 20 meter or 14 megacycle antenna would be

$$\frac{463}{14} \text{ or } 33.7 \text{ feet long overall}$$

This type of antenna is broken in the center with an insulator and has the transmission line connected to each resulting quarter wave section at that point. This antenna is a very good performer, in a direction broadside to its length, only on the relatively narrow group of frequencies for which it was cut. It does not function well on harmonic frequencies.

When using either type of doublet antennas the transmission line should be connected to A_1 and A_2 binding posts. The wire connecting the A_2 to ground or G can be left connected if the performance of the receiver is improved.

FREQUENCY RANGE

The SKYRIDER 23 tunes from 540 to 34 MC. This coverage is obtained by adjusting the band switch knob to the particular range desired. The band switch mechanism is unique in view of the above coverage being obtained in the first four positions. Bandspreading is accomplished on the next four positions.

The frequency coverage with the band switch in the "General Coverage" position is as follows:

Band 1 - 540 KC - 1,700 KC
2 - 1.7 MC - 5.2 MC
3 - 5.2 MC - 16.5 MC
4 - 11 MC - 34.0 MC

The calibration covering each of the above ranges appears on the "Venetian Blind" indirectly illuminated dial in the order named. The outside scale of the dial is not calibrated in frequency, but marked in divisions from 0-to-100. As indicated on the translucent window protecting the dial, this scale is to be used when the Band Switch of the receiver is so adjusted to cover the particular amateur band desired.

BAND SPREAD

Realizing that reset accuracy is a very desirable feature the SKYRIDER 23 was designed so that only the amateur bands from 10 to 80 meters could be bandspread. The switch mechanism and associated temperature compensated condensers are unique and eliminate the necessity of accurately resetting the main tuning dial whenever it is desired to band spread the amateur frequencies.

The four "Band Spread" positions found on the SKYRIDER 23 cover the frequencies indicated below:

Band 10 - 28 MC to 30 MC
20 - 14 MC to 14.4 MC
40 - 7 MC to 7.30 MC
80 - 3.50 MC to 4.00 MC

When operating the receiver in the band spread position it will be noticed that more than just the frequencies of each amateur band are covered. This has been found advisable for the reception of signals being sent on frequencies outside the amateur bands, as well as the reception of commercial stations for marker purposes, inasmuch as their exact frequency is usually known.

Each amateur band is spread over a sufficient number of divisions on the band spread scale to make tuning on that particular band effortless and accurate.

In addition to the frequency range in the circuit being identified by the Hallicrafters band switch knob under the main tuning dial, that particular band is also shown by referring to the illuminated indicator directly to the right of the main dial.

Unless otherwise specified the SKYRIDER 23 operates on 110-125 volts 60 cycle alternating current. A universal transformer model is available which will operate on 25-60 cycle current. This transformer is provided with taps to cover in 5 steps a voltage range from 110 to 250 volts. Actual operation is identical with either the 25 or 60 cycle transformer.

On the rear apron of the chassis you will find output terminal strips marked 500 and 5000 ohms. The Hallicrafters permanent magnet dynamic matching S23 speaker should be connected to the 5000 ohm terminals. The 500 ohm contacts can be connected to a separate speaker or a load of that impedance value. The terminals marked "EXT SW" should be connected to an external switch, a portion of which is used to turn "on" and "off" your transmitter. The "EXT SW" terminals are paralleled with the front panel "Send Receive" switch. In order to

make the external switch operate the "Send Receive" switch must be left in the "send" position. In viewing the receiver from the back the right hand "EXT SW" contact is grounded. When connecting to associated equipment this point should be borne in mind so that no potential difference will arise between it and the receiver.

TUBE LINE-UP

6SK7	R.F. Amplifier
6SA7	1st Detector-Mixer
6SJ7	High Frequency Oscillator
6SK7	1st I.F. Amplifier
6SK7	2nd I.F. Amplifier
6SQ7	2nd Detector, 1st Stage of Audio
6F6	2nd Stage of Audio
6SJ7	Beat Frequency Oscillator
6H6	Automatic Noise Limiter
6B8	Amplified A.V.C.
80	Rectifier

CONTROLS AND OPERATION

Each of the controls is identified by appropriate marking on the panel. The "Tone Control" turns the receiver "on" and "off", and also allow the operator to make adjustments for the type of reproduction most pleasing to him. Treble reproduction is to the far left position, just after the set is turned on, while the base is at the extreme right. Intermediate positions allow for any desired degree of mixing.

The "Pitch Control" is to be used when code or CW signals are being received. In its counter clockwise position the Beat Frequency Oscillator is "off". Rotating the control clockwise turns on the B.F.O. in addition to varying the pitch of the beat note to the operator's taste.

Directly below the two controls mentioned will be found the "Phone Jack". Any type of high impedance headphones may be used because no direct current flows in the headphone circuit. The strength of the signal in the headphones will be found to be at the proper level for most comfortable headphone reception. When headphones are used the speaker is automatically disconnected.

The "AF Gain" control adjusts the volume of the receiver by varying the output of the audio amplifier. Volume is controlled in both the headphone and loud speaker circuits and the setting of this control is optional with the user of the receiver for the amount of volume desired.

The "ANL" or Automatic Noise Limiter control turns the noise limiter "on" or "off". No modern communications receiver is complete without an effective noise limiter. With the A.N.L. switch in the "on" position the noise limiter will prove to be of great assistance and frequently mean the difference between hearing a signal which otherwise would be inaudible on the higher frequencies where ignition and other pulsating types of interference are most aggravating.

The "RF Gain" control adjusts the sensitivity of the receiver by varying the cathode bias on the RF and IF amplifiers. Maximum sensitivity will be obtained with this control rotated clockwise as far as it will go. When this is done a switch will be operated, the function of which will be described under S meter.

When using the receiver under varying local conditions of noise, it will be advisable to adjust both the "RF" and "AF" gain controls until the most favorable signal to noise ratio is found. Until such a time as you have become thoroughly familiar with the function of all controls it is suggested that the R. F. gain be advanced until the white dot on the knob is pointing approximately at the "S" on SKYRIDER. Later experiment to find the best position for a given signal bearing in mind that with the selectivity switch in any of the

"AVC Off" positions, an extremely strong signal will cause the receiver to block. Because of the unusually low residual noise level of the SKYRIDER 23 it is advised to adjust all controls carefully in familiarizing yourself with their functions and effects.

The "Stand-By" or "Send-Receive" switch when in the "Send" position removes plate voltage from the tubes. This allows the receiver to be made temporarily inoperative should it be used in conjunction with a transmitter.

The hand-wheel marked "Tuning", is for adjusting the main dial to the frequency desired. The mechanism is quiet in operation and free from back lash. The conveniently located control will give the greatest tuning ease after continued hours of operation.

CRYSTAL OPERATION

There are three controls which must be properly adjusted for most satisfactory crystal filter operation. Their operation shall be treated in the order in which they are called upon to perform their functions in the receiver.

Selectivity Switch -

There are three positions of selectivity with the Automatic Volume Control circuit operating. For high fidelity broadcast reception the selectivity switch should be rotated to the "IF Broad" position.

With the switch placed in the "IF Sharp" position the selectivity is greatly increased at no apparent sacrifice in tone reproduction.

The "Phone Crystal" position affords maximum selectivity with automatic volume control. The receiver will have to be accurately resonated on each desired signal because this step of selectivity greatly attenuates the side-bands of a modulated carrier. You will notice the apparent slot into which the signal falls, only in the exact center of which will intelligibility of a good order be maintained. The "Phone Crystal" position is recommended under conditions of extreme interference where adjacent channel stations are causing objectionable heterodynes.

Rotating the switch in a counter-clockwise position still farther allows the receiver to be used in the three selectivity positions with the A.V.C. circuit disconnected. When the selectivity switch is so adjusted it is then necessary to manually adjust the "RF Gain" to keep the signal under control.

In the "CW Crystal" position the maximum selectivity of the set is obtained. The drop in background noise is immediately apparent. This position is recommended only for the reception of CW or code signals because the selectivity is so great phone signals are practically unreadable. To realize the maximum in performance from the SKYRIDER 23 crystal circuit, the following two controls should be adjusted as described. First tune in an extremely strong CW signal.

The "Pitch Control" should be turned until a beat note is audible. Then adjust the main tuning control and go across the signal. Two distinct signals will be heard either side of zero beat, or the null position in the center tuning through which no signal is audible. See whether the low or the high frequency side of the signal (that which appears either side of zero beat) is the weaker. Leave the receiver set on whichever of the two signals is the weaker. Now very carefully adjust the "Phasing Control" until you have eliminated that signal as much as possible. As an additional step to see whether you have chosen the proper low or high frequency image to reject, rotate the "Pitch Control" through zero beat to the other side so that a beat note of approximately the same pitch as before is obtained. Now retune the receiver and it will be apparent that the signal on the other side of zero beat (as referred to the markings on the dial at which this signal was first tuned in) is reduced in volume. Again carefully adjust the "Phasing Control" and compare the strength of the audio image when this side has been phased out, or rejected. When you have demonstrated that the phasing or rejection is better on either the low or high frequency audio image the phasing control is left in that position and you then have the SKYRIDER 23 adjusted for the extremely selective crystal action for which it is noted.

The "Pitch and Phasing Controls" should be called upon frequently to demonstrate how, through proper adjustment, extreme conditions of interference can be coped with. Frequently, a slight adjustment of the pitch control will place a desired signal in the clear when the two signals differ in frequency by only a few hundred cycles. Minute adjustment of the phasing control will frequently obliterate an interferring signal by dropping it in the crystal slot.

S METER

Close to the license tag on the rear of the receiver will be found a knurled shaft which is to be used in adjusting the "S" meter. Prior to adjusting this control the R. F. gain control must be in the maximum gain position, or rotated clockwise until a switch which is mounted on this control is heard to operate. Additionally, the Selectivity Switch must be in any one of the three "A.V.C. On" selectivity positions. When the above two conditions are filled the meter is in the circuit and should be adjusted as follows: Disconnect the antenna from the receiver, being sure no strong local signal is being picked up by the receiver with the antenna removed. Now adjust the S meter shaft until the meter rests at zero. Reconnecting the antenna will then show the meter indicating relative carrier strength in both S units as well as DB's or decibels. Should most accurate S meter indication be desired, it is recommended that the meter be adjusted with the Selectivity Switch in the step of selectivity most frequently used.

The S meter does not function with the Selectivity Switch in the "A.V.C. Off" position because the meter is connected in the A.V.C. circuit which preferably is used for telephone reception.

The SKYRIDER 23 draws 110 watts at 115 volts 60 cycles alternating current.

The Hallicrafters, Inc., reserve the right to make changes in design or to add improvements to instruments of their manufacture without incurring any obligation to install the same in any instrument previously purchased.

ALIGNMENT PROCEDURE

The alignment of the S23 is straightforward and requires no equipment other than the usual signal generator, or other signal source, and an output meter.

I. F. ALIGNMENT

No. 1 - Remove the "Bottom Pan" from the cabinet and then the square "RF Coil Shield Bottom" so that the RF oscillator and mixer tube bases, switch and coils are accessible.

No. 2 - Unsolder the control grid wire from 6SA7 tube base at the point at which it connects to switch section No. 6. Signal is applied to this grid for alignment of I. F. AVC and BFO circuits. An output meter is connected across 5000 ohm speaker terminals.

No. 3 - Connect the signal generator to the control grid of the 6SA7 mixer through a .01 mfd condenser. Now connect a 100,000, 1/3 watt, resistor from the control grid of the 6SA7 to AVC Return on the mixer RF coil form. (See note "A" Schematic).

No. 4 - Place the selectivity switch in "AVC Off IF Sharp" position; the wave band switch in #6.2-16.0 megacycle position or #3 band, volume and RF controls in maximum gain position.

No. 5 - Apply 455 KC signal of sufficient strength to give an approximate output of 500 milliwatt and adjust trimmers A1, A2, A4, A5, A6, A7 and A8 to maximum deflection of output meter.

B.F.O. ADJUSTMENT

Turn the BFO control so that the dot on the knob is pointing to the top of the cabinet and then adjust A10 until the beat note is zero frequency.

CRYSTAL ALIGNMENT

No. 6 - For alignment of crystal, place selectivity switch in CW crystal position, remove modulation from signal source, adjust BFO pitch control until a beat note of approximately 1000 cycles is attained. Detune the signal source from 455 KC and then adjust the crystal phasing control to a point where the hiss noise from the speaker is reduced to a minimum. Now vary the frequency of the signal source from about 453 to 457 KC. At some frequency between these points a sharp increase in speaker output will be noted. This is the resonant frequency of the crystal. The signal generator should be adjusted to this point of crystal resonance for maximum meter deflection. Touch up all trimmers, No. A2, A4, A5, A6, A7 and A8 for precise alignment to the crystal frequency. Assuming the output beat note is still set at approximately 1000 cycles, and leaving all controls on the receiver as previously adjusted, change the frequency of the signal generator until the output beat note is reduced from 1000 cycles down thru zero beat and up to the other side to a frequency of approximately 400 cycles. Now balance A1, and the crystal phasing control until the rejection slot is at minimum. It will be necessary to increase the output of the signal generator for this adjustment in order to obtain a satisfactory output level.

Note: A3 is a coupling condenser which should never need adjustment as it will not effect the alignment of the set but only vary the gain of the I. F. unit.

No. 7 - To adjust the AVC, turn the BFO pitch control to "off" position, the selectivity switch to "AVC On I. F. Sharp" position. Adjust the frequency of the modulated signal source to the resonant frequency of the I. F. unit with the signal strength sufficient to set up about 500 milliwatts in output meter. Now adjust A9 until the output is reduced to a minimum, which is the point where the AVC is resonant and operating properly.

Resolder the grid wire of the 6SA7 to the switch section contact and replace the R.F. coil shield bottom.

R.F. ALIGNMENT

The holes in the "RF Coil Box Cover" marked "W" as shown in the instruction book are to permit the insertion of a "Wand" into the coil forms for checking of alignment. The "Wand" is a rod of insulating material having a brass slug in one end and a powdered iron slug in the other. When the iron slug is placed in field of coil the inductance is increased, and when the brass slug is used, the inductance is decreased.

NOTE: When checking points of alignment the meter deflection should decrease when either end of "Wand" is used, if the set is properly aligned. If the meter deflection increases when the "Iron" end of "Wand" is in the field then the trimmer capacity should be increased. If, however, the meter reading increases when the "Brass" end of "Wand" is used then the trimmer capacity will have to be reduced.

When the condenser gang is fully closed be certain that the indicating line on the dial window is in line with the zero mark on the band spread calibration and the small line below the 550 KC calibration point. Place selectivity control in the "I. F. Sharp-AVC off" position. R. F. and Audio gain controls adjusted for maximum gain and signal of sufficient strength fed to the receiver to give approximately 500 milliwatts output.

Band No. 1 - "545 KC to 1700 KC"

Connect a wire between A2 and ground terminal or "G" on the antenna strip. Connect the ground side of the signal generator to the ground terminal of antenna strip and connect the high side of signal generator to A1 thru a 200 mmfd condenser.

Set the receiver dial and signal generator dial to 1500 KC - align trimmer indicated as Osc. 1 to resonance with this signal frequency and then adjust RF trimmer and antenna trimmer as indicated Band No. 1 to obtain maximum deflection on output meter. Next set the generator signal and receiver to 600 KC and while rocking the main tuning knob adjust low frequency pad (indicated as Pad BD1) until the output is maximum. Recheck alignment at 1500 KC and then the 600 KC position again for precise alignment.

Band No. 2 - "1700 KC to 5.2 Megacycles"

Note: Replace the 200 mmfd condenser with a 400 ohm resistor for alignment of Bands Nos. 2, 4 and 5.

Following same procedure as Band No. 1, align first at 4000 KC, using trimmers indicated as "Osc. 2" and R. F. trimmers "Band 2". The low frequency end is checked at 1800 KC by rocking condenser gang while adjusting pad BD2 until maximum output is obtained.

Band No. 3 - "5.2 Megacycles to 16 Megacycles"

The high frequency end of this band is aligned at 14 megacycles, using oscillator Trimmer "Osc-3" and RF trimmers indicating Band 3. The low frequency end is padded at 7. megacycles using series pad indicated "Pad BD3".

Band No. 4 - "10 Megacycles to 34. Megacycles"

This band is aligned at 30 megacycles first by setting dial at 30 megacycles and adjust Osc. 4 until signal is received, then by "rocking" condenser gang slightly and adjusting ("Band 4") RF trimmer until maximum output is obtained. Antenna trimmer, Band 4, is not aligned until the oscillator and R. F. trimmers are first adjusted for maximum output. It is not necessary to adjust the oscillator for low frequency tracking as this is adjusted at factory and should be permanent.

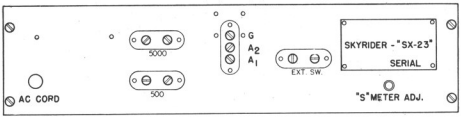
The band spread positions do not require alignment as the alignment for band coverage position also takes care of band spread alignment.

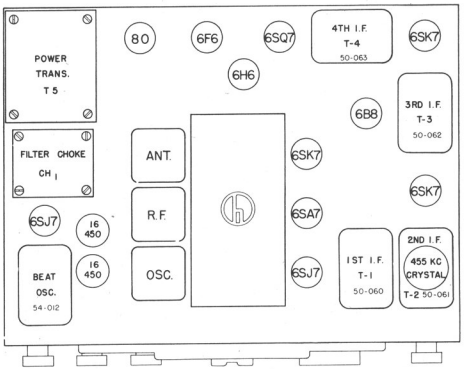
LIST OF CONDENSERS SKYRIDER 23

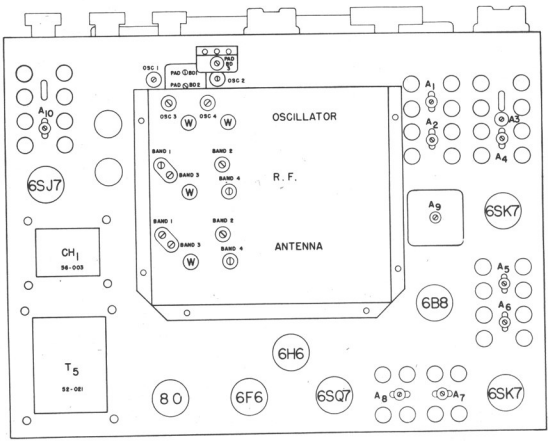
NO.	VALUE	VOLTAGE	TYPE
1 2 3	437 mmfd.		Main tuning gang
4	1.2-12.0 "		R.F. Circuit trimmer
5	Series padding for Band Spread See detailed Schematic.		
6	.05 mfd.	200	Paper
7	Parallel padding for Band Spread See detailed Schematic.		
8	.05 mfd.	200	Paper
9	.01 "	400	"
10	.05 "	"	"
11	1.2-12 mmfd.		R.F. Circuit trimmer
12	Series padding for Band Spread		
13	.05 mfd.	200	Paper
14	Parallel Padding for Band Spread		
15	.05 mfd.	200	Paper
16	.002 "		Mica
17	50 mmfd.		Ceramic
18	.01 mfd.	400	Paper
19	.002 "		Mica
20	250 mmfd.		Ceramic
21	200 "		"
22	.05 mfd.	400	Paper
23	100 mmfd.		Ceramic
24	100 "		"
25	2-25 "	Variable	
26	5-50 "	"	Mica
27	250 "		Ceramic
28	.05 mfd.	200	Paper
29	.01 "	"	"
30	.05 "	"	"
31	250 mmfd.		Ceramic
32	250 "		"
33	250 "		Mica
34	.05 mfd.	200	Paper
35	.05 mfd.	400	Paper
36	250 mmfd.		Ceramic
37	3 "		Gimmick
38	100 "		Ceramic
39	50 "		Ceramic
40	.05 mfd.	200	Paper
41	.05 "	400	"
42	.01 "	"	"
43	.01 "	"	"
44	20 "	25	Electrolytic
45	.002 "		Mica
46	.01 "	400	Paper
47	250 mmfd.		Mica
48	500 "		Ceramic
49	2-25 "		Variable
50	.05 mfd.	400	Paper
51	150 mmfd.		Ceramic
52	.1 mfd.	200	Paper
53	250 mmfd.		Mica
54	.05 mfd.	"	Paper
55	.05 "	"	"
56	.05 "	"	"
57	16 "	475	Electrolytic
58	16 "	"	"
59	.25 "	200	Paper
60	.002 "		Mica
61	.002 "		"
62	50 mmfd.		Ceramic
63	Parallel padding for Band Spread		
64	Series " "	"	
65	1.2-12 mmfd.		O & C trimmer
66	.002 mfd. in 3rd Band OSC Series tracking pad		
67	.01 "	400	Paper
68	.02 "	200	"
69	.1 "	"	"

LIST OF RESISTORS SKYRIDER 23

NO.	OHMS	WATTAGE	TOLERANCE
R1	100,000	1/3	20%
2	1,000	"	10%
3	10,000	R.F. Gain Control	
4	5,000	1/3	20%
5	100,000	"	"
6	600	"	10%
7	20,000	"	20%
8	5,000	"	"
9	100,000	"	"
10	1,000	"	10%
11	5,000	"	20%
12	1,000	"	10%
13	5,000	"	20%
14	1,000,000	"	"
15	200,000	"	10%
16	400,000	"	"
17	500,000	"	20%
18	500,000	A.F. Gain Control	
19	400	1	10%
20	5,000	2	20%
21	50,000	1	"
22	50,000	1/3	"
R23	5,000	1/3	20%
24	500,000	"	"
25	250,000	"	10%
26	200,000	"	"
27	500	"	"
28	1,000,000	"	20%
29	25,000	"	"
30	5,000	2	
31	6,500	7	
32	500	1/3	10%
33	500	"S" Meter Adjustment	
34	15,000	1	20%
35	25,000	"	"
36	3,000	1/3	10%
37	500	"	"
38	50,000	"	20%
39	500,000	Tone Control	
40	1,000	1/3	10%
41	1,000	"	"
42	10,000	1/2	20%
43	100,000	1/3	"







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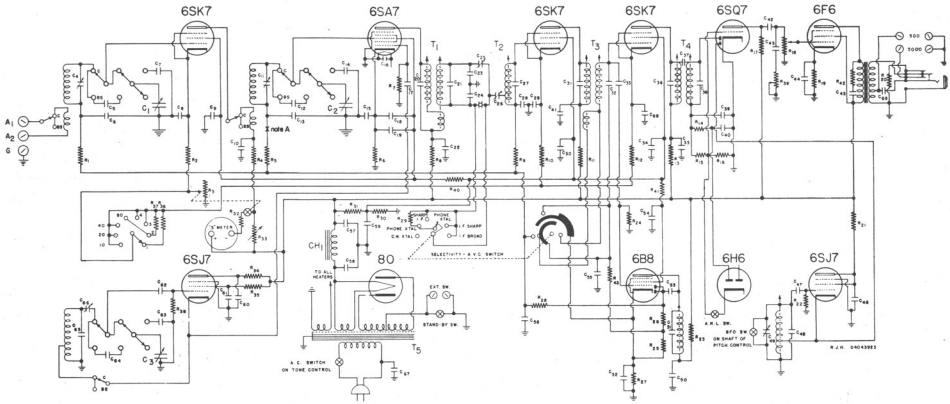
SCHEMATIC DIAGRAM—SKYRIDER 23



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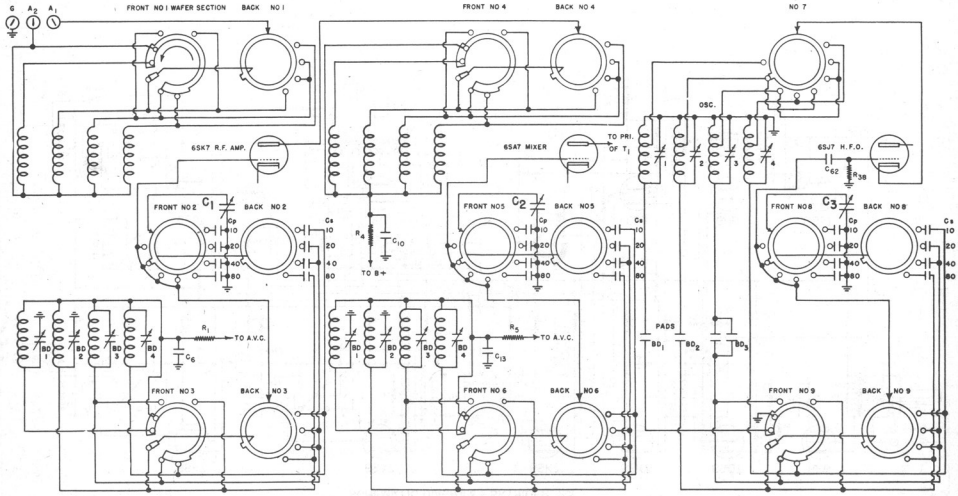

NO. 1 WAFER IS FARTHEST FROM THE FRONT PANEL AND SELECTS ANTENNA PRIMARIES

Cp (CONDENSERS PARALLEL)

10	59.7	mmfd	CERAMICON
20	104.4	"	"
40	57.1	"	"
80	94.3	"	"

Cs (CONDENSERS SERIES)

10	51.4	mmfd	CERAMICON
20	38.	"	"
40	313.6	"	"
80	99.5	"	"

R.J.H. 04113923

DETAILED SCHEMATIC R.F. SWITCHING SECTION