INSTRUCTION MANUAL

for

THE NATIONAL MODEL

NC-46

RECEIVER

A reliable communications-type receiver in the low price range covering frequencies from 540 to 30,000 kilocycles.

NC-46 RECEIVER

FEATURES . . .

- 540 to 30,000 Kilocycles Range.
- 4 Accurately Calibrated Tuning Bands.
- Band-spread Coverage for Amateur Bands.
- Full-Vision Well-Illuminated Dial Scale.
- A.C. or D.C. Operation.
- Push-Pull Audio Output.
- Automatic Volume Control.
- Series Valve Noise Limiter.
- Beat Frequency Oscillator.
- Distinctive Innovations in Cabinet Design.
- Speaker In Matching Cabinet.

CAUTION . . . . . In installations where one side of the power line is grounded, care should be exercised to avoid electrical shock. The operator can prevent any shock occurring by not making bodily contact between receiver cabinet and chassis or chassis and ground. Proper polarization of the A.C. line plug will prevent the possibility of shock.

Bought 5-23-'46

THE NC-46 COMMUNICATION RECEIVER

SECTION I DESCRIPTION

1-1. General

The new NC-46 is a ten tube A.C. D.C. superhetrodyne Radio Receiver covering a continuous frequency range of from 540 to 30,000 kilocycles. The components used throughout the NC-46 have been selected with care to insure greater durability, better performance, and with the intention of providing a reliable communication receiver in the low price range. Excellent selectivity and stability are secured through the use of permeability tuned iron core transformers in the intermediate frequency and beat frequency oscillator stages. Four watts of audio output power are available for loud speaker operation.

Each equipment consists of a receiver and loud speaker and also an instruction manual.

1-2. Circuit

The circuit employed in the NC-46 consists of a converter stage, two intermediate frequency stages, diode detector, limiter, beat frequency oscillator, AVC amplifier, phase inverter, push-pull output and rectifier stages.

The second detector utilizes one set of elements of a dual diode; the other set of elements is used for a noise limiter. Separate tubes are used in the automatic volume control and beat frequency oscillator circuits. The latter is coupled to the second detector for C.W. reception.

All voltages required by the receiver circuits are supplied by a built-in power supply.

1-3. Tube Complement

The NC-46 is equipped complete with tubes which are tested in the receiver at the time of alignment.

The tubes employed are as follows:

Converter	6K8
First I.F. Amplifier	6SG7
Second I.F. Amplifier	6SG7
Second Detector - Limiter	6H6
Beat Frequency Oscillator	6SJ7
Automatic Volume Control	6SF7
Amplifier and Phase Inverter	6SC7
Push-Pull Audio Output (2)	25L6GT/G
Rectifier	2575

1-4. Tuning System

The master tuning capacitor C2 and four sets of associated coils are used to tune the frequency range of the receiver in four tuning bands for both general coverage and bandspread operation.

The overall frequency coverage of the four bands is as follows:

Band A	11.5	-	30 0 MC
Band B	4.4	-	12.0 MC
Band C	1.55	-	4.6 MC
Band D	0.54	-	1.6 MC

The following bands in the short wave ranges are tunable by the bandspread capacitor and are spread as follows:

3.5 - 4.0 MC	65 Divisions
7.0 - 7.3 MC	50 Divisions
14.0 - 14.4 MC	56 Divisions
28.0 - 30.0 MC	40 Divisions

1-5. Audio Output

Two audio output circuits are provided:

(1) A headphone jack is mounted on the rear of the receiver and is so wired as to silence the loudspeaker when the phone plug is inserted. The load impedance for the headphone output is not critical and any good set of headphones may be used.

(2) Tip-jack terminals are provided at the rear of the receiver for speaker connection. The output load impedance of the receiver is 10 ohms. This allows the use of a permanent magnet speaker with a voice coil of 8 to 10 ohms. The use of a matching output transformer is not required. Maximum undistorted audio power output available is approximately 4 watts.

1-6. Power Supply

The NC-46 Receiver is designed for operation from a 110/130 volt, A.C. or

D.C. power source. Normal power consumption is approximately 65 watts. All voltages required for the heater and B supply circuits are delivered by a built-in power supply.

One side of the input power line is connected through a 2 ampere fuse to prevent any possible damage to the receiver due to a short-circuit or ground. This fuse is housed in an extractor post mounted at the rear of the receiver which permits ease in removal or inspection of the fuse.

1-7. Loud Speaker

The loud speaker supplied with NC-46 Receiver is of the permanent magnet field type having a nominal diameter of 6 inches. A two wire cable with tip jack terminations is furnished for connection between the loud speaker and receiver.

The loud speaker is housed in a cabinet for table mounting finished to match the receiver.

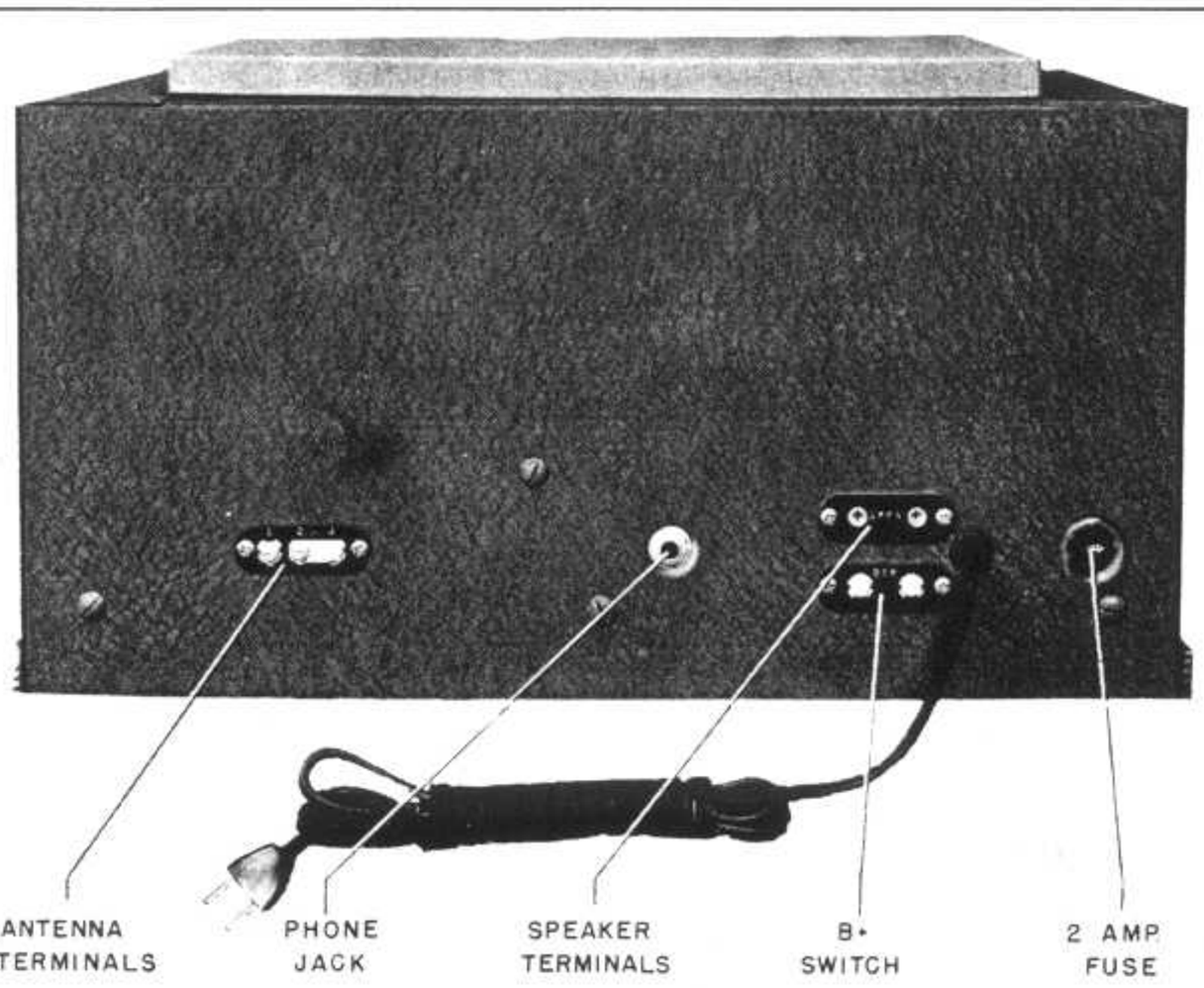


FIG. NO. 1

SECTION 2 INSTALLATION

2-1. Antenna Recommendations

There is an antenna terminal strip mounted at the rear of the receiver with three screw-type connections available marked #1, #2 and #3. Terminal #3 is the ground connection. The strip is furnished with a sliding link to short out terminals #2 and #3 for operation with a single wire antenna. Doublet antennae, directive arrays etc., having two wire feeder systems may be used connecting directly to terminals #1 and #2, terminal #3 and strap not being used. For general coverage a single wire antenna of approximately 50 to 100 feet will be found to give satisfactory results. To obtain peak performance on any particular desired channel the antenna length should be approximately an odd quarter-wave length of the band in use.

2-2. Starting The Receiver

After unpacking the NC-46 Receiver and loud speaker from the shipping cases, proceed as follows:

(1) Check to see that the tubes are seated firmly in their sockets.

(2) Connect the loud speaker cable to the receiver speaker terminal strip.

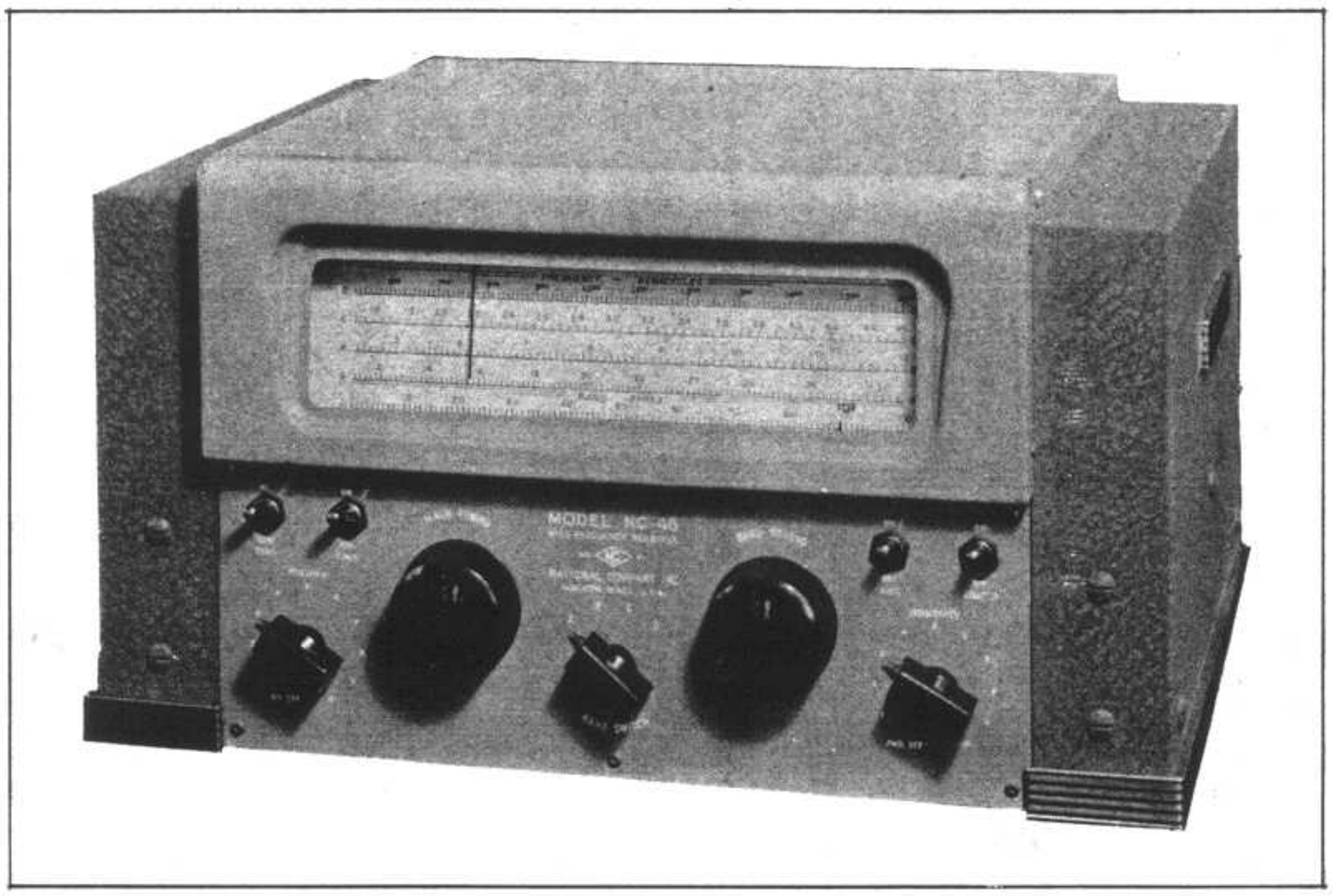
(3) Connect antenna.

(4) Plug line cord in proper source of supply. For D.C. operation proper polarity of the plug must be observed. This can be determined by trial and no damage will result from the improper connection.

(5) Set controls as recommended in Section 3 for reception of signals.

2-3. Loud Speaker

The recommended position of the loud speaker is at the side of the receiver or if desired at some location removed from the receiver. Placing the loud speaker on top of the receiver is not desirable since vibration from the speaker is apt to be introduced into the tubes producing undesirable microphonic noises.



SECTION 3 OPERATION

3-1. Controls

The MAIN TUNING control knob is located to the left of the center of the front panel. This knob operates a two gang variable capacitor through a 30 to 1 ratio reduction drive mechanism. The main tuning dial is the full vision slide rule type and features four accurate scales calibrated in megacycles which are easily and quickly read.

The ELECTRICAL BANDSPREAD control knob is located to the right of the center of the front panel. This knob operates a separate two gang variable capacitor to provide bandspread tuning. There is a separate scale and pointer provided for accurate logging of bandspread channels.

The BAND SELECTOR switch is located at the center of the front panel and functions to select the tuning band desired. The band in use is indicated by the designating letters on this switch dial. The four tuning scales on the main tuning dial are marked at either end of the dial by these designating letters.

Tuning is accomplished by the following steps:

(a) Select the band to be used by means of the BAND SELECTOR switch.

(b) The frequency calibration of the main tuning dial will only be correct with the bandspread pointer set at 90. After this setting has been made the MAIN TUNING control knob is used to tune in the desired station. The bandspread pointer may then be used to give greater accuracy in logging.

The TONE CONTROL switch is located at the upper left-hand side of the receiver and functions to select the frequency characteristic of the audio amplifier as desired, i.e. HIGH or LOW. The HIGH position will give the better fidelity and the LOW a better signal to noise ratio.

The C.W.O. CONTROL switch is located to the right of the TONE CONTROL switch functioning to switch on or off the beat frequency oscillator.

The VOLUME control is located to the left of the MAIN TUNING knob functioning to adjust the audio amplification of the receiver. Part of this control is a stand-by switch permitting the A.C. line switch to remain on but with B supply circuit open.

The LIMITER CONTROL switch is located at the upper right-hand side of the front panel functioning to switch "On" or "Off" the noise limiter. This control is normally in the "Off" position but can be turned "On" to suppress any undesired noise pulses.

The A.V.C. CONTROL switch is located to the left of the LIMITER switch functioning to switch the automatic volume control circuits into or out of the receiver circuits.

The SENSITIVITY control is located to the right of the BANDSPREAD control knob and functions to adjust the amplification of the two I.F. amplifier tubes. Incorporated in this control is the power supply "ON" "OFF" switch; with this switch in the "Off" position the receiver is inoperative.

There is a B.S.W. terminal panel provided at the rear of the receiver to permit remote stand-by control. The terminals are connected in series with the B switch.

3-2. *Phone Reception*

After the equipment is properly installed, in accordance with Section 2, it is placed in operation by turning the SENSITIVITY control to 10 and the VOLUME control to the point which provides the desired audio volume. The TONE control should be "On"; the C.W.O. control should be "Off"; the A.V.C. control should be "On"; the LIMITER should be "Off". The receiver is now adjusted for the reception of phone signals and can be tuned to the desired frequency and band by means of the MAIN TUNING control and BAND SELECTOR switch.

If a receiver signal is weak and partially obscured by external noise better signal to noise ratio will be obtained by setting the TONE control at "Low".

The LIMITER control may be set at "On" to improve the signal to noise ratio in the event that noise pulses of high intensity and short duration are encountered.

3-3. *C.W. Reception*

The best reception of code signals is accomplished by turning the C.W. switch "On" and the A.V.C. switch "Off". As audio fidelity is relatively unimportant in the reception of C.W. signals, the TONE switch may be "Off" and the LIMITER switch "On". The VOLUME control should be well advanced and the SENSITIVITY control used to adjust the audio output of the receiver and also to prevent overloading. This setting of the controls will result in better reception of weak signals and better noise suppression.

The B.F.O. transformer is aligned in the National laboratories to deliver a 1000 cycle beat note at optimum tuning; this can be varied to suit the operator by readjusting the tuned iron core or by slightly detuning the received signal.

SECTION 4 SERVICE AND TEST DATA

4-1. *Tube Failures*

Failure of a vacuum tube in the receiver may result in reduced sensitivity, intermittent and noisy operation, or cause the equipment to be completely inoperative. In such cases tubes should be checked in a reliable tube tester or be replaced by tubes of proven quality taking care to return tubes removed to their original sockets.

Individual tubes of the same type are

apt to vary slightly in their characteristics and it is well to remember this fact when replacements become necessary. The circuit of the receiver has been designed to reduce the effect of such variations to a minimum but care should be taken in replacing the converter and I.F. amplifier tubes. A replacement converter tube should be checked in the receiver to make sure that the inter-electrode capacities are the same as those of the tube originally employed. This is readily checked by noting any change in the calibration at the high end of any tuning band. This change should not exceed two or three dial division.

4-2. *Circuit Failures*

All components in the NC-46 receiver have been selected to provide an ample factor of safety but failure may occur in individual cases. Excluding tubes the most common failure will probably be due to a faulty capacitor or resistor. A bypass capacitor which has failed may cause overload of associated resistors. An overloaded resistor can sometines be located by visual inspection; scorching or discoloration may appear on the surface of the resistor. An open capacitor may be checked by temporarily connecting a good capacitor across it.

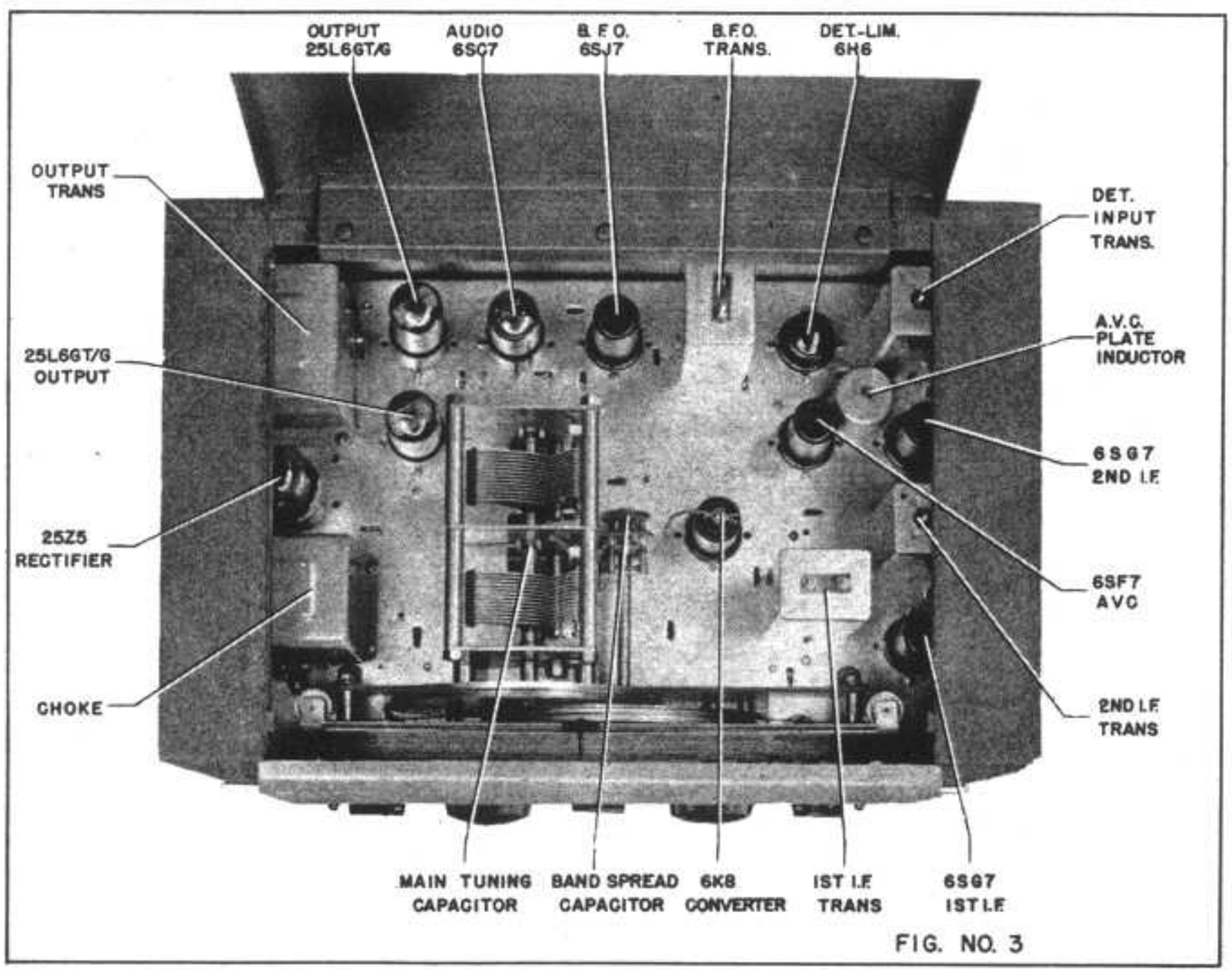


FIG. NO. 3

SECTION 5 ALIGNMENT DATA

5-1. *General*

All circuits are carefully aligned, before shipment, using precision crystal controlled oscillators, which insures close conformability to the dial calibration. A performance check of the receiver will determine the necessity of realignment. In most cases realignment will not be necessary unless the receiver has been tampered with or damaged.

The coil groups are mounted in a cadmium plated steel compartment which is directly below the main two gang variable capacitor. The oscillator coils are mounted nearest the left-hand side of the receiver with the first detector coils at the right. All coils have individual trimmer capacitors.

5-2. *I.F. Amplifier Alignment*

The intermediate frequency of the NC-46 Receiver is 455 kilocycles. The three I.F. transformers are of the permeability tuned iron-core type with primary and

secondary adjustments.

The first I.F. transformer adjustments, the primary of the second I.F. transformer and the secondary of the third I.F. transformer adjustments are made from inside the cabinet; the secondary of the second I.F. transformer and the primary of the third I.F. transformer adjustments are made through holes in the top of the cabinet. These holes are concealed by means of sliding buttons.

To properly align the receiver the equipment should be set up as specified in Section 3-2 except that the antenna be disconnected and the A.V.C. switch turned to "Off", the VOLUME control turned to 10 and the TONE control be switched "Off" An output meter having a 10 ohm resistive load should be connected to speaker output terminals. The high output lead of an accurately calibrated signal generator should be connected to the grid terminal of the converter tube and the grounded lead to any convenient point on the chassis. Adjust the output attenuator of the signal generator to provide a signal of approximately 100 microvolts and vary the tuning control of the signal generator slowly between the frequencies of 452 and 458 kilocycles. At some frequency between these points the I.F. amplifier of the receiver will show a sharply peaked response as indicated on the output meter. The I.F. tuned iron cores should be carefully adjusted to give a maximum reading on the output meter. The order in which these adjustments are made is not important.

5-3. Coil Alignment

Controls should be set as outlined in Section 3-2. Alignment is effected as follows:

a. H.F. Oscillator alignment

(1) Set the MAIN TUNING dial to some frequency at the high end of the tuning band to be aligned.

(2) Connect a signal generator, accurately tuned to deliver a signal of the same frequency as that indicated by the receiver dial setting, to the antenna input terminals through a standard 500 ohm dummy antenna.

(3) By checking the calibration of the receiver against the signal delivered by the signal generator, the accuracy of the H.F. oscillator alignment can be observed. If the dial reading of the receiver is found to be high it can be corrected by decreasing the capacity of the H.F. oscillator trimmer capacitor; conversely, low dial readings can be corrected by increasing the capacity of the trimmer.

(4) Care should be taken to insure that the H.F. oscillator is tuned to the fundamental frequency and not the image. This can be checked by tuning to the image frequency which should appear 910 kilocycles below the fundamental frequency and should be considerably weaker. If the operator finds the receiver is tuned to the image signal the capacity of the H.F. oscillator trimmer capacitor should be decreased until the fundamental frequency appears at the proper dial setting.

b. 1st Detector alignment.

(1) With the signal generator adjusted to deliver a modulated signal near the high frequency limit of the tuning band to be checked, the receiver should be tuned to give maximum output, as indicated by the output meter. The 1st detector trimmer capacitor should then be adjusted to give a maximum reading on the output meter. If this trimmer requires considerable realignment it may necessitate the realignment of the H.F. oscillator trimmer to maintain correct calibration.

(2) An alternate method of aligning the 1st detector in the event a signal generator is not available is to set the trimmers at the setting giving the maximum background noise. It will be found that this method gives a sufficiently sharp indication to provide good alignment.

SECTION 6 PARTS LIST

Symbol	Type	Rating
	CAPACITORS	
C1	Paper	0.1 mfd., 400 VDCW
C2A	Air	365 mmf. max.
C2B	Air	365 mmf. max.
C3	Paper	0.01 mfd., 400 VDCW
C4	Mica	See Note #1
C5	Air	See Note #1
C6	Air	See Note #1
C7	Mica	0.0047 mfd., 500 VDCW
C8	Paper	0.1 mfd., 400 VDCW
C9	Mica	100 mmf., 500 VDCW
C10	Paper	0.1 mfd., 400 VDCW
C11	Paper	1 mfd., 200 VDCW
C12	Paper	0.1 mfd., 400 VDCW
C13	Paper	0.01 mfd., 400 VDCW
C14	Paper	0.1 mfd., 400 VDCW
C15	Paper	0.01 mfd., 400 VDCW
C16	Paper	0.1 mfd., 400 VDCW
C17	Paper	0.01 mfd., 400 VDCW
C18	Paper	0.1 mfd., 400 VDCW
C19	Paper	0.01 mfd., 400 VDCW
C20	Paper	0.1 mfd., 400 VDCW
C21	Ceramic	50 mmf., 500 VDCW
C22	Mica	270 mmf., 500 VDCW
C23	Paper	0.1 mfd., 400 VDCW
C24	Paper	0.01 mfd., 400 VDCW
C25	Electrolytic	25 mfd., 50 VDCW
C26	Paper	0.01 mfd., 400 VDCW
C27	Paper	0.01 mfd., 400 VDCW
C28	Paper	0.02 mfd., 400 VDCW
C29	Paper	0.1 mfd., 400 VDCW
C30	Paper	0.1 mfd., 400 VDCW
C31	Electrolytic	40 mfd., 200 VDCW
C32	Electrolytic	40 mfd., 200 VDCW
C33	Paper	0.1 mfd., 400 VDCW
C34	Mica	270 mmf., 500 VDCW
C35	Mica	270 mmf., 500 VDCW
C36	Paper	0.1 mfd., 400 VDCW
C37	Paper	0.1 mfd., 400 VDCW
C38	Mica	0.001 mfd., 500 VDCW
C39	Mica	510 mmf., 500 VDCW
C40	Mica	510 mmf., 500 VDCW
C41	Mica	510 mmf., 500 VDCW
C42	Mica	510 mmf., 500 VDCW
C43	Mica	510 mmf., 500 VDCW
C44	Mica	510 mmf., 500 VDCW
C45	Paper	0.01 mfd., 400 VDCW
C46	Paper	0.1 mfd., 400 VDCW
C47	Bakelite	1 mmf., 400 VDCW
C48	Paper	0.1 mfd., 400 VDCW
C49	Ceramic	270 mmf., 500 VDCW
	Note #1. Capacitor ratings differ for each coil range and definite ratings cannot be listed.	
	RESISTORS	
R1	Fixed	470,000 Ohms, 1/2 w
R2	Fixed	10,000 Ohms, 1/2 w
R3	Fixed	220 Ohms, 1/2 w
R4	Fixed	1,000 Ohms, 1/2 w
R5	Fixed	1,000 Ohms, 1/2 w
R6	Fixed	470,000 Ohms, 1/2 w
R7	Fixed	560 Ohms, 1/2 w
R8	Not Used	
R9	Fixed	22,000 Ohms, 1/2 w
R10	Fixed	1,000 Ohms, 1/2 w
R11	Fixed	470,000 Ohms, 1/2 w
R12	Fixed	560 Ohms, 1/2 w
R13	Fixed	22,000 Ohms, 1/2 w
R14	Fixed	2,200 Ohms, 1/2 w
R15	Fixed	1,000,000 Ohms, 1/2 w
R16	Fixed	470,000 Ohms, 1/2 w
R17	Fixed	1,000,000 Ohms, 1/2 w
R18	Fixed	470,000 Ohms, 1/2 w
R19	Variable	500,000 Ohms, 1 w
R20	Fixed	3,900 Ohms, 1/2 w
R21	Fixed	270 000 Ohms, 1/2 w
R22	Fixed	270,000 Ohms, 1/2 w
R23	Fixed	270,000 Ohms, 1/2 w
R24	Fixed	68 Ohms, 1/2 w
R25	Fixed	270,000 Ohms, 1/2 w
R26	Fixed	270,000 Ohms, 1 2 w
R27	Fixed W.W.	5 Ohms, 5 w
R28	Fixed	100,000 Ohms, 1/2 w
R29	Fixed	100,000 Ohms, 1/2 w
R30	Fixed	100,000 Ohms, 1/2 w
R31	Fixed	50,000 Ohms, 1/2 w
R32	Fixed	470,000 Ohms, 1/2 w
R33	Fixed	470,000 Ohms, 1/2 w
R34	Fixed	22,000 Ohms, 1/2 w
R35	Fixed	2,200,000 Ohms, 1/2 w
R36	Fixed	100 Ohms, 1/2 w
R37	Variable	10,000 Ohms, 1½ w
R38	Fixed	22,000 Ohms, 1/2 w
R39	Fixed	33,000 Ohms, 1/2 w

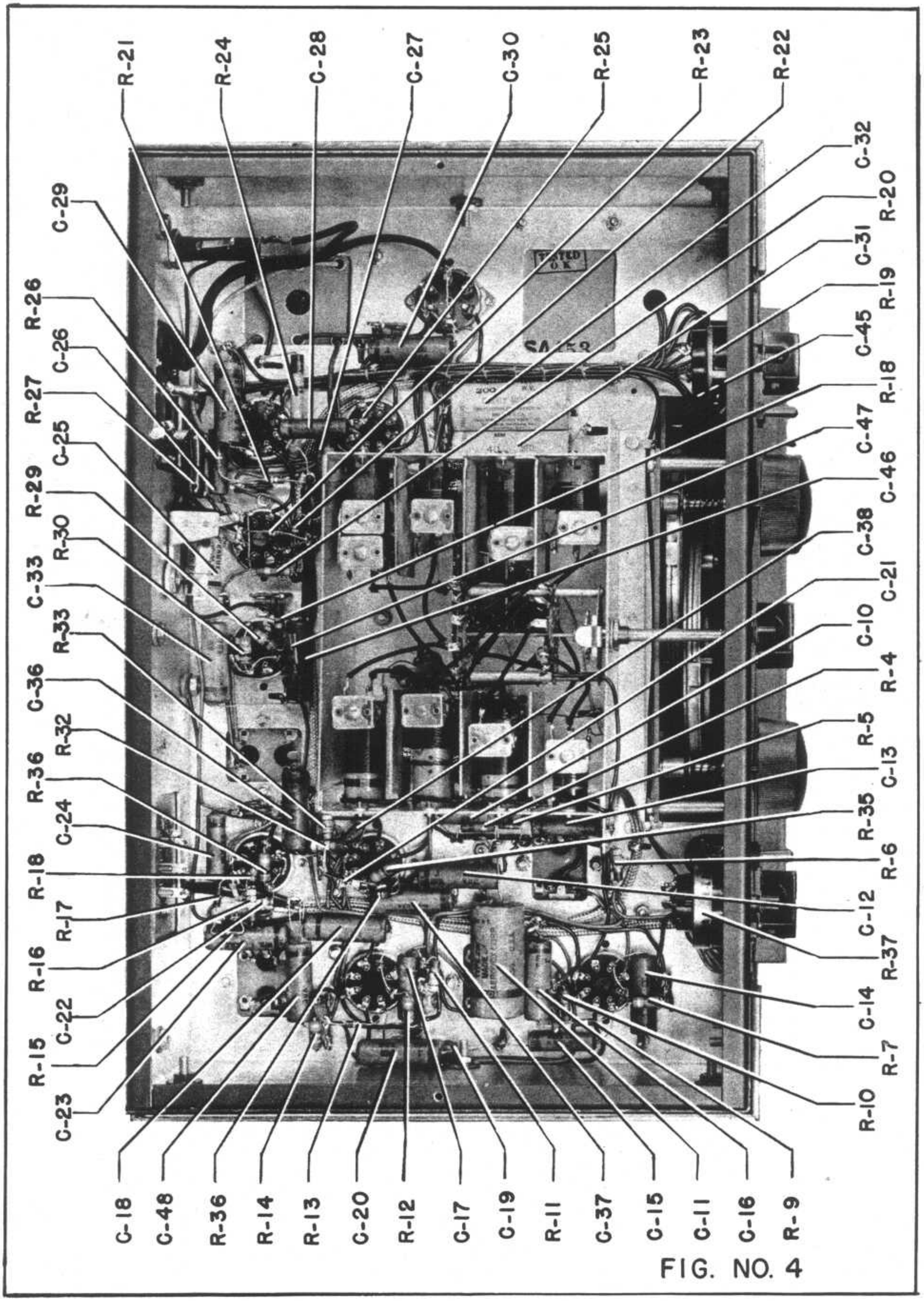

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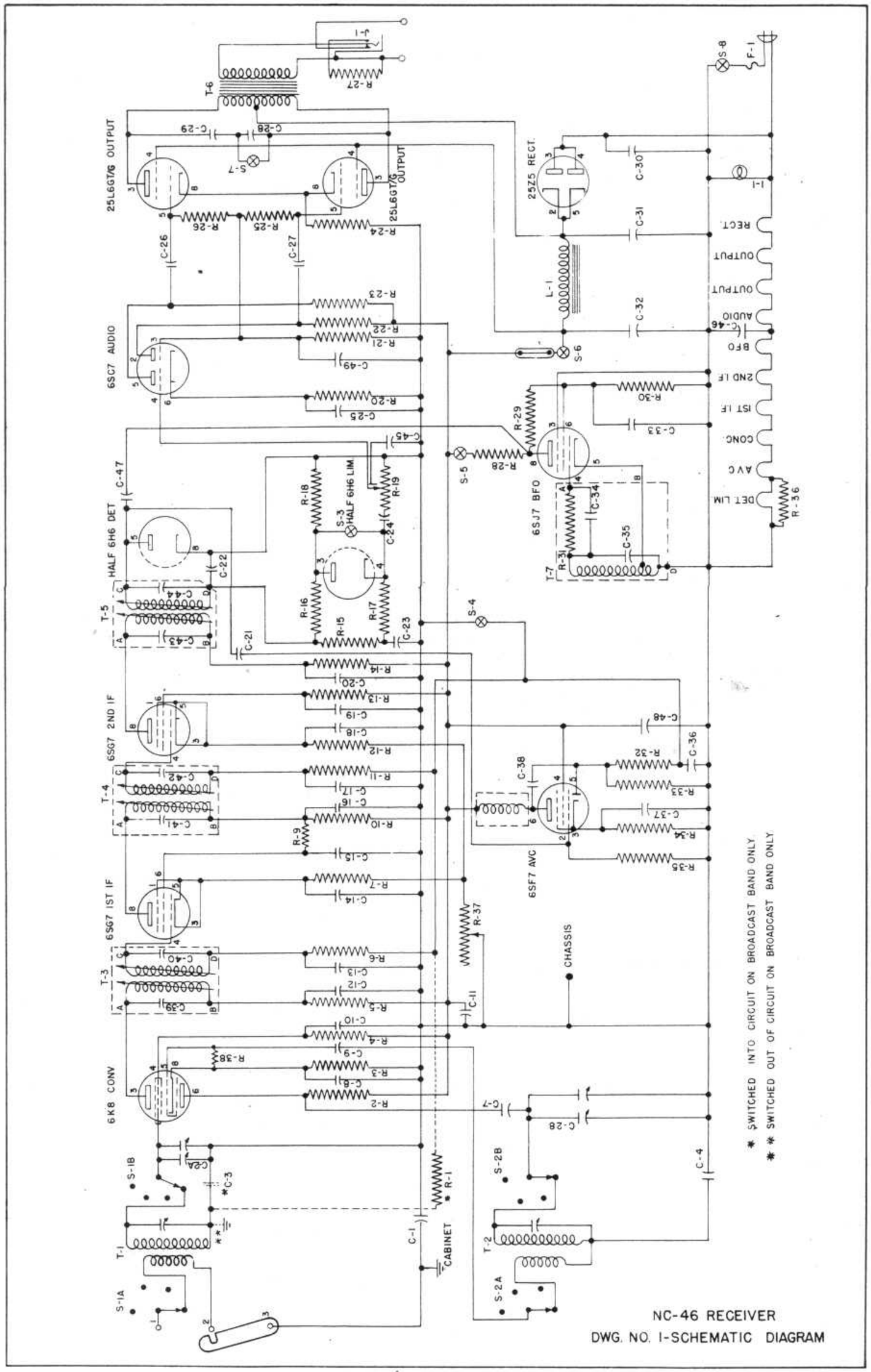
FIG. NO. 4



NC-46 RECEIVER
DWG. NO. I-SCHEMATIC DIAGRAM

THE NATIONAL NC-46 RECEIVER

Price List

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NC-46 Receiver, table mounting, two-tone gray finish, complete with tubes, band-spread coverage, noise limiter, beat frequency oscillator and 120 volt, 50-60 cycle, A.C. D.C., built-in power supply.

NC-46TS 6″ PM Loudspeaker in matching cabinet.

Prices on Application

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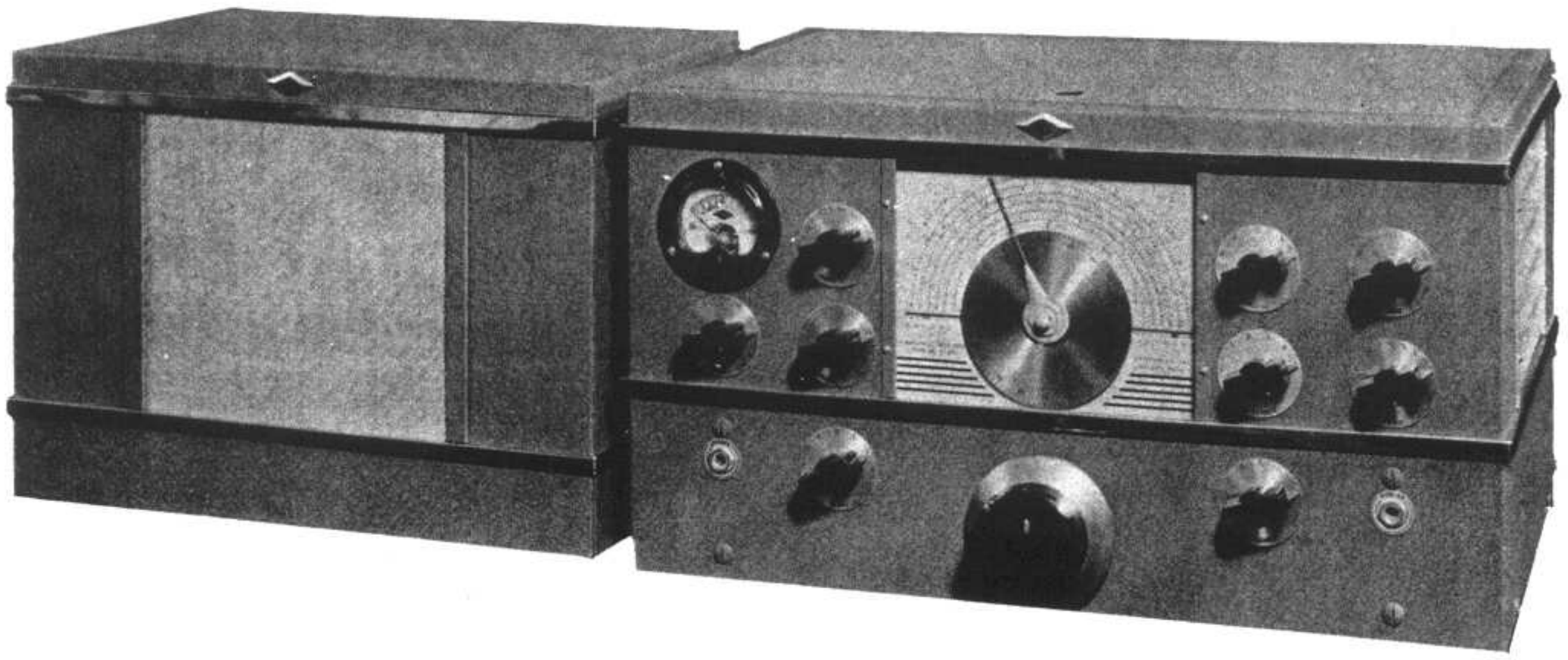
National Co., Inc., Malden. Mass., U.S.A.



THE NATIONAL NC-2-40C SERIES COMMUNICATIONS RECEIVER

DESCRIPTION

The NC-2-40C Radio Receiver is a twelve tube superhetrodyne built for exacting service in the communication field. This receiver is a new modern product of the National Company incorporating many new and improved concepts in receiver design and construction. Some of the operational features of this receiver are a highly stable high frequency oscillator, a flexible crystal filter with variable selectivity and phasing, and a series valve noise limiter.

CONTROLS

Band Tuning and Band Switching; R.F. Gain; Audio Gain; B+ On/Off; Selectivity; Phasing; Limiter; Tone; C.W. Oscillator; A.V.C.

TUBES

R.F. Amplifier	6SK7
First Detector	6K8
H.F. Oscillator	6J5
First I.F. Amplifier	6K7
Second I.F. Amplifier	6SK7
Second Detector-Limiter	6SL7GT/G
Automatic Volume Control	6SJ7
Beat Frequency Oscillator	6SJ7
Amplifier and Phase Inverter	6SN7GT/G
Push-Pull Audio Output (2)	6V6
Rectifier	5Y3G

FREQUENCY RANGE

NC-2-40C; 490 K.C. to 30 M.C.
NC-2-40CS; 200 to 400 K.C. and 1.0 to 30 M.C.

PRICE'S

Rack or Table Model Complete with Tubes	List $375.00
Loudspeaker in Matching Cabinet	$ 25.00

HRO-C -- A Deluxe Receiver Installation consisting of an HRO with an SPC Unit (power unit, coil container and loudspeaker) in an MRR Table Rack. Chromium-plated appearance strips and side trim strips included.

THE NATIONAL HRO-5 SERIES COMMUNICATIONS RECEIVERS

DESCRIPTION

The HRO series of radio receivers is an honored product of the National Company. This equipment has proven itself to be a high performance reliable communication receiver suitable for use in any type of installation for the reception of radio signals. Operational features include two preselector stages, a flexible crystal filter, a signal strength meter, a separate beat frequency oscillator stage, and automatic volume control.

CONTROLS

Band Tuning; A.V.C. On/Off; B+ On/Off; Audio Gain; R.F. Gain; C.W. Oscillator; Selectivity; Phasing; S-Meter On/Off.

TUBE'S

First R.F. Amplifier	6K7
Second R.F. Amplifier	6K7
First Detector	6J7
High Frequency Oscillator	6J7
I.F. Amplifiers (2)	6K7
Diode Detector-1st Audio-AVC	6SQ7
Second Audio	6V6GT/G
Beat Frequency Oscillator	6J7

PRICES

HRO Table Receiver (with tubes & A,B,C,D coils)	List $329.50
HRO Rack Receiver (with tubes & A,B,C,D coils)	352.00
697 Table Power Unit	29.50
SPU 697 Rack Power Unit	55.00
MCS 8" PM Table Loudspeaker	18.25
RFSH 8" PM Rack Loudspeaker	33.00
HRO-C Deluxe Receiver Combination	475.00
SPC Unit Combination	99.00
MRR Table Rack	24.75

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