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**NATIONAL RESEARCH COUNCIL OF CANADA  
RADIO SECTION**

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Date:.....

**OTTAWA  
OCTOBER, 1941**

CANADA INSTITUTE FOR S.T.I.  
**N.R.C.C.**  
JUN 17 1997  
INSTITUT CANADIEN DE L'I.S.T.  
**C.N.R.C.**

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**PRA-11**

Copy No. 22

ANALYZED

Revision of Previous  
Pamphlet entitled  
"N.W. Set #2"  
May, 1941.

**NATIONAL RESEARCH COUNCIL OF CANADA**

**RADIO SECTION**

**N.W. SET #2**

**DESCRIPTION**

**OTTAWA**

**OCTOBER, 1941**

5804066

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N.W. SET #2  
DESCRIPTION

PRA-11

GENERAL

N.W. #2 operates on a wavelength of 140 cm. It requires a 110-120 volt, 60 cycle supply and draws a total of about 4 amperes.

The two units (receiver and transmitter) can be readily assembled with the aid of Drawings 26 and 27, filed at the back of these instructions, and by following the code markings on the several cables found within the cabinets. The proper locations for the various electron tubes can be found in Drawings 28 to 34. The inter-cabinet cables are indicated in Drawing 8.

RECEIVER UNIT

1. Line Voltage Control The variac on the receiver unit (Dwgs. 8 & 26) controls the supply voltage to both receiver and transmitter units. This voltage is indicated on both units by A.C. voltmeters (Dwgs. 26 & 27). From the variac the current passes through plug fuses and door interlock switches on each unit, thence to the power switches.

2. Receiver Power Supply Chassis (Dwg. 30) The receiver power switch is located at the bottom of the meter panel (Dwg. 26) and an auxiliary power switch is situated behind the power chassis (Dwg. 30). These switches control the filament supplies, the 300 volt regulated plate supply (Dwg.16), the -150 volt bias supply (Dwg.15) and the 3600 volt scanning supply (Dwg.9). There is a switch for the latter on the back of the chassis.

The output potential of the regulated supply may be adjusted by means of a rheostat (screwdriver control) on the top of the chassis.

3. Receiver Chassis (Dwgs. 11, 23, 24 & 28) The receiver for N.W. #2 has one R.F. stage whereas N.W. #1, which was demonstrated at Halifax, had none. Receivers with two and three R.F. stages are now being prepared for production. The model with one R.F. stage gives satisfactory results, but the later models considerably improve the signal-to-noise ratio.

The R.F. and first detector stages are tuned by screwdriver adjustment from the front of the panel (Dwg. 26). The local oscillator frequency is adjusted by the knob on the same panel. The gain control (screen voltage on I.F. stages) is situated in the center of the meter panel.

4. Scanning Chassis (Dwgs. 18, 25, 26 & 29) The centering, focus and intensity controls are on the front of the panel. The recurrence frequency control (Dwg. 29) is normally adjusted to 1000 c.p.s. The sweep balancing control is adjusted, if necessary, to give a 45° line on the C.R. tube when the sweep voltage from the 6AC7 tube is applied to one pair of deflecting plates, and that from the 884 to the other pair. The range in miles represented by the length of the scanning line may be altered by changing the position of the plug in the four red plug sockets above the C.R. tube socket. The ranges provided are roughly 3-1/2, 7, 10 and 14 miles.

TRANSMITTER UNIT

1. Oscillator Power Supply and Modulator Chassis  
(Dwgs. 13, 17 & 32)

The control switches are found on the meter panel (Dwg. 27). The variac on the bottom panel controls the oscillator plate supply voltage. The pulse duration control is situated on the back of the power pack chassis (Dwg. 32).

2. Oscillator Chassis (Dwgs. 19 & 31) The controls on the front of the panel (Dwg. 27) are the aerial coupling condenser, the plate tuning condenser and the grid leak control. The latter is not critical.

3. Monitor Chassis (Dwgs. 20, 21 & 33) The monitor indicates the form of output pulse being transmitted. The signal is picked up on a short aerial behind the panel, and applied to the monitor C.R. tube. A toggle switch on the front of the panel (Dwg. 27) changes the pulse control from receiver to transmitter. In the latter case the pulse is generated in the monitor chassis, allowing the transmitter to be tested in the absence of the receiver. Ganged with this switch is another which takes the triggering pulse to the modulator unit from the scanning chassis or the monitor chassis, respectively. A screwdriver control on the chassis (Dwg. 33) controls the recurrence frequency of this monitor pulse generator. Another screwdriver control at the rear of the chassis controls the sweep delay.

AERIALS (Dwgs. 35 & 36)

Two billboards covered with 1/4" mesh wire cloth are required to mount the two 20-element arrays. Only the arrays proper are being sent. Details are given in Drawings 35 and 36.

Each array is centre fed and has an impedance of about 150 ohms. Open wire or concentric line may be used, but in either case provision must be made for matching the line to the array. This may most easily be done with a stub on the open wire feeder at the array. The length and position of this stub can only be found by experiment.

Using the transmitter as a test oscillator, with 600-800 volts on the plates, it should be possible to reduce the standing wave ratio to 1.3 or better. Trombones are provided in case it is desirable to use concentric line. These have an impedance of 280 ohms when connected to 70 ohms concentric. Soft copper coaxial cable, type 22, supplied by Victor J. Andrew of Chicago, Ill., is recommended. A trombone is provided to bring the balanced transmitter output to the unbalanced coaxial cable. This may be mounted inside the transmitter with flexible leads to adjustable clips on the coupling loop.

If open wire line is used to the receiver, this trombone may be used to bring the line into concentric for the receiver input. The tap on the grid coil of the R.F. stage may have to be adjusted together with the tuning condenser, in order to obtain the best match to the feeder.

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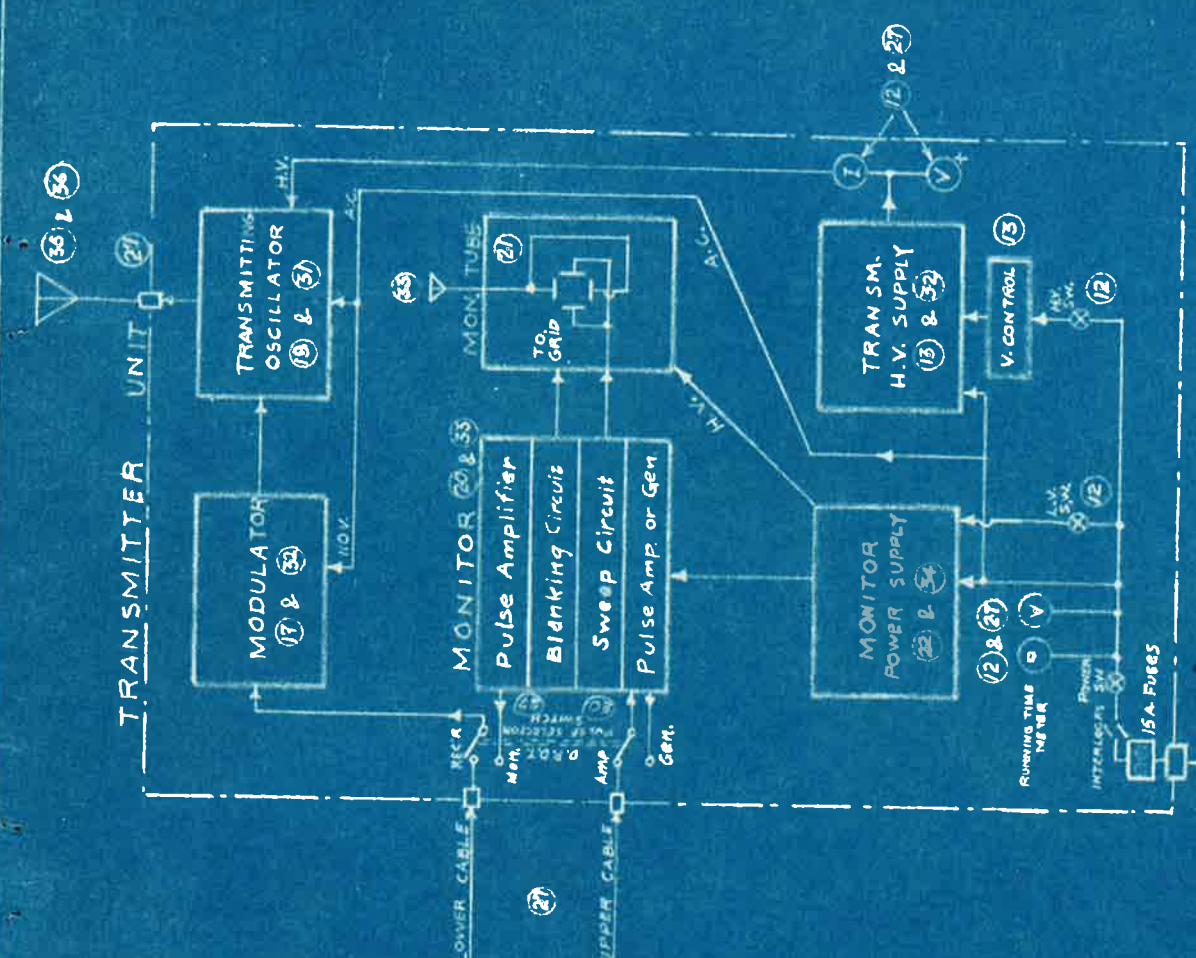
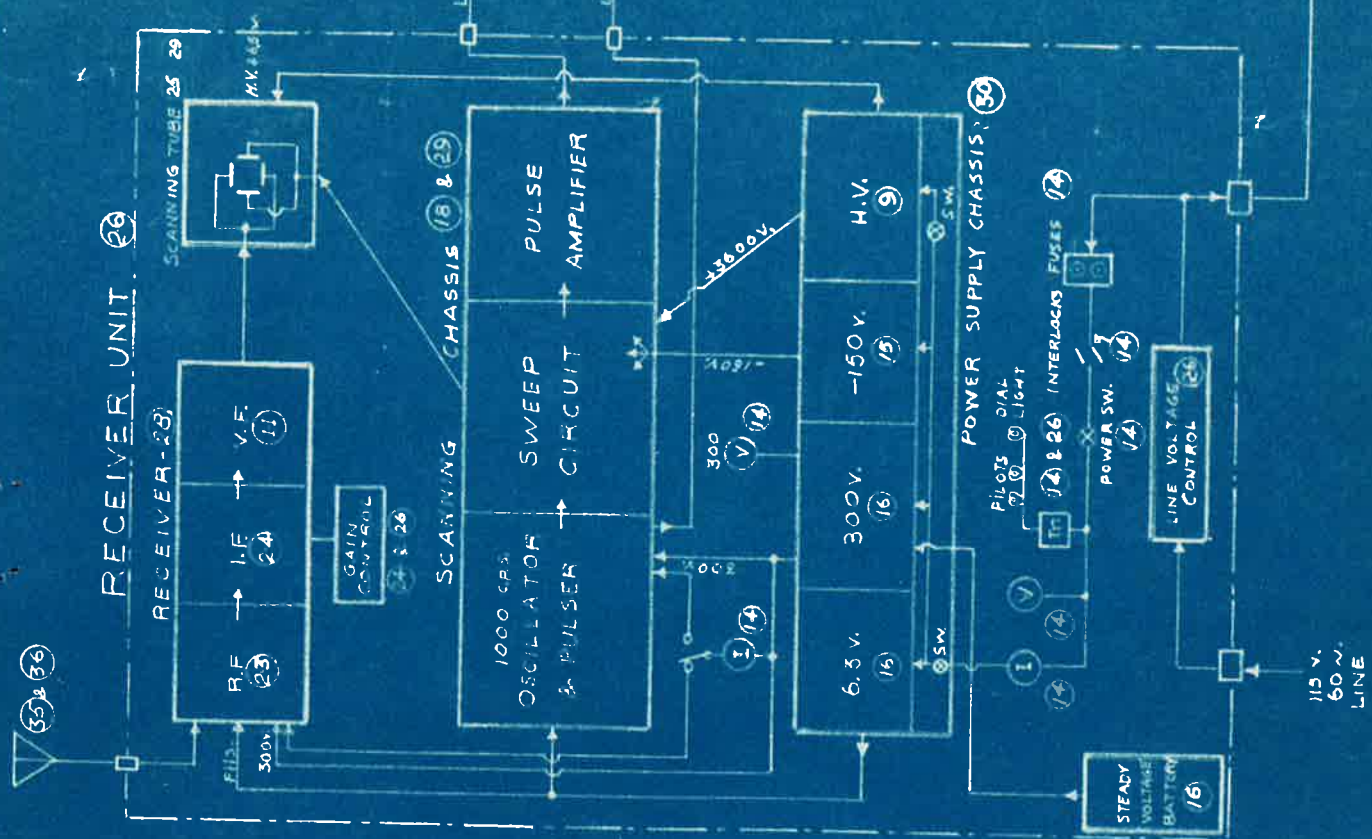
OPERATING INSTRUCTIONS

Turn on the receiver and transmitter power switches and adjust the variac on the receiver to 120 volts. When the sweep on the scanning tube is working, switch on the high voltage on the transmitter and turn up its variac to 110-130. Tune the oscillator; if necessary, also the receiver. Observe the 'pips' on the scanning sweep line produced by reflected signals.

- CAUTION
1. Never turn off the receiver with high voltage on the oscillator plates, as they are likely to flash over.
  2. If making adjustments on the transmitting chassis with power on, avoid contact with the plate circuit, which carries 9000 volts; similarly on the scanning chassis where 3600 volts are present.

LIST OF DRAWINGS

- 8 Block Circuit Diagram and Key to Drawings
- 9 C.R. Power Supply
- 10 Socket Connections
- 11 Video Amplifier
- 12 Transmitter Meter Panel
- 13 Oscillator Power Supply
- 14 Receiver Meter Panel
- 15 Bias Supply
- 16 Regulated 300 V. Power Supply
- 17 Modulator
- 18 Scanning Chassis
- 19 Transmitter Oscillator Circuit
- 20 Monitor Circuit
- 21 Monitor Tube Connections
- 22 Monitor Power Supply Circuit
- 23 R.F. Amplifier
- 24 4 Stage I.F. Amplifier
- 25 Scanning Tube Connections
- 26 Front View of Receiver Unit
- 27 Front View of Transmitter Cabinet
- 28 Layout of Receiver Chassis
- 29 Layout of Scanning Chassis
- 30 Layout of Receiver Power Supply Chassis
- 31 Layout of Oscillator Chassis
- 32 Layout of H.V. Power Pack and Modulator
- 33 Layout of Monitor Chassis
- 34 Layout of Monitor Power Pack
- 35 20 Element 140 Cm Array
- 36 Billboard for 140 Cm Arrays



SECRET

National Research Council  
Radio Section — Ottawa

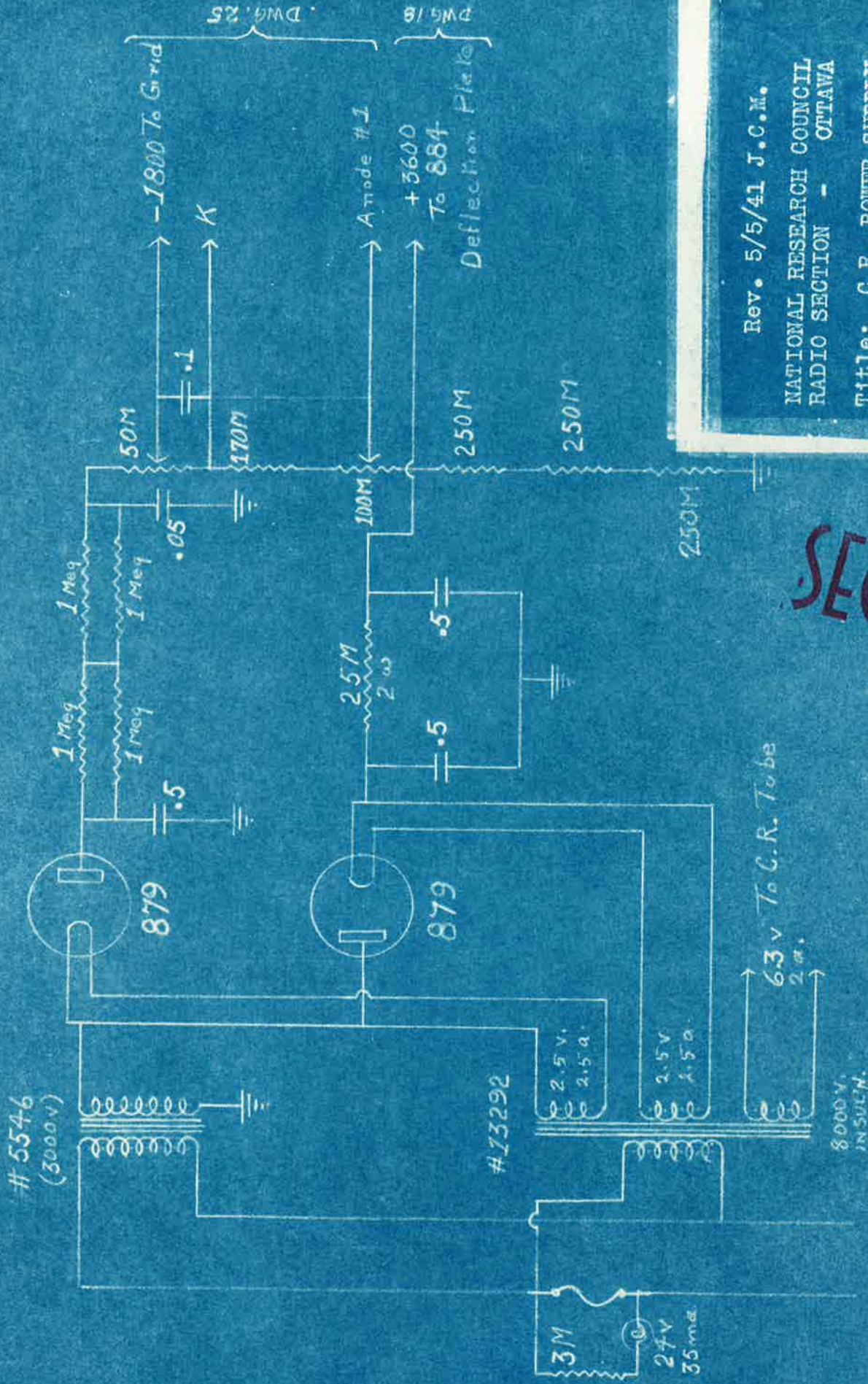
Title Block Circuit Dia: &  
Key to Drawings  
N. W. #2

Orig by J.C.M. Retrace by J.L.C.  
Oct 21/41

Drawn by J.C.M. CH'K by J.C.M.

Date Aug. 5/41 Per No. 8

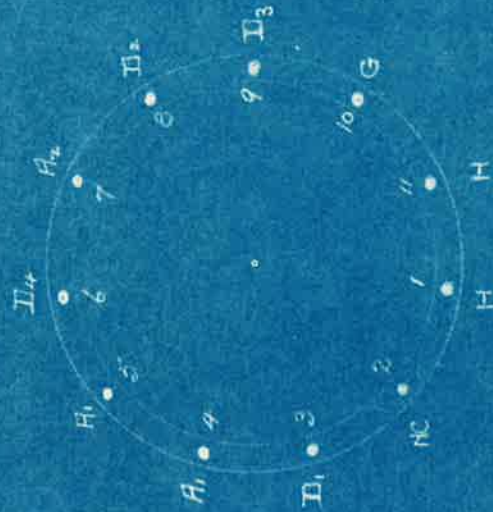
No Numbers in Circles Refer to Drawings.



**SECRET**

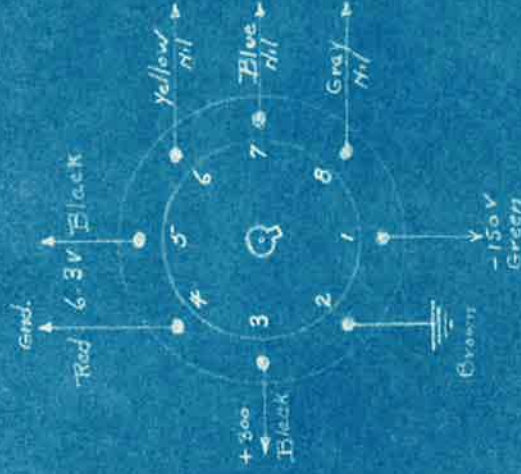
Rev. 5/5/41 J.C.M.  
 NATIONAL RESEARCH COUNCIL  
 RADIO SECTION - OTTAWA  
 Title: C.R. POWER SUPPLY  
 N.W. #2  
 Orig. by J.C.M.  
 Drawn by J.E.L.  
 Ck'd by H.R.S.  
 Date Feb. 24/41 REF. #9

5AF4

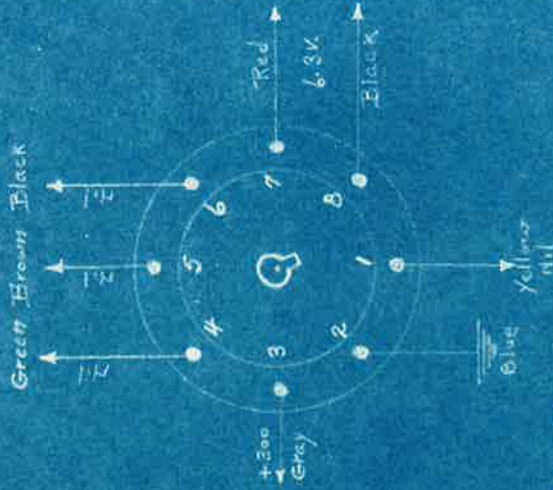


(cf DWG 75)

Scanner Connector



Receiver Connector

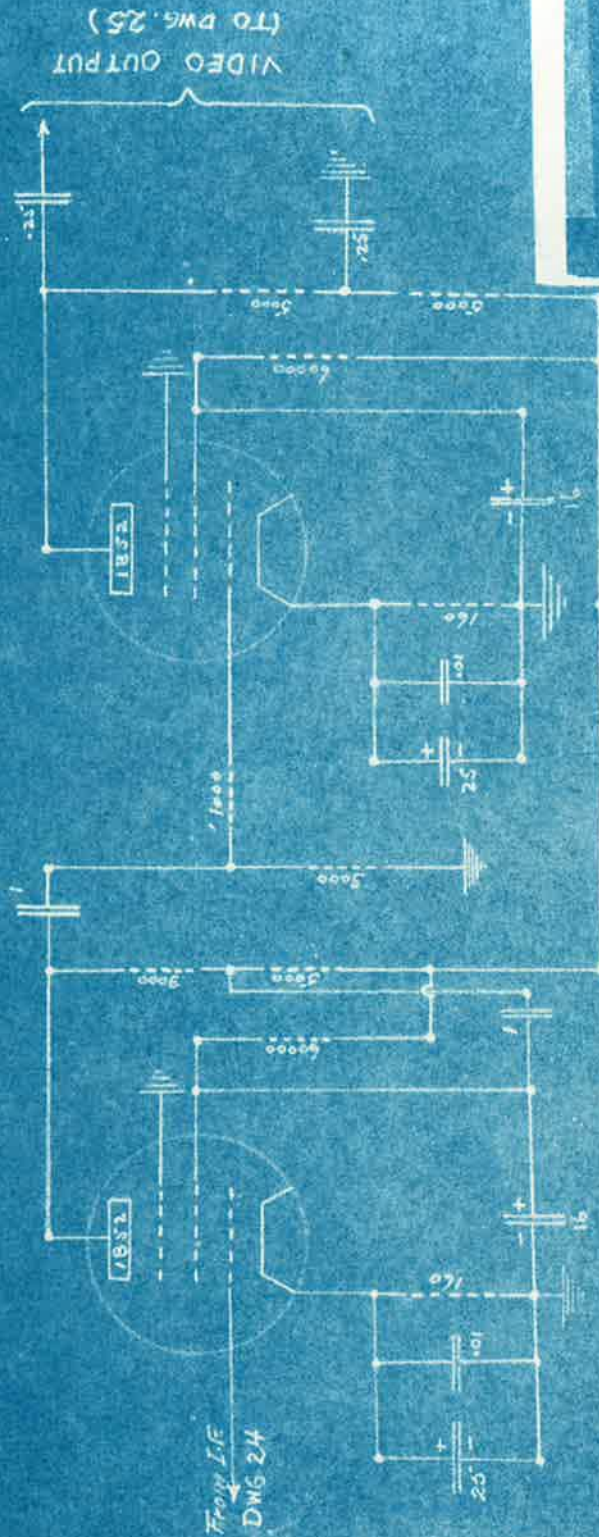


cf. DWGS. 28-30

SECRET

Rev. 6/5/41 J.C.M.  
 NATIONAL RESEARCH COUNCIL  
 RADIO SECTION - OTTAWA

Title: SOCKET CONNECTIONS  
 N.W.#2 140 CM  
 Orig. by H.R.S.S.  
 Drawn by H.R.S.S.  
 Ck'd by H.R.S.S.  
 Date Feb./41 REF. #10



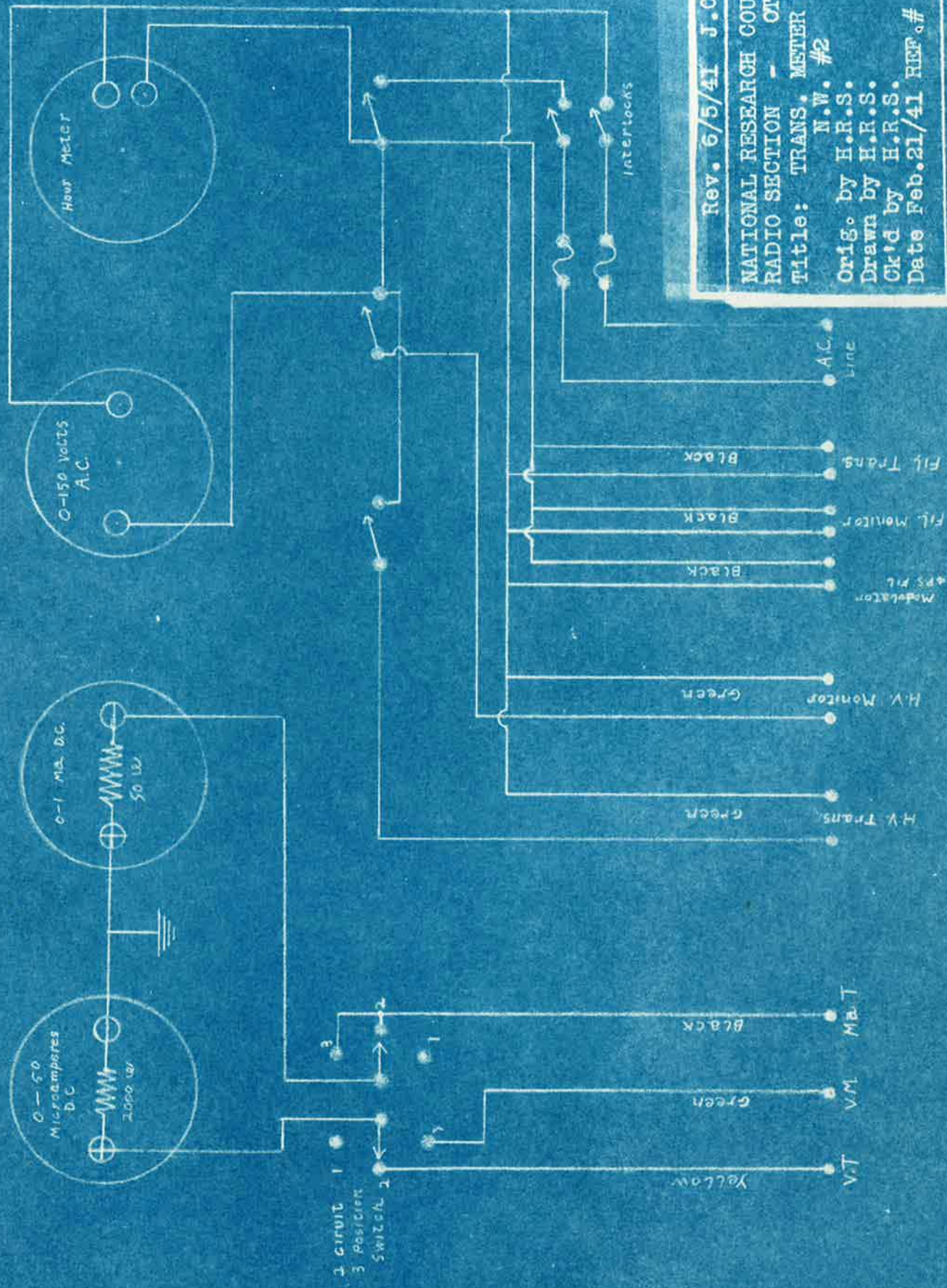
From I.F.  
DWG 24

Rev. 6/5/41 J.C.M.  
 NATIONAL RESEARCH COUNCIL  
 RADIO SECTION - OTTAWA  
 Title: VIDEO AMPLIFIER  
 N.W. #2 140 CM  
 Orig. by H.R.S.  
 Drawn by H.R.S.  
 Ckd by H.R.S.  
 Date Feb./41 REF. #11

**SECRET**

+300 V  
DWG. 16

# SECRET



Rev. 6/5/41 J.C.M.

NATIONAL RESEARCH COUNCIL  
RADIO SECTION - OTTAWA

Title: TRANS. METER PANEL  
N.W. #2

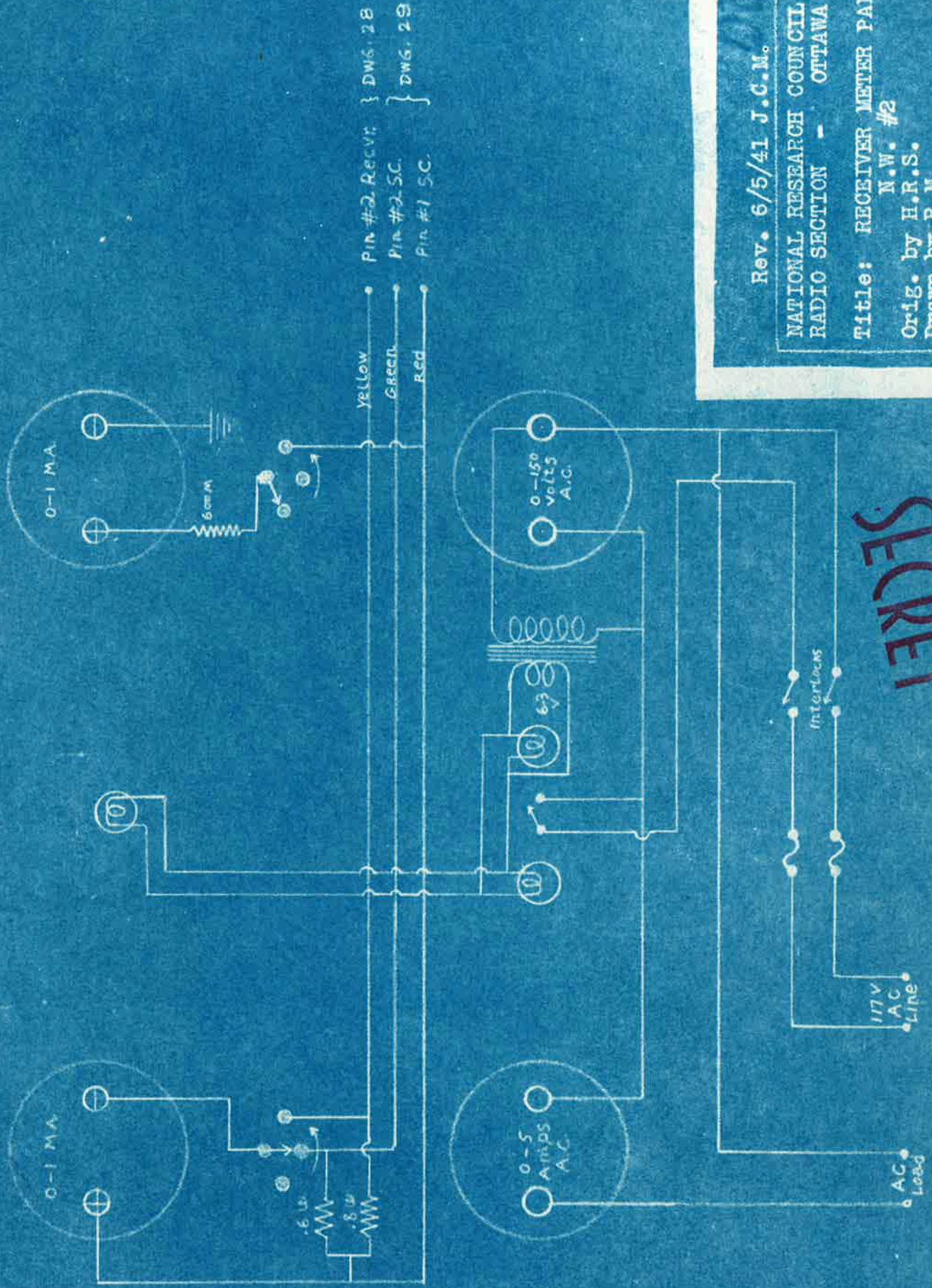
Orig. by H.R.S.

Drawn by H.R.S.

Ck'd by H.R.S.

Date Feb. 21/41 REF. # 12





Pin #2 Recvr } DWG. 28  
 Pin #2 SC. } DWG. 29  
 Pin #1 SC.

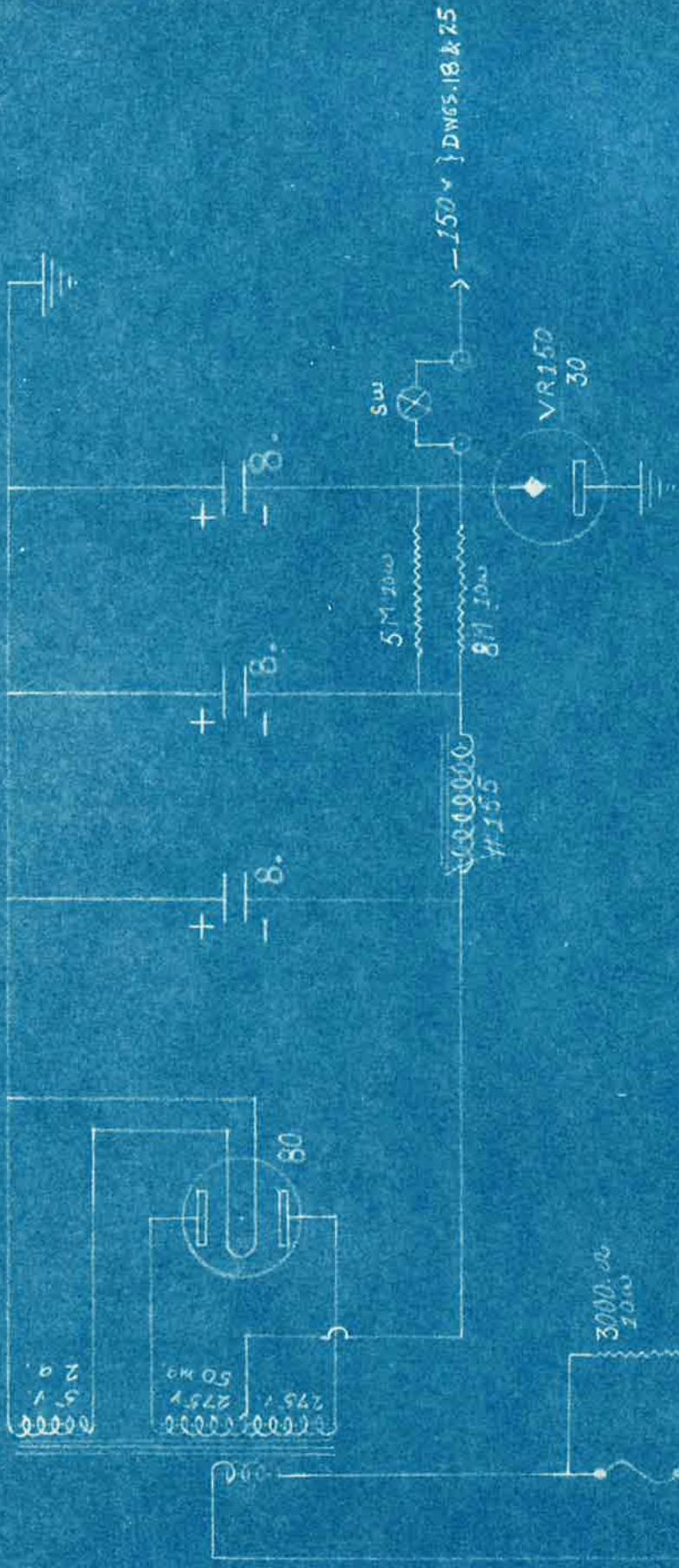
Rev. 6/5/41 J.C.M.

NATIONAL RESEARCH COUNCIL  
 RADIO SECTION - OTTAWA

Title: RECEIVER METER PANEL  
 N.W. #2  
 Orig. by H.R.S.  
 Drawn by R.M.  
 Ckd by H.R.S.  
 Date Feb. 20/41 REF. #14

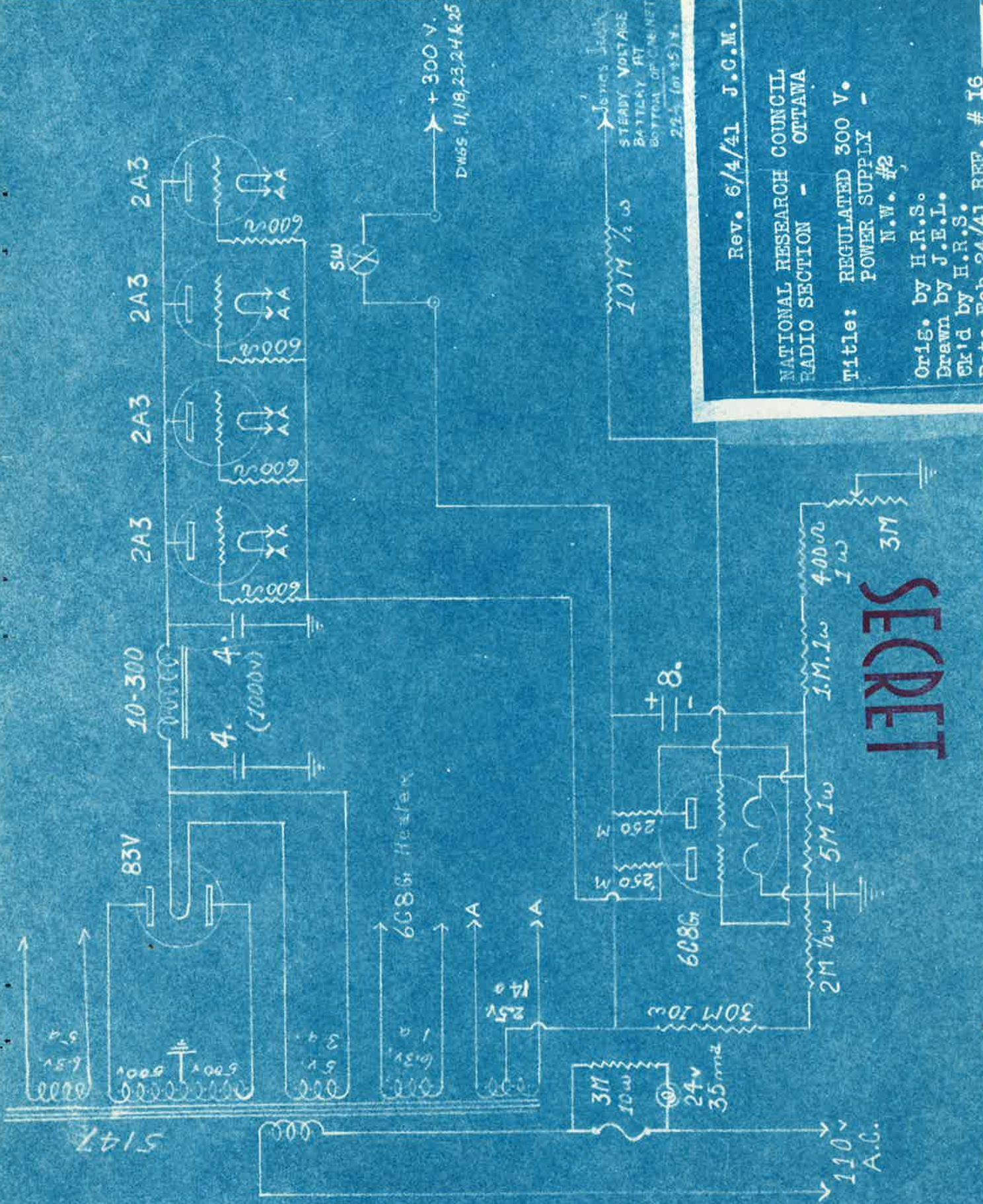
SECRET

#271



SECRET

Rev. 6/5/41 J.C.M.  
 NATIONAL RESEARCH COUNCIL  
 RADIO SECTION - OTTAWA  
 Title: BIAS SUPPLY  
 N.W. #2  
 Orig. by H.R.S.  
 Drawn by J.E.L.  
 Ck'd by H.R.S.  
 Date Feb. 22/41 REF. #15



Rev. 6/4/41 J.G.M.

NATIONAL RESEARCH COUNCIL  
RADIO SECTION - OTTAWA

Title: REGULATED 300 V.  
POWER SUPPLY -  
N.W. #2

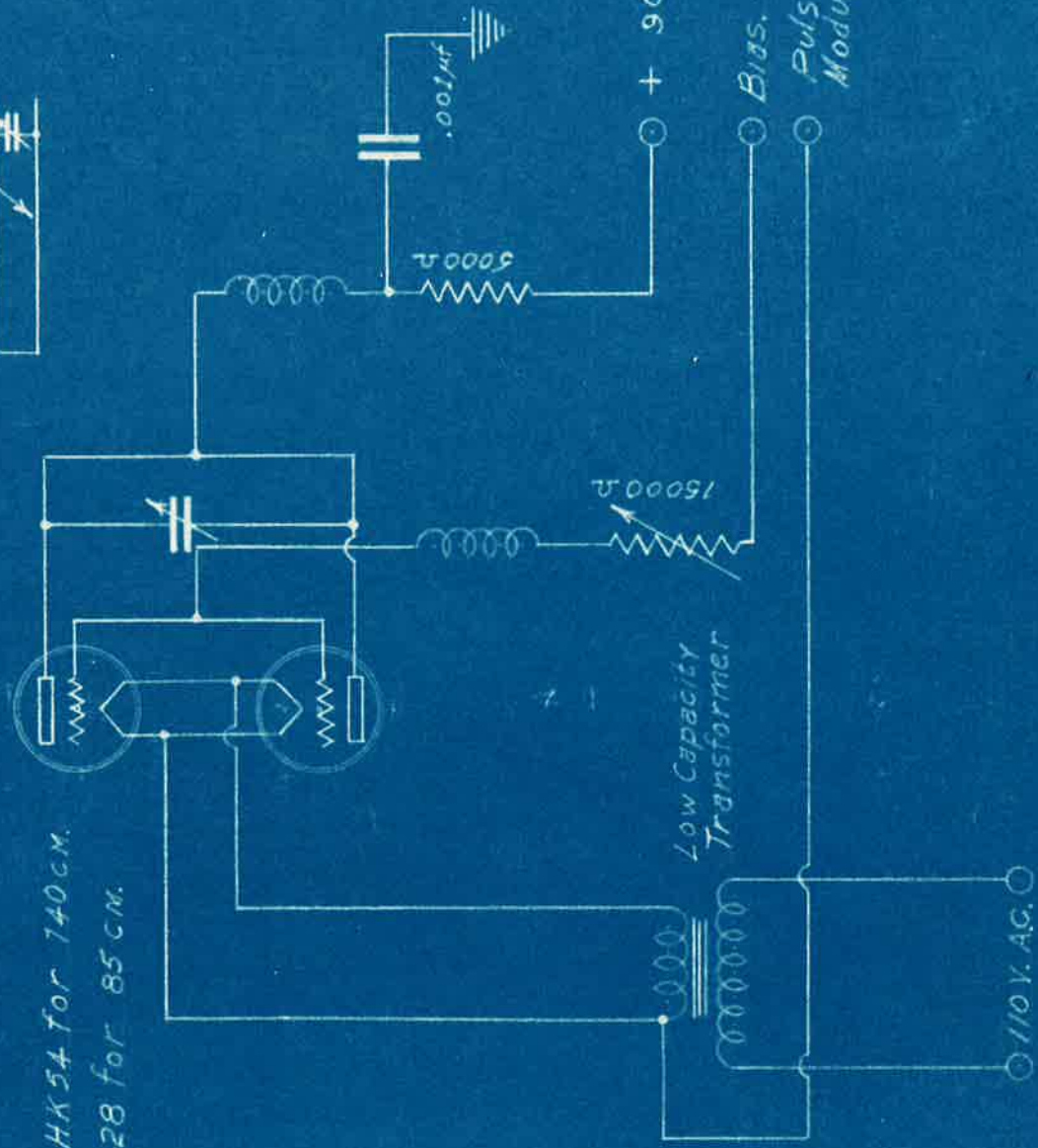
Orig. by H.R.S.  
Drawn by J.E.L.  
Ck'd by H.R.S.  
Date Feb. 24/41 REF. # 16

SECRET





To Aerial



HK54 for 140cm.  
 1628 for 85cm.

Low Capacity  
 Transformer

+ 9000 V. Dwg #5

Bias. + 200 V. Dwg #10  
 Pulse from  
 Modulator

110 V. A.C.

**SECRET**

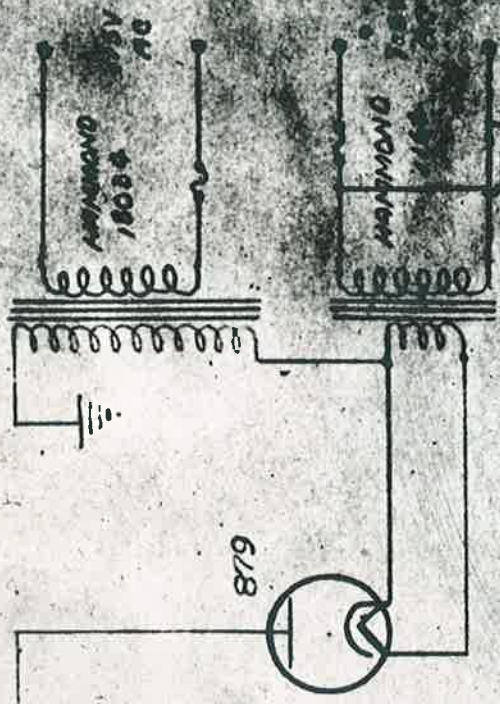
National Research Council	
Radio Section - Ottawa	
Title: Transmitter Oscillator Circuit N.W.#2	
Orig. by H.R.S.	Rechecked by J.L.C. Oct 27/41
Drawn by J.L.C.	CHK. by
Date Mar. 11/41	Ref. No. 19





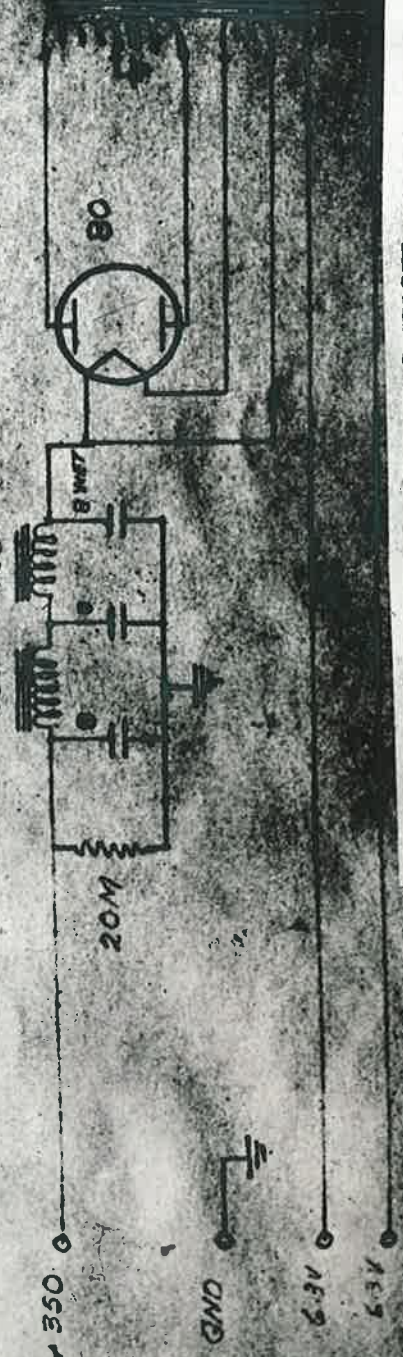
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HAMMOND 990 CHOKES



NOTE: HAMMOND 1166 & 1167 TRANSFORMERS MAY BE INCORPORATED IN A SINGLE SPECIAL TRANSFORMER.

HAMMOND CHOKES 157 158



- 2200

C.R. 63V

FILE 63V

350

GND

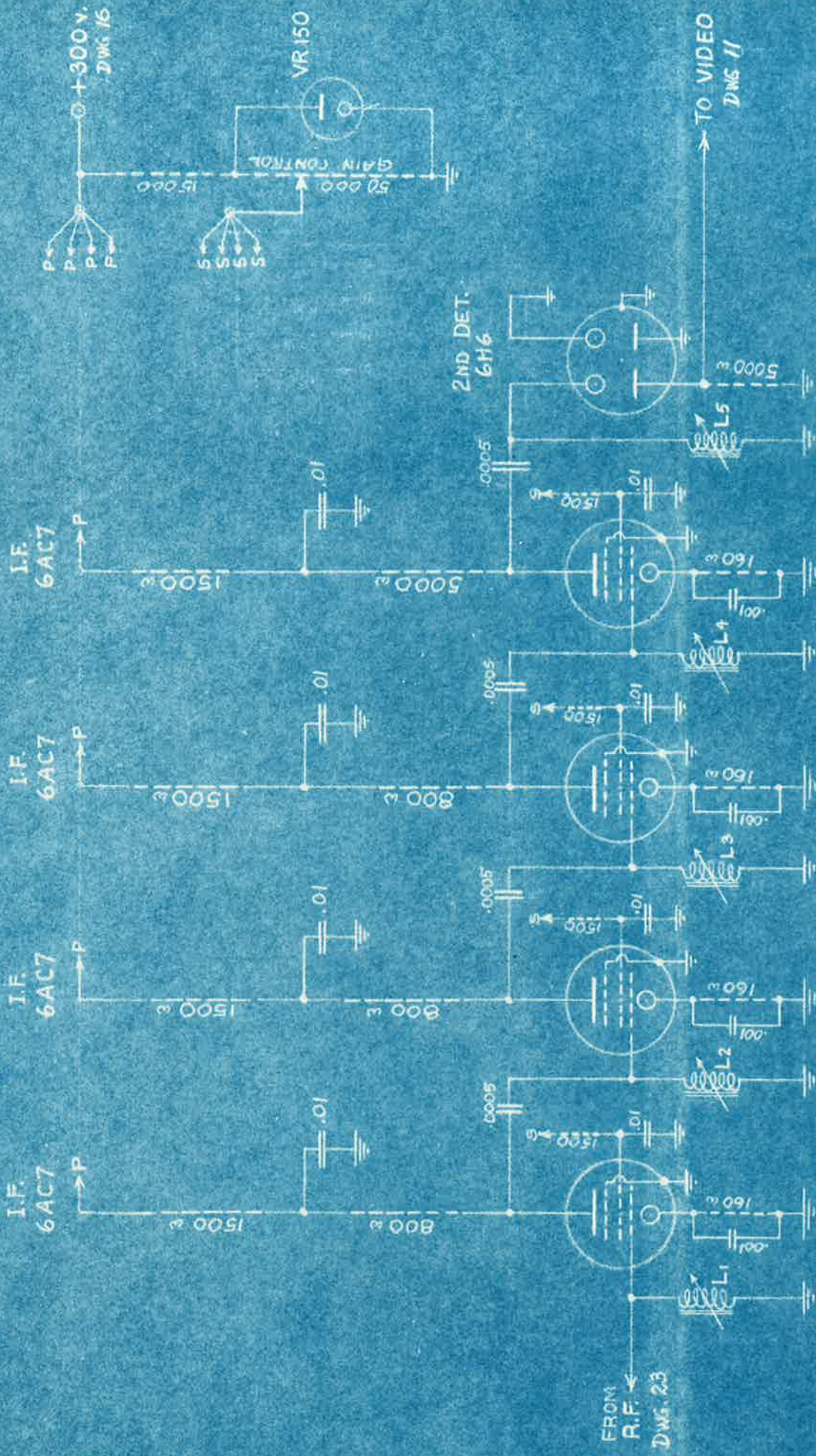
63V

63V

NATIONAL RESEARCH COUNCIL  
 RADIO SECTION - OTTAWA  
 Title: MONITOR POWER SUPPLY CIRCUIT  
 Orig. by J.W.B. Drawn by H.M. Ck'd by H.R.S.  
 Date Feb. 4/41 REF. #22

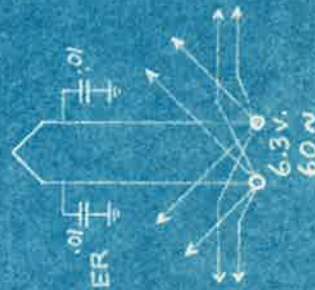
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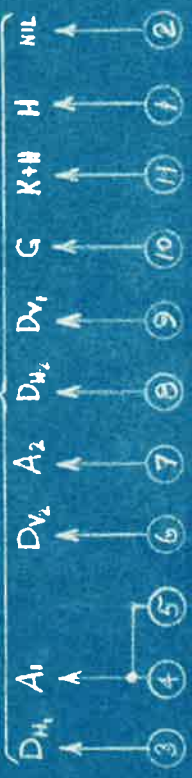
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NATIONAL RESEARCH COUNCIL  
 RADIO SECTION - OTTAWA  
 Title: 4 STAGE I.F. AMPLIFIER  
 15 MC - N.W. #2  
 Orig. by J.C.M.  
 Drawn by J.C.M.  
 Ckd by H.M.  
 Date Feb. 5/41 REF. #24

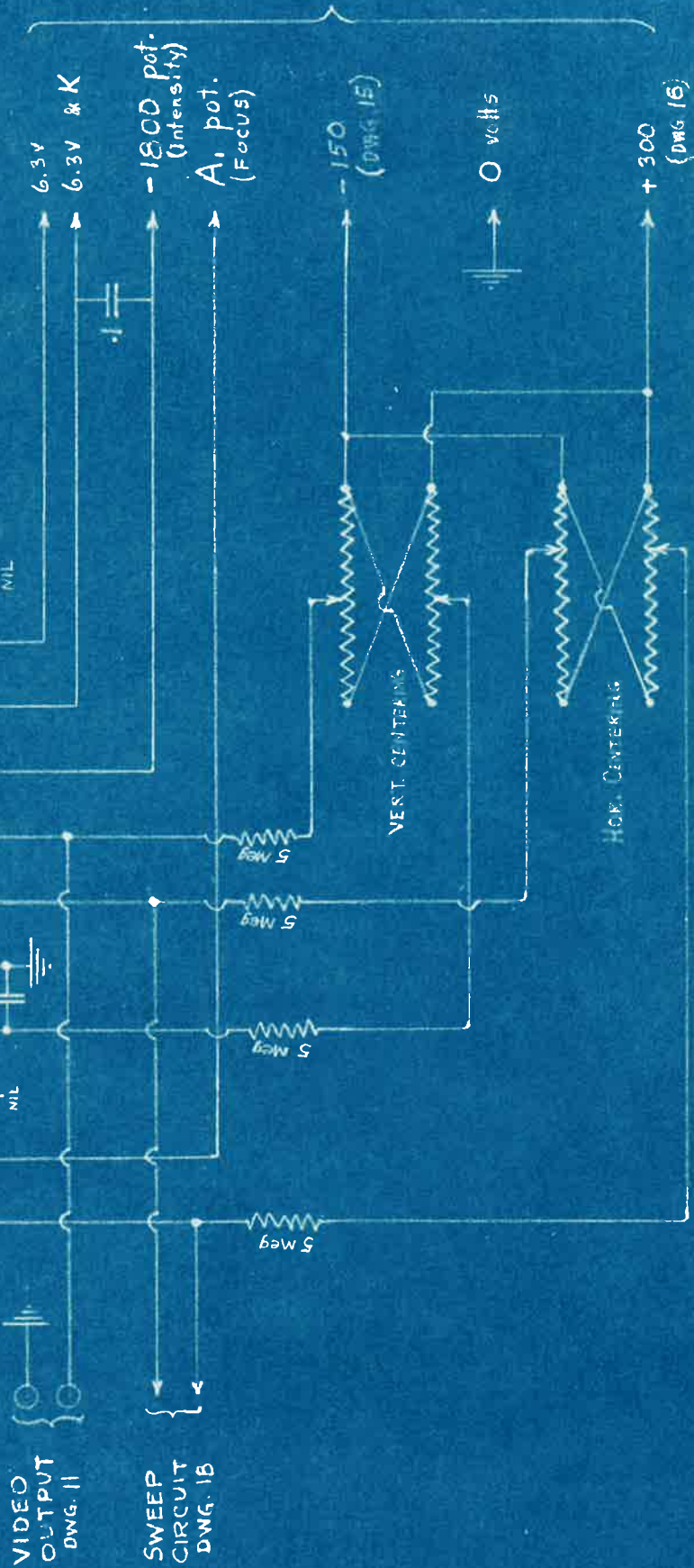


TYPICAL HEATER

C.R. TUBE - 5AP1 or 5AP4



SOCKET - DWG. 10



TO POWER UNIT  
DWG. 9

**SECRET**

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RADIO SECTION - OTTAWA

Title: SCANNING TUBE CONNECTIONS -  
N.W. #2

Orig. by J.C.M.  
Drawn by J.C.M.  
Ck'd by J.C.M.

Date May 5/41 REF. # 25

BLANK PANEL

RECEIVER CHASSIS

SCANNING CHASSIS

CONTROL PANEL

TABLE

POWER SUPPLY CHASSIS

POWER CONTROL

BLANK



**SECRET**

UPPER RIGHT METER

- SW. AT 1 — MEASURES SCANNING PLATE CURRENT
- SW. AT 2 — " " RECEIVER " "

NATIONAL RESEARCH COUNCIL  
RADIO SECTION - OTTAWA

Title: FRONT VIEW OF  
RECEIVER UNIT -  
N.W. #2

Orig. by J.C.M.

Drawn by J.C.M.

Ck'd by J.C.M.

Date Apr. 30/41 REF. #26

BLANK PANEL

TRANSMITTER  
OSCILLATOR  
CHASSIS

MONITOR  
CHASSIS

METERS &  
CONTROL PANEL

MON. POWER SUPPLY  
CHASSIS

BLANK

TRANS. H.V. SUPPLY  
AND MODULATOR  
CHASSIS



**SECRET**

CONNECTIONS FOR CABLES TO REC'R CABINET:-

- ① LEADING PULSE TO MONITOR.
- ② TRIGGERING PULSE TO MODULATOR.

NATIONAL RESEARCH COUNCIL  
RADIO SECTION - OTTAWA

Title: FRONT VIEW OF  
TRANSMITTER CABINET

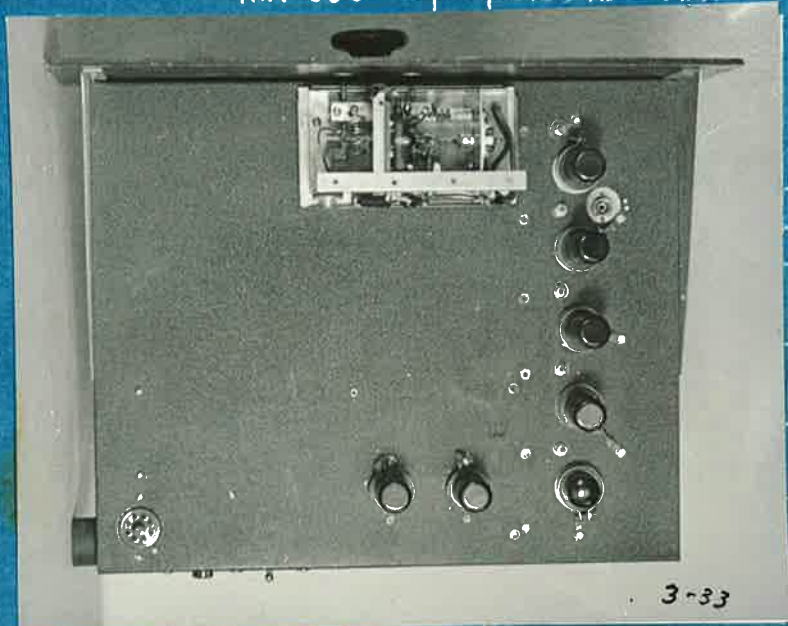
N.W. #2

Orig. by J.C.M.

Drawn by J.C.M.

Cl'd by J.C.M.

Date Apr. 30/41 REF. #27



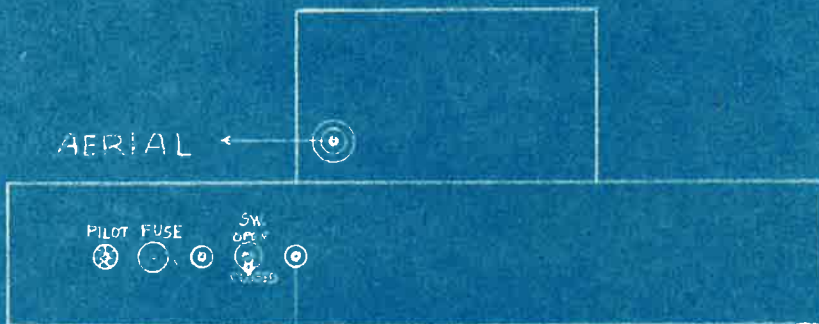
— 6AC7 }  
 — 6AC7 } CONNECTION FOR  
 — 6AC7 } GAIN CONTROL  
 — 6AC7 } ON METER PANEL  
 — 6AC7 } I.F.  
 — 6H6 — DET.

**SECRET**

TO POWER PACK ←

PLAN

6AC7's - VIDEO

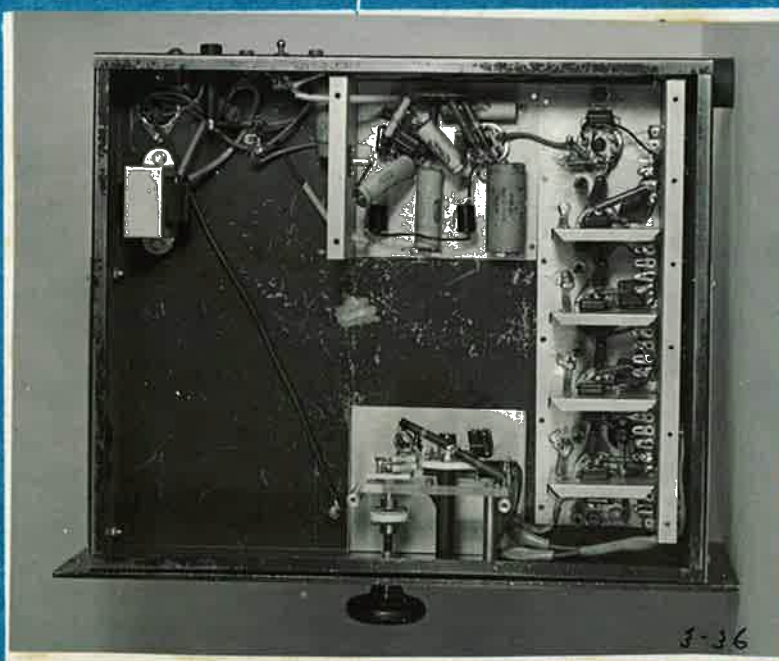


16 METER ←  
 DWG 14

BACK VIEW

NOTE

PILOT LIT WHEN FUSE BLOWN.  
 SW. UP ENABLES EXTERNAL  
 METER TO BE USED BETWEEN  
 THE TWO JACKS.



VIDEO OUTPUT  
 JONES PLUG

955 - OSCILLATOR

BOTTOM VIEW

NATIONAL RESEARCH COUNCIL  
 RADIO SECTION - OTTAWA  
 Title: LAYOUT OF RECEIVER  
 CHASSIS - N.W. #2

Orig. by J.C.M.  
 Drawn by J.C.M.  
 Ck'd by J.C.M.  
 Date Apr. 28/41 REF. #28

6N7 - 1000 c.p.s. OSC.

FREQUENCY ADJUSTMENT SW. TO 'SHORT' SAME

884 - PULSE GEN. BIAS CONTROL FOR SAME

JONES JACK - PULSE TO MON.

884 & BIAS CONTROL - SWEEP CCT. -

JONES JACK - PULSE TO TRANS.

TRANS. PULSE { 884 & BIAS (1/2 OF) 6N7

POWER CABLE

INPUT CABLE FROM REC'R

6X5 GT - DIODE SWEEP LIMITER

5API  
1805-PI

*Photo*  
*Page 2-13*

SWEEP BALANCING AND LENGTH CONTROL.

6AC7/1852  
-SWEEP CCT.-

PLAN

4 POSITION RANGE SELECTOR

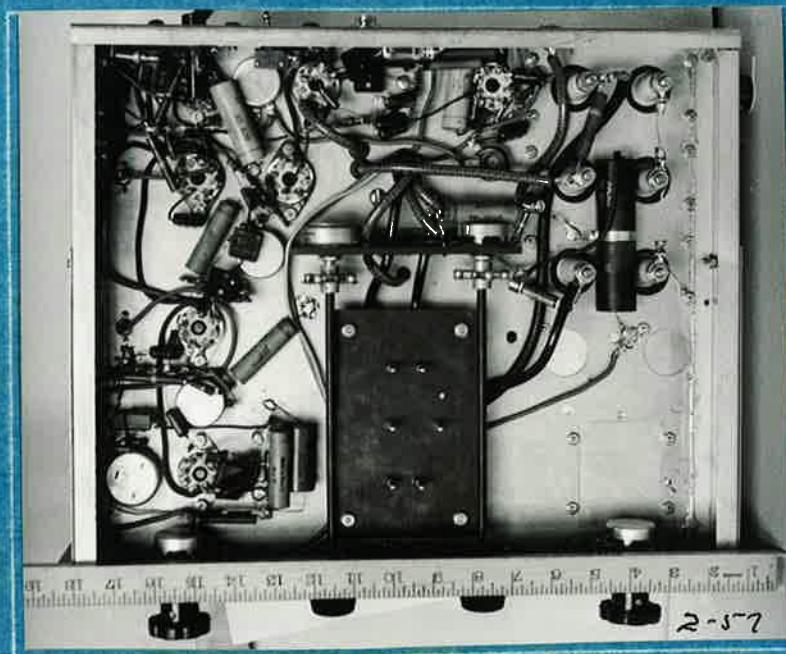
**SECRET**



FUSE & TAP FOR EXT. METER IN B+ LINE

TO METER PANEL  
DWG 14

BACK VIEW



BOTTOM VIEW

CONNECTION FOR H.V. CABLE FROM POWER PACK

NATIONAL RESEARCH COUNCIL  
RADIO SECTION - OTTAWA

Title: LAYOUT OF SCANNING  
CHASSIS - N.W. #2

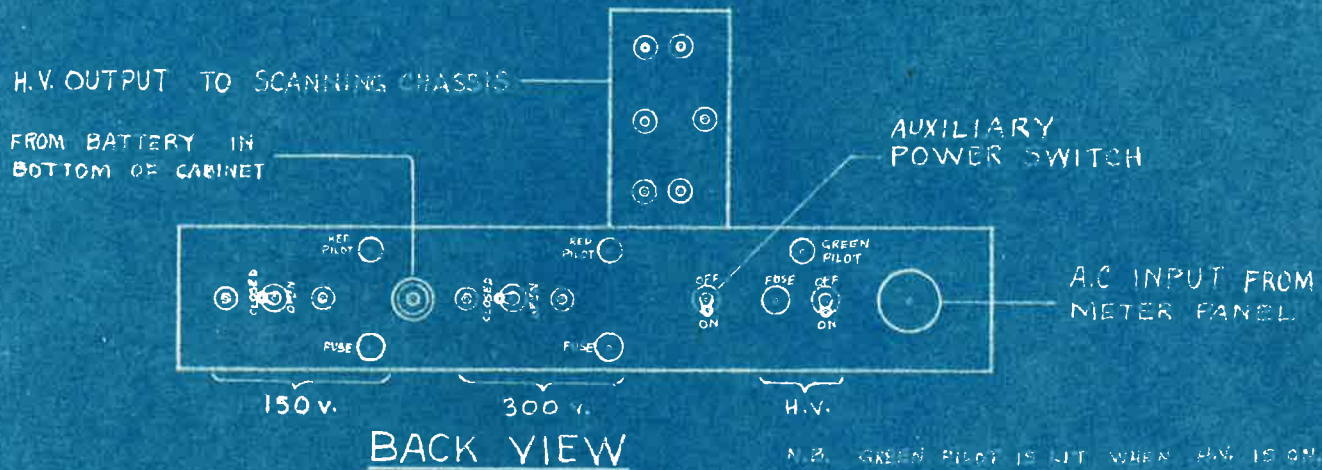
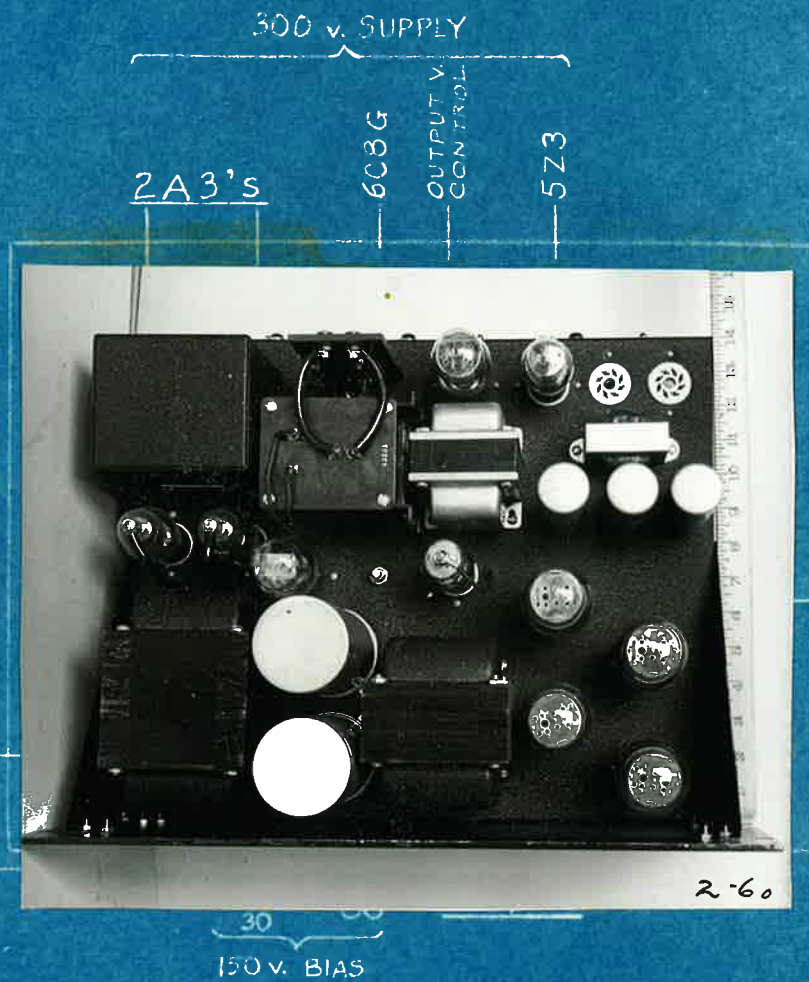
Orig. by J.C.M.

Drawn by J.C.M.

Cl'd by J.C.M.

Date Apr. 28/41

REF. # 29



NATIONAL RESEARCH COUNCIL  
RADIO SECTION - OTTAWA

Title: LAYOUT OF RECEIVER  
POWER SUPPLY CHASSIS

N.W. #2

Orig. by J.C.M.

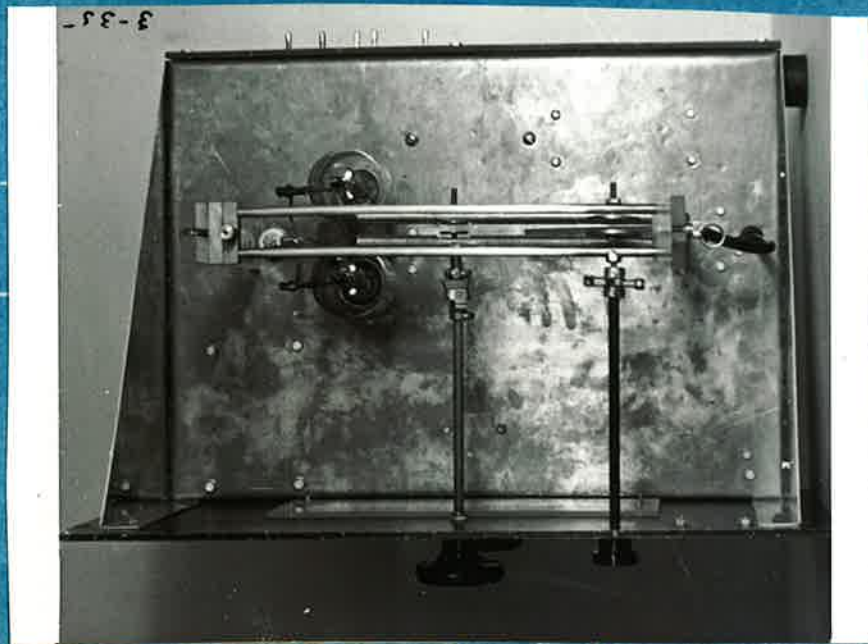
Drawn by J.C.M.

Ck'd by J.C.M.

Date Apr. 29/41 REF. # 30

PLATE TUNING  
CONTROL

AERIAL COUPLING  
CONDENSER CONTROL

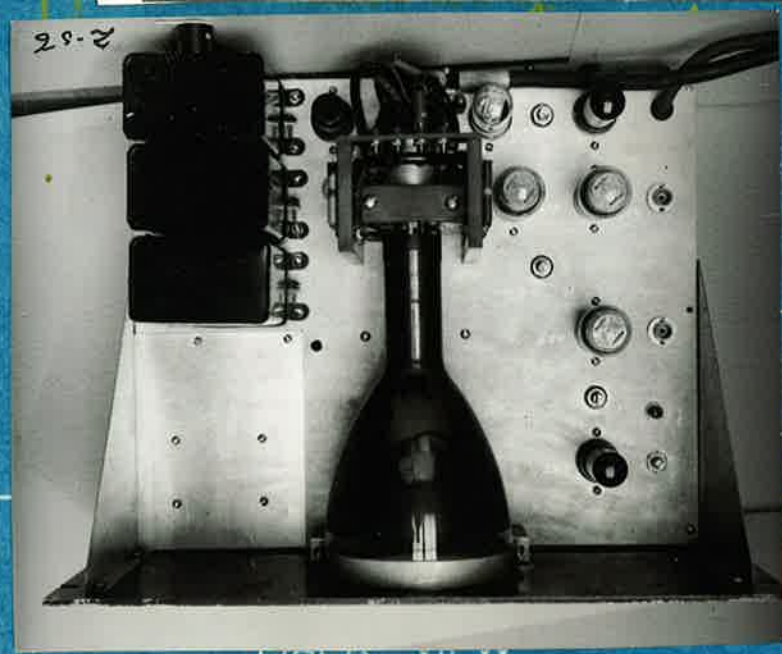


SECRET

A.C. FROM METER PANEL

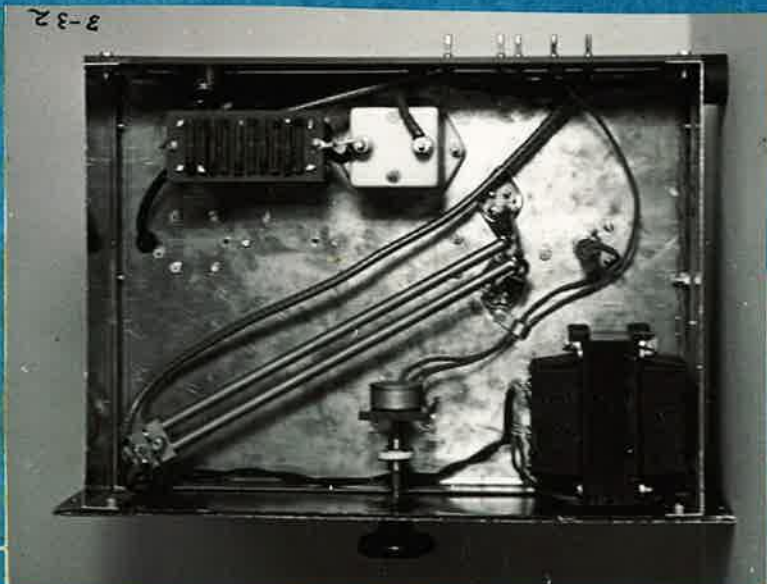
H. & K. TYPE 54  
GAMMATRONS

FROM H.V. CHASSIS



BACK VIEW

GRID  
LEAK  
CONTROL



BOTTOM VIEW

NATIONAL RESEARCH COUNCIL  
RADIO SECTION - OTTAWA

Title: LAYOUT OF OSCILLATOR  
CHASSIS - N.W. #2

Orig. by J.C.M.

Drawn by J.C.M.

Cl'd by J.C.M.

Date Apr. 26/41 REF. #31

VARIAC

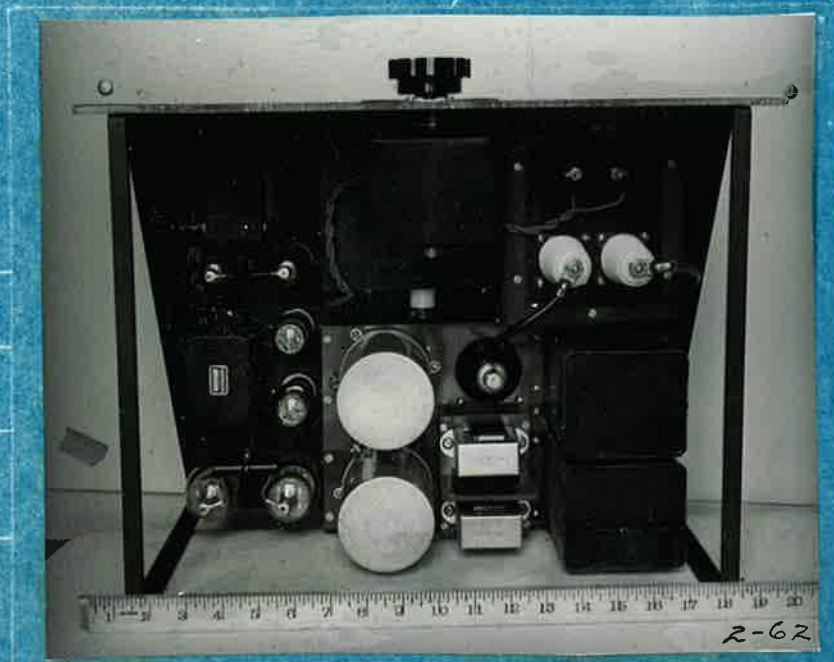
SECRET

2X2's

884

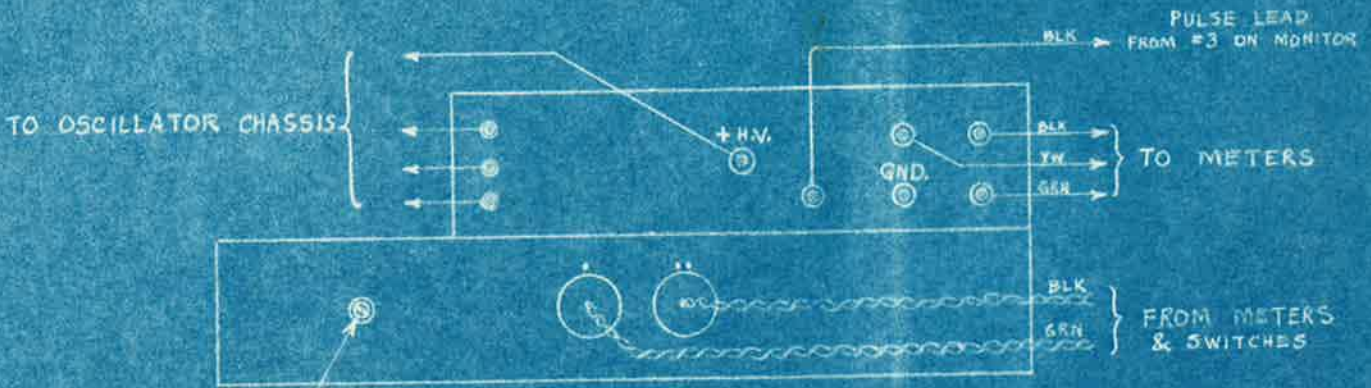
6X5G

807's



878

TOP VIEW



BACK VIEW

PULSE DURATION CONTROL  
(3 POSITION SWITCH)

NATIONAL RESEARCH COUNCIL  
RADIO SECTION - OTTAWA

Title: LAYOUT OF H.V. POWER  
PACK AND MODULATOR

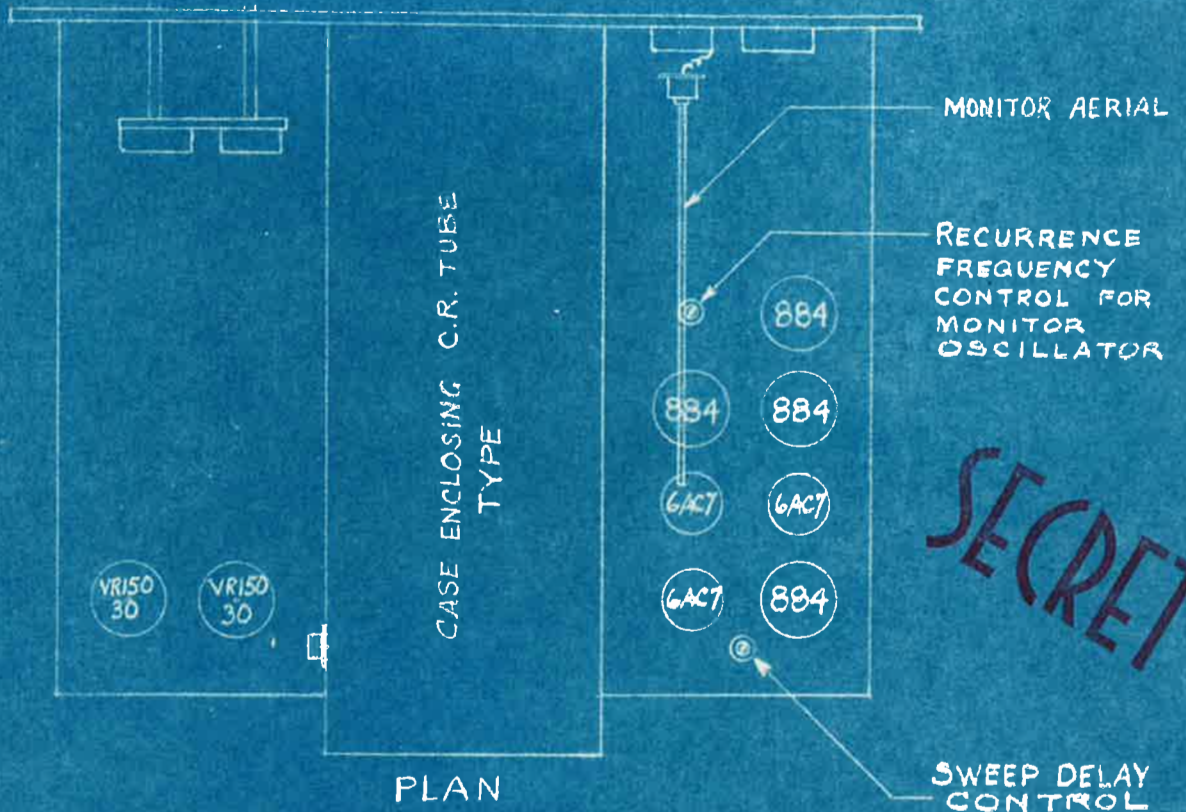
N.W. #2

Orig. by J.C.M.

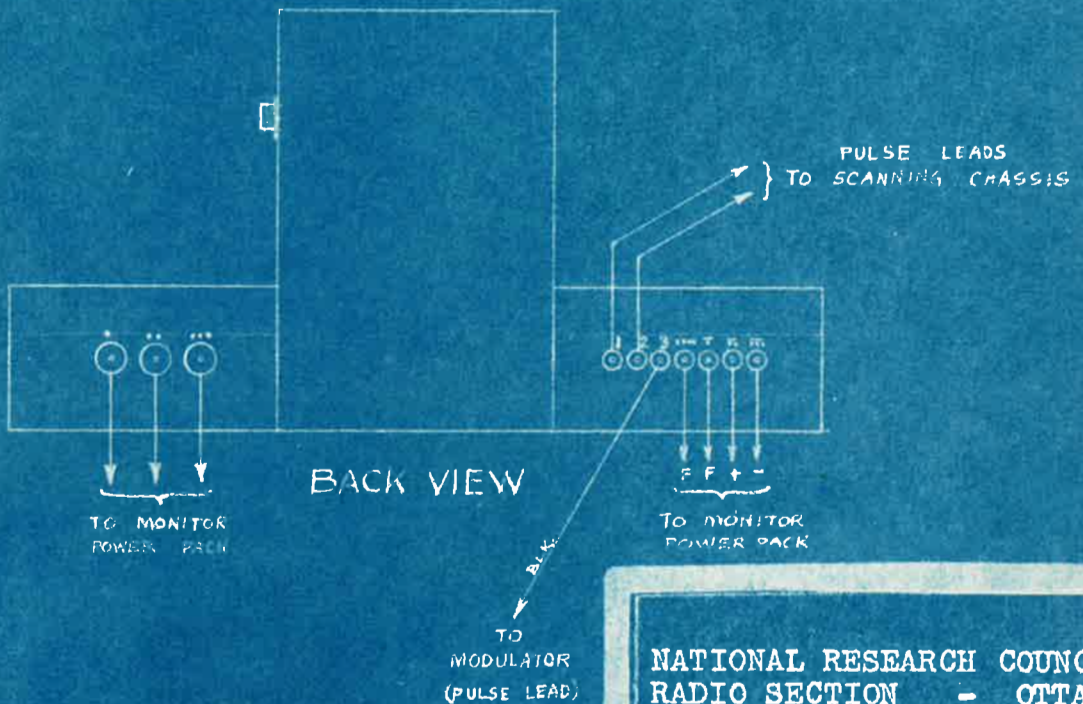
Drawn by J.C.M.

Ck'd by J.C.M.

Date Apr. 24/41 REF. # 32



**SECRET**

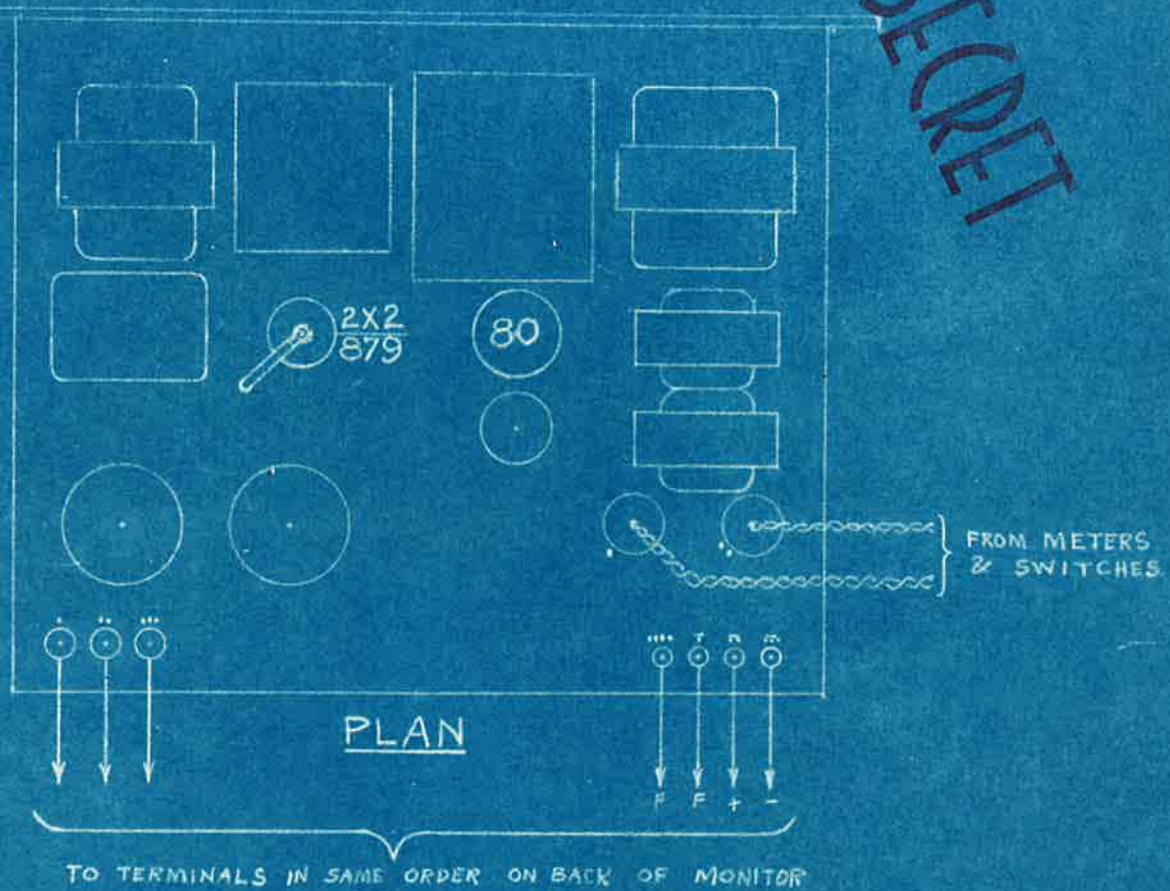


NATIONAL RESEARCH COUNCIL  
 RADIO SECTION - OTTAWA

Title: LAYOUT OF MONITOR  
 CHASSIS - N.W. #2

Orig. by J.C.M.  
 Drawn by J.C.M.  
 Clk'd by J.C.M.  
 Date Apr.23/41 REF. #33

SECRET



BACK VIEW

NATIONAL RESEARCH COUNCIL  
RADIO SECTION - OTTAWA

Title: LAYOUT OF MONITOR  
POWER PACK - N.W.#2

Orig. by J.C.M.  
Drawn by J.C.M.  
Ck'd by J.C.M.  
Date Apr.25/41 REF.#34

**BILLBOARD**  
SEE DWG 36

GALVANIZED CARRIAGE BOLTS  
 $\frac{3}{8}$ "  $\phi$  X OVER  $10\frac{1}{2}$ " LONG

UPPER WIRE TO A & C  
LOWER " " B & D

#14 BARE COPPER LINES  
SEPARATED 5 CM BY  
CERAMIC SPREADERS

TO SET

$17\frac{1}{2}$  CM.

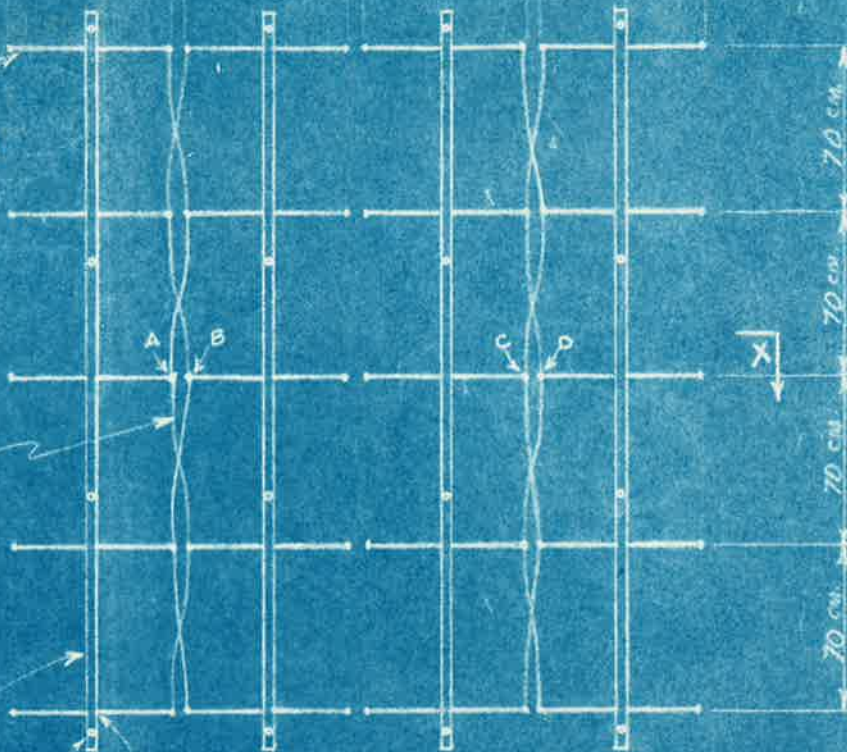
6" LONG  $\frac{3}{8}$ " I.P.S.  
BRASS PIPE  
SPACERS  
WITH A STD. 1" O.D.  
GALV. WASHER  
AT EACH END.

SECTION XX

MATCHING STUB  
LENGTH & POSITION  
TO BE DETERMINED  
BY MEASUREMENT  
AFTER INSTALLATION  
OF ARRAY.



$\frac{1}{4}$ " I.P.S. BRASS PIPE  
WITH STD.  $\frac{7}{16}$ " HEX. BRASS  
CAP SCREWS IN EACH END.  
70 CM. LONG OVERALL.



$\frac{1}{4}$ " DIA. BRASS ROD  
WITH 70 AMP. COPPER  
LUGS ON EACH END.  
71 CM. C.T.C. HOLES.  
ATTACHED WITH  
#12-24 R.H. BRASS M. SCREWS

ELEVATION

$\frac{1}{2}$ " X  $\frac{1}{2}$ " DRESSED OAK  
WAX IMPREGNATED  
FOUR  $\frac{3}{8}$ "  $\phi$  MOUNTING HOLES  
SPACED TO MATCH BILLBOARD  
HOLES (ABOUT 3'-3 $\frac{1}{2}$ " APART)

FIVE  $\frac{17}{32}$ "  $\phi$  HOLES FOR PIPE  
SPACED EXACTLY 70 CM.,  
WITH 5" LONG SAW CUTS  
AS DETAILED BELOW.



**SECRET**

NATIONAL RESEARCH COUNCIL  
RADIO SECTION - OTTAWA

Title: 20 ELEMENT 140 CM  
ARRAY - N.W. #2

Orig. by J.C.M.

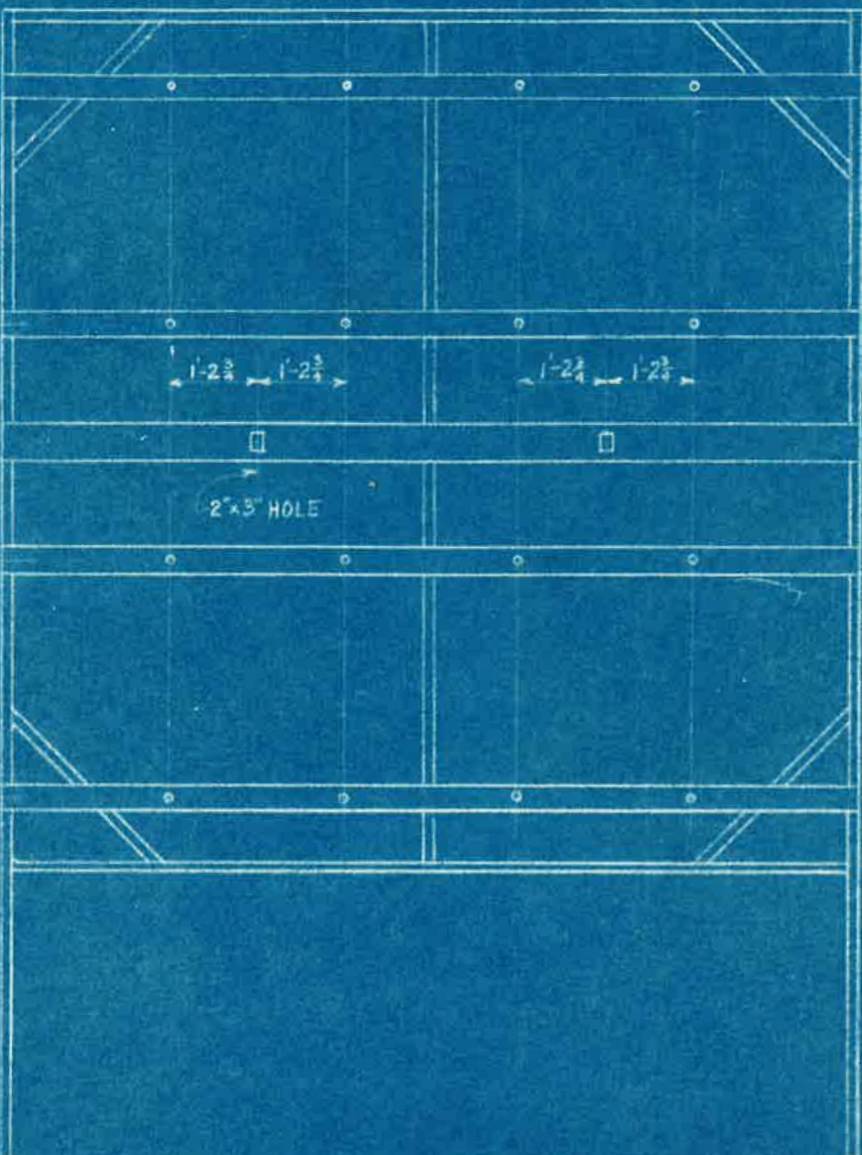
Drawn by J.C.M.

Ch'd by C.J.B.

Date Sept. 5/41 REF. #35

# SECRET

$\frac{1}{2}$ "  $\phi$  HOLES



WOODEN BUILDING

THE OTHER BILLBOARD

SIDE VIEW

FRONT VIEW

COVER THE 12' x 12' AREA  
WITH  $\frac{1}{4}$ " MESH GALVANIZED SCREEN  
(4 VERTICAL STRIPS 3' WIDE.)

DIMENSIONS NOT GIVEN MAY BE SCALED.

NATIONAL RESEARCH COUNCIL  
RADIO SECTION - OTTAWA

Title: BILLBOARD FOR 140 CM  
ARRAYS - N.W. #2

Orig. by J.C.M.

Drawn by J.C.M.

Clk'd by C.J.B.

Date Sept. 5/41 REF.#36