Short wave cathode ray direction finder: detailed description

National Research Council of Canada. Division of Physics and Electronical Engineering. Radio Section

CONFIDENTIAL

PRA-44

Copy No. 39

NATIONAL RESEARCH COUNCIL OF CANADA

DIVISION OF PHYSICS & ELECTRICAL ENGINEERING

RADIO SECTION

SHORT WAVE CATHODE RAY DIRECTION FINDER

DETAILED DESCRIPTION

OTTAWA

APRIL, 1942.

SHORT WAVE CATHODE RAY DIRECTION FINDER

DETAILED DESCRIPTION

INDEX

INDEX (CONT'D)

PLATES

DRAWINGS

Ref. #

Schematics

INDEX (CONT'D)

SHORT WAVE CATHODE RAY DIRECTION FINDER

DETAILED DESCRIPTION

1. INTRODUCTION

Reference will be made throughout to the report, PRA-42, Specifications and Description on Short Wave Cathode Ray Direction Finder, reprinted by the National Research Council in September, 1941. The above contains much general descriptive matter which need not be repeated here. It is intended to restrict this report to a description of details in each circuit diagram and chassis layout.

2. GENERAL

(a) Power Requirements - The present model requires about 3 amperes, 115 volts, at 60 cycles. It has been found highly desirable to have a fairly well-regulated supply voltage using, if necessary, a regulating transformer to hold variations to ± 3%.

(b) Construction (Plate 1) - The direction finder, with the exception of the indicator unit, is mounted on a 6-foot steel rack. A 3/16" brass plate bolted on the top section of the rack carries all units except the I.F. amplifiers, the main object being rigidity of construction. Each unit is likewise strongly and rigidly constructed using 1/8" brass on the panel.

(c) Operating Conditions - It is important to maintain a fairly dry atmosphere and hold temperature variations to about ± 15° F. Undue heat or cold warps panels and condenser plates and stiffens gear drives, tending to overload spring-loaded gears, etc. A moist atmosphere corrodes commoning and band-change switch contacts.

3. R.F. TUNING UNITS

(a) Condenser Ganging - As explained in Section 3 of PRA-42, the 1st R.F. stages of N-S, E-W, and sense receivers are tuned by a 3-gang National condenser, type PW-3, 225 μμfd per section. The 2nd R.F. and mixer stages are similarly ganged. These three 3-gang condensers

are gear driven from the main vertical shaft on the front panel, which also drives the oscillator gang. (Plate 4, drawing CRDF-SW-44). Any backlash simply results in a slight loss of sensitivity and image rejection and does not detune one receiver with respect to another. The worm gear drive introduces some noise due to uncertain electrical contact on the gear teeth. This could be eliminated and quieter mechanical operation obtained with the use of fibre worm gears. Drawing CRDF-SW-22 gives the schematic of the motor tuning control. A dummy dial carrying a commutator controls the field current of the tuning motor. The oscillator tuning shaft, which is coaxial with the dummy dial, carries brushes which follow the motion of the dial (drawing CRDF-SW-46). It is suggested to simplify this arrangement and use manual tuning, if friction losses can be sufficiently reduced. This would further reduce noise due to motor commutator sparking and clicks from the reversing relay when tuning. The limit switches, Sw1 and Sw2 (Plate 4 and drawing CRDF-SW-44), are situated on the 2nd R.F. tuning shaft.

Each section of each condenser gang is isolated electrically from the other sections by an insulating rotor shaft. The tuning unit proper consists of a 1/8" brass shelf, with provision for mounting on the main panel, on which is bolted a 3/16" sheet of bakelite. Three 1/8" brass plates mounted side by side on this shelf form the isolated R.F. ground systems to which the rotors of corresponding condenser sections are connected (Plate 14 and drawing CRDF-SW-32). Rigidity of construction is important in this unit.

(b) Cam Trimmers - The cam trimmers are shown in plates 15, 16 and 17, with the shield cams removed. E-W and sense cams are driven by a spring-loaded cable from the condenser shaft. The cam shaft is insulated. For details of trimmers refer to drawing CRDF-SW-41. It is recommended that the steel bar on the back of each moving plate be made thicker than the 1/8" shown to allow for more play in the contour of the cam. The sections of each gang should be lined up so as not to depart more than about 2 μμfd from the N-S section. This variation can be taken care of by the cam trimmers, without any rapid changes in contour, to within 1/20 μμfd. It is important to keep friction losses in the cams as low as possible to avoid overloading the spring-loaded gears in the condenser reduction drive. Gear drives on the cams would be more satisfactory than the cable drives, as the latter require frequent repair which necessitates removal of the unit from the rack with the risk of spoiling the ganging. Each section, with its cam trimmer, is individually shielded by cans grounded only to that

particular section. Provision must be made for external adjustment of cams and windows must also be provided to aid alignment (Plate 3). The concentric lines (drawing CRDF-SW-42) connecting the tuning units to corresponding R.F. stages, are clamped at the back by means of brass bars (drawing CRDF-SW-32).

4. R.F. AMPLIFIER UNITS

(a) Aerial coupling circuit - Balanced coupling is required from the aerial system and it is desirable to reduce capacitive coupling to the 1st tuned circuit in T1 and T2 (drawing CRDF-SW-25) as much as possible. This could be obtained with the use of a Faraday shield. The input impedance is likely to be of the order of 200 ohms, depending on the type of aerial used.

(b) Phase and gain controls - Plate 4 shows all controls adjustable from the front of the R.F. units. Superscripts ', '', and ''', on lettered controls indicate N-S, E-W, and sense units respectively. T_1 and T_2 are 25 µµfd trimmers in parallel, mounted inside transformer T1; similarly, T_3 and T_4 are in parallel inside transformer T2, and so on down to T_{11} and T_{12}. These trimmers allow for individual adjustment of the different bands and are rarely touched once the set is lined up. P_1, P_2, and P_3 are small 10 µµfd trimmers shown as C_{21}, C_{22} and C_{23} respectively in drawing CRDF-SW-25. They may be adjusted from time to time if, for instance, a tube is replaced, changing the fixed capacity in a tuned circuit. One of these trimmers, P''_3, is controlled at the front for the purpose of conpensating for phase variations which may arise owing to temperature changes, slight misadjustment of cam trimmers, etc. The gain controls G_1, G_2, and G_3 are cathode bias resistors R_6, R_7 and R_8 in drawing CRDF-SW-25. They require adjustment occasionally.

(c) R.F. coils - The bands covered in the model are 1.7 - 3.5 mc., and 3.95 - 7.25 mc. Corresponding coils in the three receivers are wound to have differences in inductance of not more than 1/10% when mounted in their shield cans. Coils should also have, within very close limits, the same value of Q. Plate 8 shows a coil cover removed from T1 and T2 of the E-W unit. The National Exciter units had trimmers T_1 and T_2, etc., mounted inside the shield cans, which are isolated from one another by mounting on a bakelite panel (drawing CRDF-SW-33). The ground connection is carried inside to the ground of the stage concerned.

(d) Commoning - Points x on drawing CRDF-SW -25 go to commoning switches mounted on the front panel. These are for the purpose of lining up the units stage by stage. Mechanical construction is shown in drawing CRDF-SW-43, and the positions are shown in drawing CRDF-SW-33. The 1/8" diameter silver rod is normally grounded by a phosphor bronze spring. When pressed by the bakelite cam (drawing CRDF-SW-45), the rod makes contact with the grid connection x, and at the same time is connected, through silver contacts on the cams and the coaxial brass tubing, to the other units. It is suggested that a switch with more positive motion might make better contact in spite of wear. Some trouble has been experienced with those installed owing to the slight motion of the contacts. It will be noticed that the N-S and E-W units are mirror images of one another (Plate 3). This was done to shorten commoning connections, thereby reducing their impedances and more closely approaching perfect commoning. The sense and E-W units are identical. All three units are isolated by bakelite panels on the front (plate 6). Each unit is fastened to the main panel by 3 studs, and may be removed for repair without disturbing other units, except for disconnecting the concentric line and clamps on the R.F. tuning units above (see Plate 8).

(e) Band changing - An extra contact on the band change switches, Sw_1, Sw_2 and Sw_3 (Plates 4 and 6, drawing CRDF-SW-25), not shown in the schematic diagram, shorts the low frequency coils when operating on the high frequency band. The switches were found unsatisfactory, owing to flimsy construction of the contacts. It is recommended that, if band-changing is required, a more reliable switch with comparably low capacity be used. The presence of the band change switch unbalances to some degree the coupling in the aerial input circuit because the coils make common connection at one end. Sw_1, Sw_2, and Sw_3 are controlled by cams driven by lever arms from a worm mechanism on the band change motor, (Plate 4 and drawing CRDF-SW-44). Limit switches at top and bottom of the worm control the motion of the cams. A double-throw toggle switch on the front panel controls the band change motor.

(f) Decoupling - Each stage is decoupled by choke and condenser bypass filters to prevent regeneration, and each unit has a filter situated near the power plug to eliminate crosstalk between units, (drawing CRDF-SW-25 and CRDF-SW-33). Oscillator input, mixer output, and power plugs are grouped together at the bottom of each unit to minimize crosstalk due to mutual impedances (Plate 7).

5. LOCAL OSCILLATOR

Drawing CRDF-SW-20 is the schematic diagram, and drawing CRDF-SW-35 and Plate 18 show the chassis with cover removed. The two section National condenser type PW-2, 225 μμfd. is driven by a gear system identical with the R.F. tuning units, on the lower end of the vertical drive shaft. The oscillator tuning shaft also carries brushes which contact the commutator on the dummy dial as mentioned in 3(a). Coils L_1 and L_2 are mounted in the same type of shield can as the R.F. transformers. $T_1°$ and $T_2°$ comprise C_1 as the low frequency band parallel trimmers, and $T_3°$ and $T_4°$ comprise C_7 as the high frequency band parallel trimmers. Series padders C_3 and C_5, visible in Plate 18, are adjustable by removing a small brass plate on the side of the copper shield cover. Ceramicon series padders, C_2 and C_6, are used to ensure stability. The oscillator output is fed onto the buffer stages through a banana plug on a bakelite sub-panel at the rear. The power supply comes from a filter in the buffer unit through banana plugs shown in Plate 18. The oscillator chassis is made up of 1/8" brass on the front and bottom - the main objects being rigidity and stability. A bakelite panel on the front isolates the unit from the rack panel. The 6J7 tube is removable through the same window used when adjusting the series padders.

6. BUFFER UNIT

(Plates 3 and 19, drawings CRDF-SW-24 and CRDF-SW-36.)

This unit consists of three 1851 tubes fed in parallel from the local oscillator. Each tube has its own gain control and the E-W (centre) stage has an additional cathode control

across R_3 on the main front panel. This control is used as an overall gain trimmer in conjunction with the phase trimmer discussed in Section 4(b) of this report to correct small errors in alignment of the set. The gain controls are adjustable through the shield at the rear. The most important point is the filtering of the power supply in the unit. The main filter is in the small compartment shown in Plate 19 with cover in place. It contains the choke, $R.F.C._5$ for the heater (6.3 v.) supply shown in drawing CRDF-SW-40. Each stage in the buffer unit is itself decoupled with chokes and bypass condensers in plate and screen supplies. The 1851 tubes have a gain of approximately unity in the circuit, and are intended to provide about 12-15 volts of oscillator voltage, through the shielded plugs on top, to the 6L7 mixers in the R.F. units. The unit is held by three bolts, tapped into the rear of the oscillator chassis, which can be removed by taking off the buffer shield. There is a bakelite panel on the front on which are mounted the plugs for power supply to oscillator, etc.

7. GAIN CONTROLS

(a) Fine Gain - Plate 1 and drawing CRDF-SW-44 show the position of the fine gain control on the front panel. Drawing CRDF-SW-29 gives the schematic diagram. R_1 is the main control, and R_2 and R_3 are adjusted for differences in characteristics of the R.F. amplifier tubes in E-W and N-S receivers, so that the gains are fairly equal over the entire range of R_1. All are mounted on a small sub-panel in front of the main rack panel. R_1 can give an attenuation of about 20 db.

(b) Coarse Gain - This control consists of 3 ganged attenuator sections separately shielded and electrically isolated from one another, (Plate 18 and drawing CRDF-SW-37). Top covers are removed in Plate 18. The ganged rotary switch has an insulated shaft. L_1 and C_1 in drawing CRDF-SW-29 are made to resonate with the capacity of the connecting cable across them. The trimmer in the 1st I.F. transformer in this circuit is adjusted on this maximum gain position. Position 2 on the switch leaves the cable capacity loading the primary of the 1st I.F. transformer, resulting in about a 20 db drop in gain from the 1st position. Succeeding switch

positions are designed to give 20 db changes in gain, and have variable trimmers so that all three attenuators may be accurately lined up. It is important that the three cables, connecting R.F., units, coarse gain controls and I.F. amplifiers, should have about the same capacity, so that when position 1 is lined up, position 2 will provide equal attenuation in all three receivers. These cables are made of Telcothene AS48 (about 11 μμfd per foot) and are shown in Plate 3.

8. INTERMEDIATE FREQUENCY AMPLIFIER UNITS

(a) Shielding and decoupling - The most important considerations in those units are complete isolation of stages to prevent regeneration, and rigid construction to ensure stability. Plates 9 and 11 show a unit with outside cover and the plate at the back of the 6K7 tubes removed. The complete filter system for the first two stages is shown in the bottom views (Plate 10). The cover plate is removed as well as the outside cover. The filter for the primary of the first I.F. transformer is on the section on the extreme right near the mixer input plug (drawing CRDF-SW-34).

(b) Transformers - The I.F. transformers used are Hammarlund VT-465 variable coupling with air trimmers. A flexible grounding lead is required on the push rod to make positive connection. A knurled disc on the rod may be adjusted through a slot in the front panel (drawing CRDF-SW-38).

(c) "Q" Adjustments - It is necessary to be able to adjust the losses in each transformer winding in order that corresponding stages in the three units maintain identical phase and gain relations whether or not the received signal is perfectly tuned in (i.e., on a frequency modulated signal). A "Q" adjustment consisting of a 100,000 ohm resistor, R_7 (drawing CRDF-SW-23), sliding inside a small capacity, C_{15}, connected to the high side of the transformer winding is used. One end of the resistor is grounded to a machine screw through a brass block. The screw is adjustable from the front panel (drawing CRDF-SW-39 and plate 13).

(d) Commoning - Plate 5 shows the three units with commoning cables in position. Each circuit may be commoned and adjusted for phase, gain, and"Q"(i.e., selectivity curves made to coincide) at the controls numbered to correspond with the commoning switch closed. Grid circuits are adjusted for phase by the trimmers in the I.F. transformer secondaries, and for gain by the mutual coupling between windings. Plate circuits are adjusted for phase by the trimmers in the I.F. transformer primaries, and for gain by cathode resistors in the various stages. The switches used are Federal Anti-capacity type. The"Q" adjustments are mounted on the switch frames. A 50 ohm resistor of nichrome wire (R_8 in drawing CRDF-SW-23) forms a ground return for each commoning terminal when in normal operating position. The purpose of this is to reduce circulating currents in the panels, which would arise should all three units be joined with very low resistance to ground at these points. Crosstalk is thus reduced to a minimum.

(e) Output stage - Pushpull output is necessary as low distortion and good focussing of the cathode ray tube is desired. Type 50 tubes are of sufficiently low impedance to make them not too critical as to gain and phase adjustment. They are similar enough in amplification to obviate the necessity of a gain control, and can deliver the 250 volts peak signal required for the cathode ray tube with very little distortion when the plate supply is only 550 volts. This is accomplished by the use of impedance loading in the plate circuit. The 10 μμfd condensers, C_n (drawing CRDF-SW-23 and plate 12) compensate for slight differences of grid-plate capacity in the tubes, and provide some degeneration which further stabilizes the output stage. The plate impedances are placed in the cathode ray tube box so as to keep heat dissipation in the I.F. units to a minimum. Shielded cables of Telcothene A548 connect each unit with the plate impedances. The I.F. units are s imilar to those in use for some time in the Long Wave C.R.D.F., except for the frequency which was changed from 110 Kc. to 440 Kc., and they have proved in every way satisfactory.

9. CATHODE RAY TUBE BOX

(a) Cathode Ray Tube - The cathode ray tube employed in the present set is a Cossor type 3272J, 12 inch tube. Although the tube may be as small as 6 inches without spoiling the precision of reading, this was the only type available at the time of construction in which the positions of the deflection plates were held to within one degree. Most types of tube allow a tolerance of ten degrees in the angle between X and Y plates. Controls for the tube on the panel are brilliancy, focussing, vertical and horizontal centering. The filament rheostat and auxiliary focussing are mounted on a subpanel at the back. The tube must be mounted in a magnetically-shielded box so that stray fields such as from nearby transformers, speakers, etc., do not introduce objectionable hum. A blue or blue-green screen is recommended for operation where good contrast is required.

(b) I.F. Output circuits - The output circuit for each I.F. unit is built into a small aluminum chassis, the N-S and E-W circuits being placed either side and the sense circuit at the back of the box, close to the socket of the tube. The load impedance consists of a 10 watt 20,000 ohm resistor across which is connected an inductance of 2 sections of a standard four-section Hammond #1504 choke. The resistors are mounted on the outside of each chassis for cooling purposes, but are shielded by a small ventilating cover. Drawing CRDF-SW-30 gives a complete schematic of the circuits in the cathode ray tube box. Dotted lines indicate shields. The shielded plugs are mounted underneath each chassis, which is mounted on bakelite to isolate it from the main box. The output terminals are loaded by 50 μμfd Ceramicons and one set (N-S) has a 25 μμfd air trimmer in addition for adjusting for differences in output circuit capacity between N-S and E-W sets. If the four deflection plates and their associated wiring were perfectly symmetrical there would be no crosstalk, but owing to slight differences a small capacity between an X and Y plate is necessary to balance out any crosstalk introduced. Two 5 μμfd Ceramicons in series, mounted on the socket, provided sufficient capacity to accomplish this.

(c) Sense Rectifier - The sense output curcuit has the same load impedances as in the other two sets, and the output on one side is fed through an 84 type half-wave rectifier (V_2 in drawing CRDF-SW-30).

C_{17} and C_{13} are required to stand the high voltage (-3000 v. with respect to ground) existing in the cathode ray tube circuit. The 84 tube has an insulated heater supply. R_{11} is the rectifier load resistor from which is obtained the signal for the shield, or grid, of the cathode ray tube. The general requirements of the sense rectifier circuit are no phase shift and a clean half-wave output signal. Application of such a signal, which is in phase with the signal on the deflection plates, blanks out the line from the centre of the tube in the direction 180° from the true bearing. With the circuit used, C_{21} was not found necessary because the tube capacity of the 84 was low, and the load resistance, R_{11}, was also low. Good insulation is needed between the heater and the cathode of the rectifier tube. L_{10} must be large to avoid phase shift. It may be found necessary to bypass the lead from the brilliancy control at the sense rectifier to prevent feedback. The power supply for all circuits comes in at the rear through a single large, well-insulated plug.

10. POWER SUPPLY

The power supply chassis is a separate unit with plugs for two multiwire cables connecting to the main receiver rack and to the cathode ray tube box. It contains three separate power supplies; one giving 250 volts and 105 volts (regulated) for the receivers, another giving 550 volts for the I.F. output stages and a high voltage supply of 2000-3000 volts for the cathode ray tube. All supplies are well filtered to keep the hum level as low as possible (drawings CRDF-SW-28 and CRDF-SW-51). The line voltage is at present controlled by a variac and indicated by a line voltmeter on the panel below the cathode ray tube box (drawing CRDF-SW-50).

11. MONITOR

An audio monitor (drawings CRDF-SW-26 and CRDF-SW-49) has been built in a chassis suitable for rack mounting. A selector switch on the input is required so that any one of the three receivers may be monitored. A beat frequency oscillator is included and this must be sufficiently well shielded and isolated to prevent feedback into the connecting cables or power supply. The present chassis produces some slight interference on the screen when the beat frequency oscillator is on, due to improper shielding.

12. REMOTELY CONTROLLED OSCILLATOR

This unit is a field oscillator capable of being continuously tuned or of being switched to any one of 5 crystal frequencies from a control unit on the direction finder. Drawing CRDF-SW-19 gives the schematics of the field oscillator, selector circuits, and remote control unit which is made up in a rack-mounting chassis (drawing CRDF-SW-48). An eleven wire cable with grounded sheath is required for interconnection of the field oscillator and the control unit.

13. RESULTS OF FIELD TESTS

The voltage at the antenna input to produce a signal five times the noise level or a line one inch long on the cathode ray tube, whichever is the greater, is less than one microvolt. When connected to an Adcock antenna with 30-foot masts and 20-foot spacing, and having an impedance of about 200 ohms, the field strength required for the above signal on the tube was somewhat less than one microvolt per metre on the 3.95 - 7.25 megacycle band, except at the low frequency end where the sensitivity dropped off slightly.

Selectivity and image selectivity are about as specified in Sec. 2 of report PRA-42.

Some provision should be made on the main control panel for the antenna paralleling switch and the sense switch (see Sec. 2 of this report). These are mounted on a bakelite panel at the side of the rack on the model (Plate 1). The paralleling switch is situated in a junction box in the centre of the array and is operated by a shaft and universal couplings. The sense switch is a push button, operating a relay which supplies plate and screen voltage to a resistance coupled amplifier at the base of the sense mast (Plate 20).

14. HISTORICAL STATEMENT

The work on the cathode ray direction finder described in this report was started in September, 1938 and completed in December, 1939 as part of the direction finding programme of the Radio Section approved by Major General A.G.L. McNaughton.

Early work on atmoshperics and long wave direction finding for ship-to shore communications led naturally to its development on shorter wave-

lengths. This experimental model was built originally for the R.C.A.F. Prior to the War, the entire radio staff was engaged on this development, and Mr. J.W. Bell, in particular, made many contributions to the design, and was responsible for the construction of the receiver. After the outbreak of War, some further experimental work was done on the aerials by Dr. G.A. Miller, and by Mr. C.W. McLeish. The latter added the tubes at the base of the Adcock masts and greatly increased the overall sensitivity of the set. In its present form it has proved to be an efficient and accurate direction finder. Factory built models will incorporate refinements of construction to suit production requirements, which should further enhance the performance.

The C.R.D.F. system unquestionably possesses the following five advantages and despite its somewhat more elaborate circuits, for many applications the extra complications entailed are fully warranted.

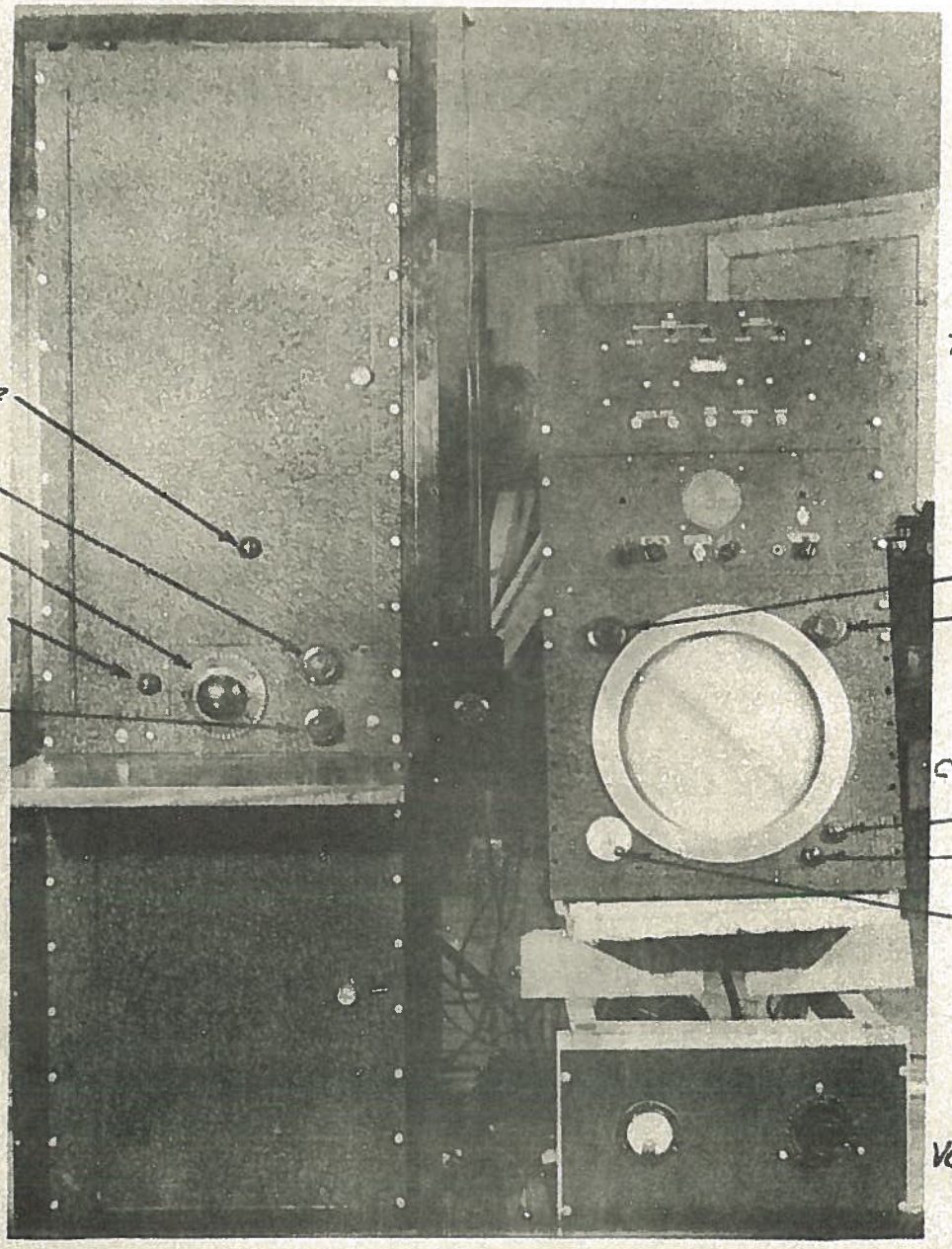
1. The system permits greater speed of operation and taking of accurate bearings on shorter signals than is possible when using a conventional direction finder.

2. The system can be used under conditions of interference from outside stations which make ordinary aural types of direction finders very slow and difficult to operate.

3. Owing to the use of a cathode ray tube as an indicator, accurate bearings can be obtained through a much higher noise level, due to atmospherics, than is ordinarily the case.

4. The presence of night effect is indicated by the appearance of the bearing on the cathode ray tube, and even when the bearing is shifting about a mean position, this mean can be determined very easily and fairly accurately.

5. Good bearings can be obtained even under conditions of bad fading.

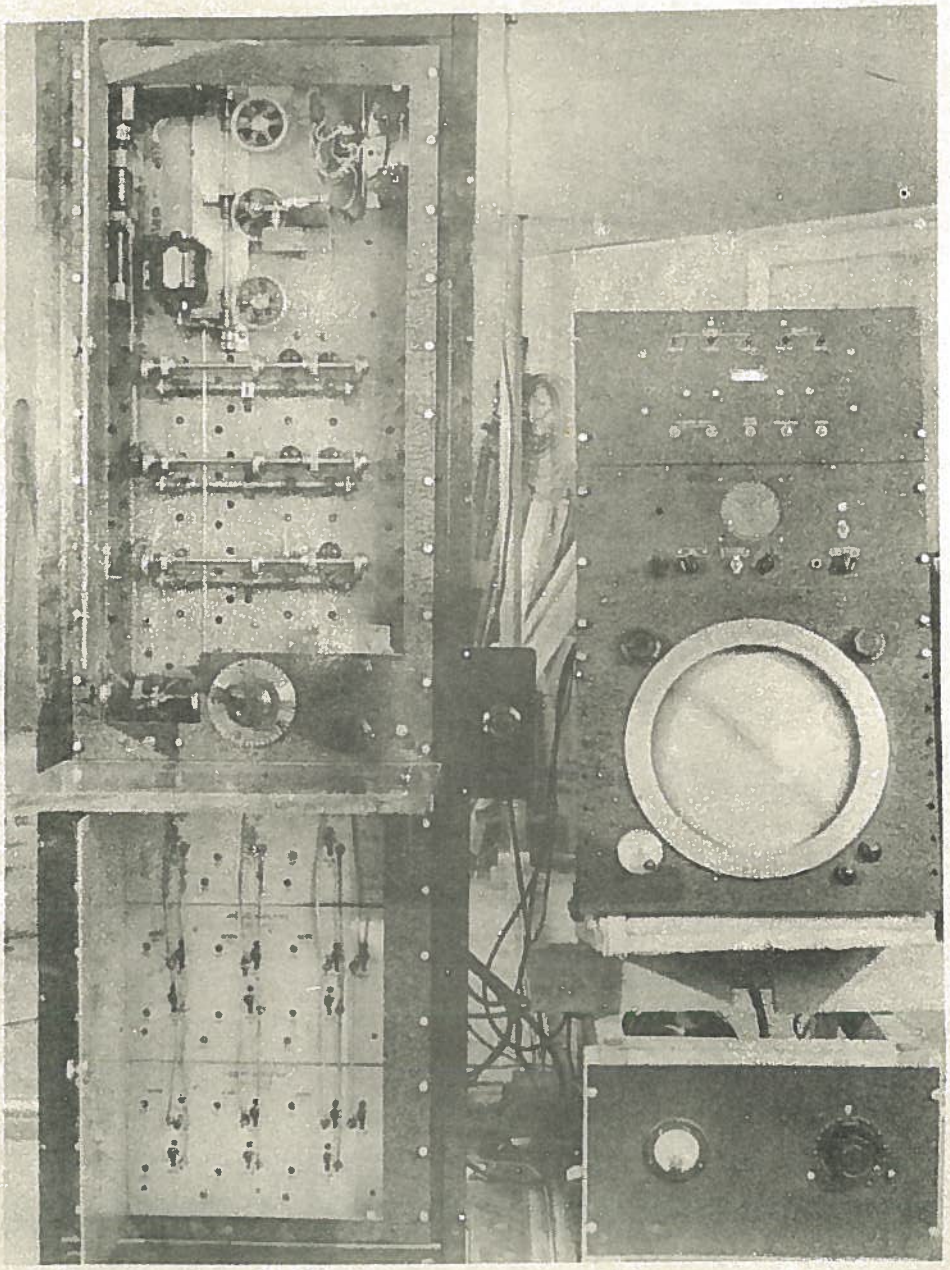


S.W. C.R.D.F.

FRONT VIEW

NATIONAL RESEARCH COUNCIL
RADIO BRANCH
OTTAWA, CAN.

PLATE 1



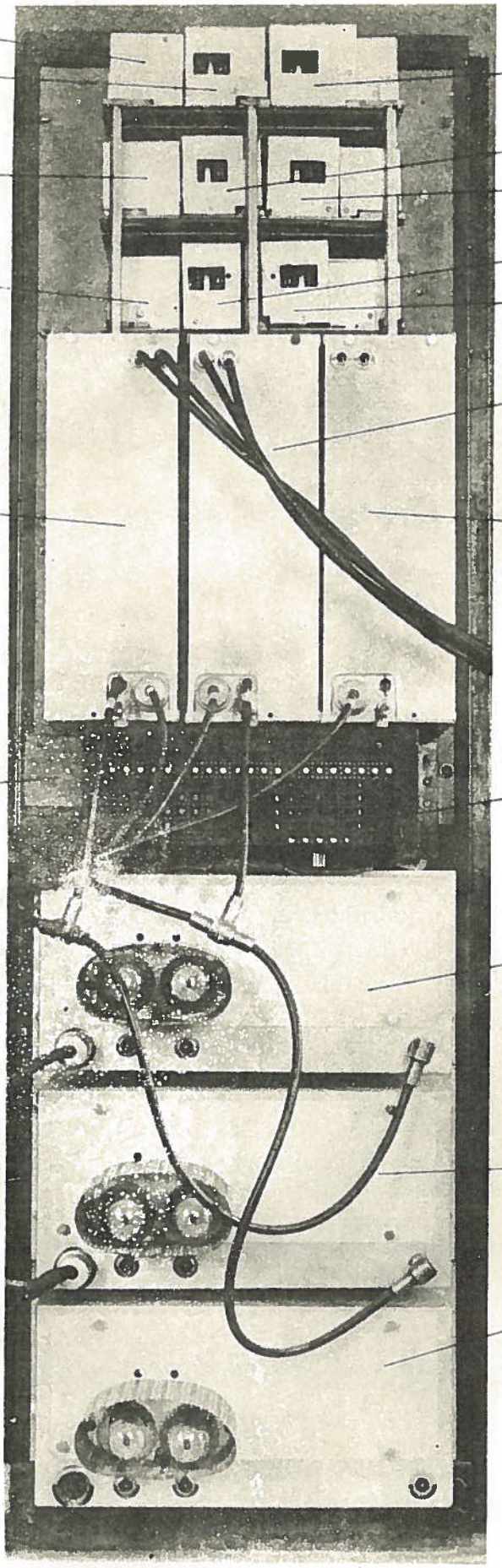
S.W. C.R.D.F.

SUB-CHASSIS

PANEL EXPOSED.

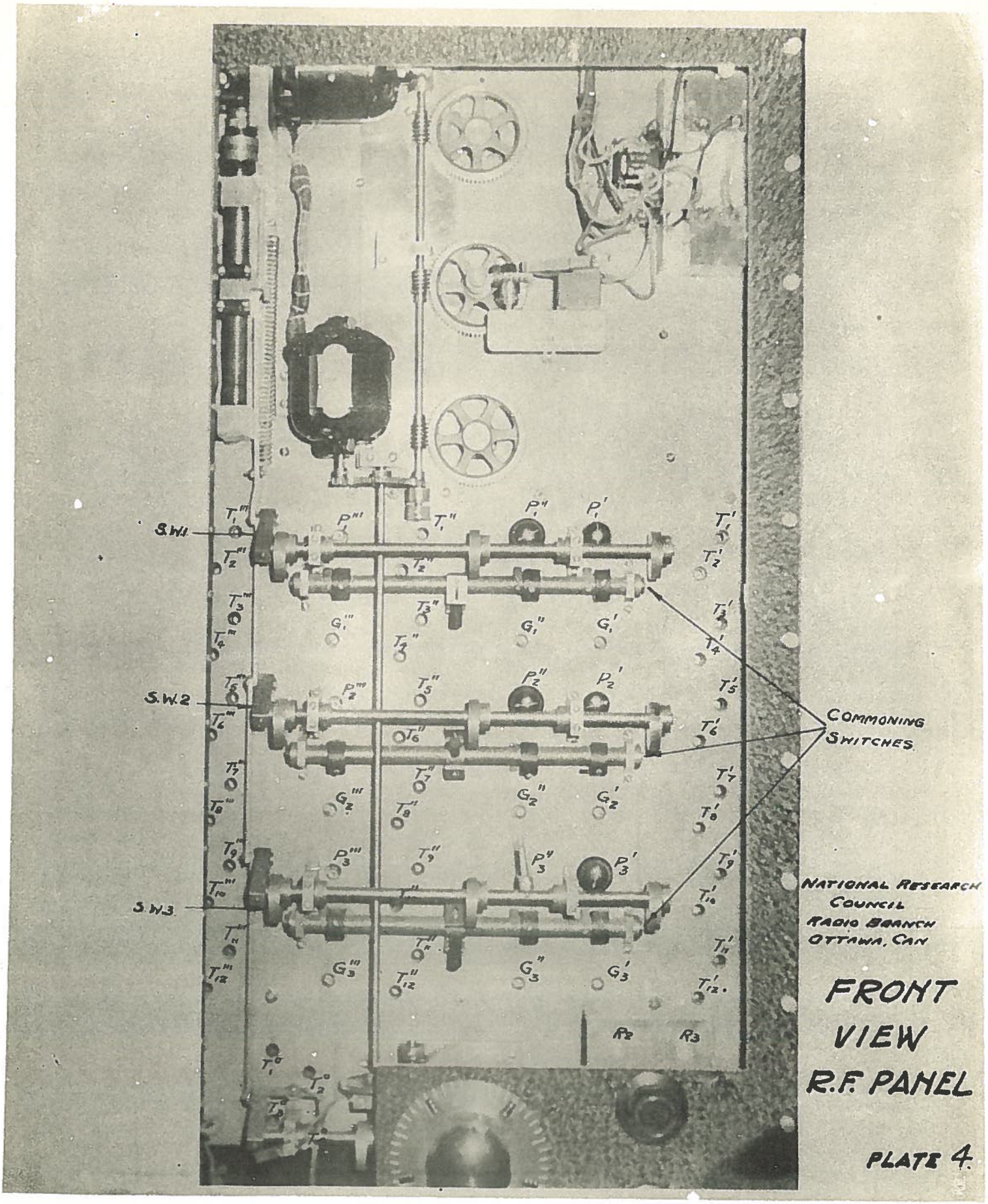
NATIONAL RESEARCH COUNCIL
RADIO BRANCH
OTTAWA, CAN.

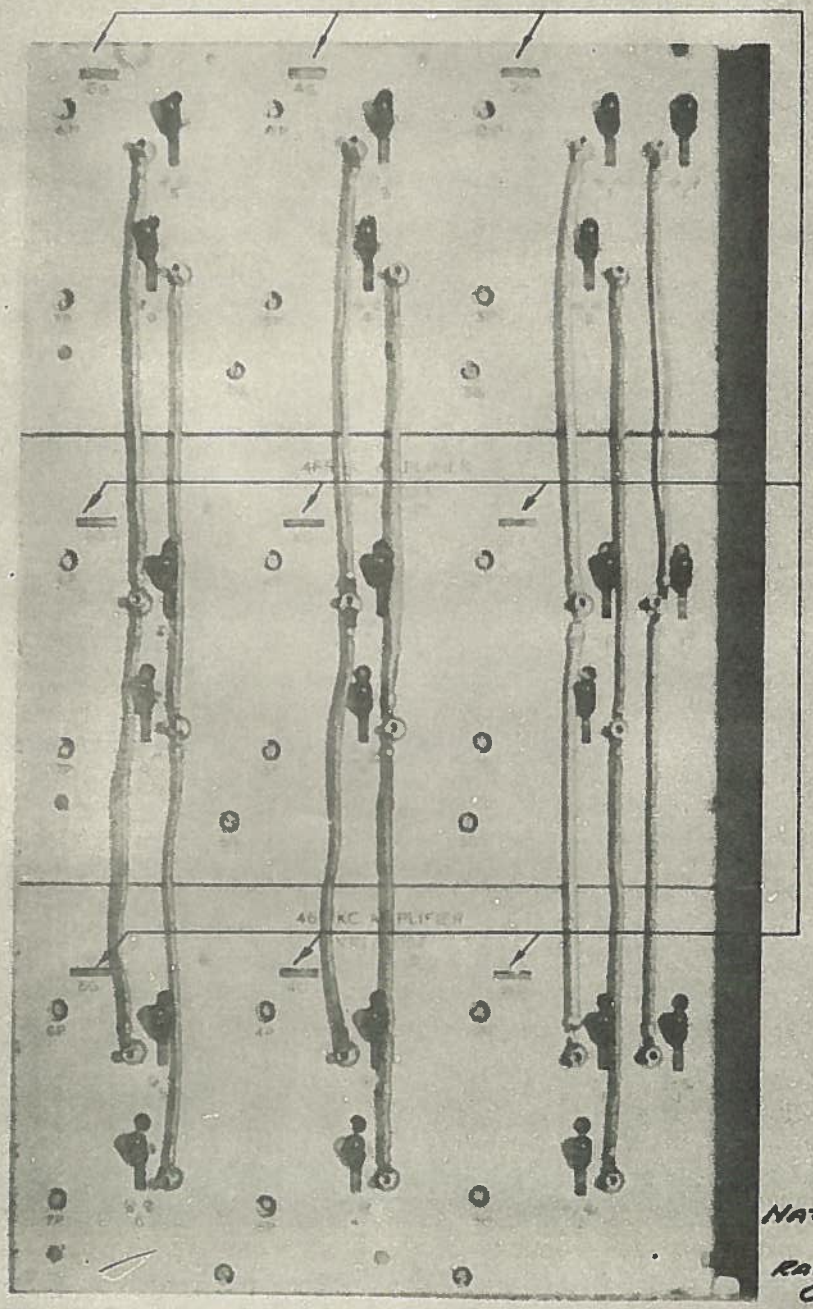
PLATE 2.



NATIONAL RESEARCH COUNCIL
RADIO BRANCH
OTTAWA, CAN.

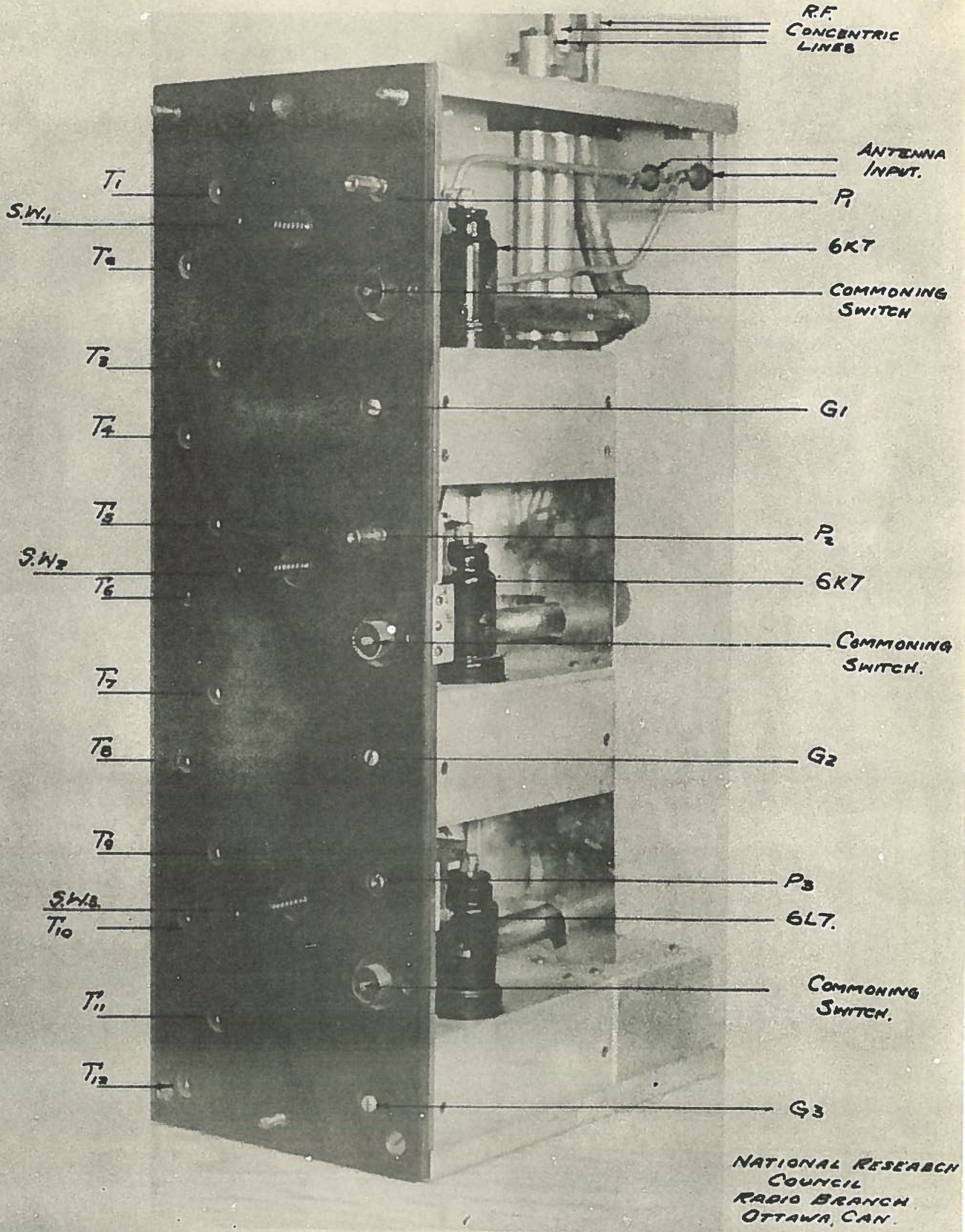
S.W. C.R.D.F.
REAR VIEW
PLATE 3.


S.W.1
S.W.2
S.W.3
COMMONING SWITCHES
NATIONAL RESEARCH COUNCIL
RADIO BRANCH
OTTAWA, CAN
FRONT VIEW R.F. PANEL
PLATE 4.



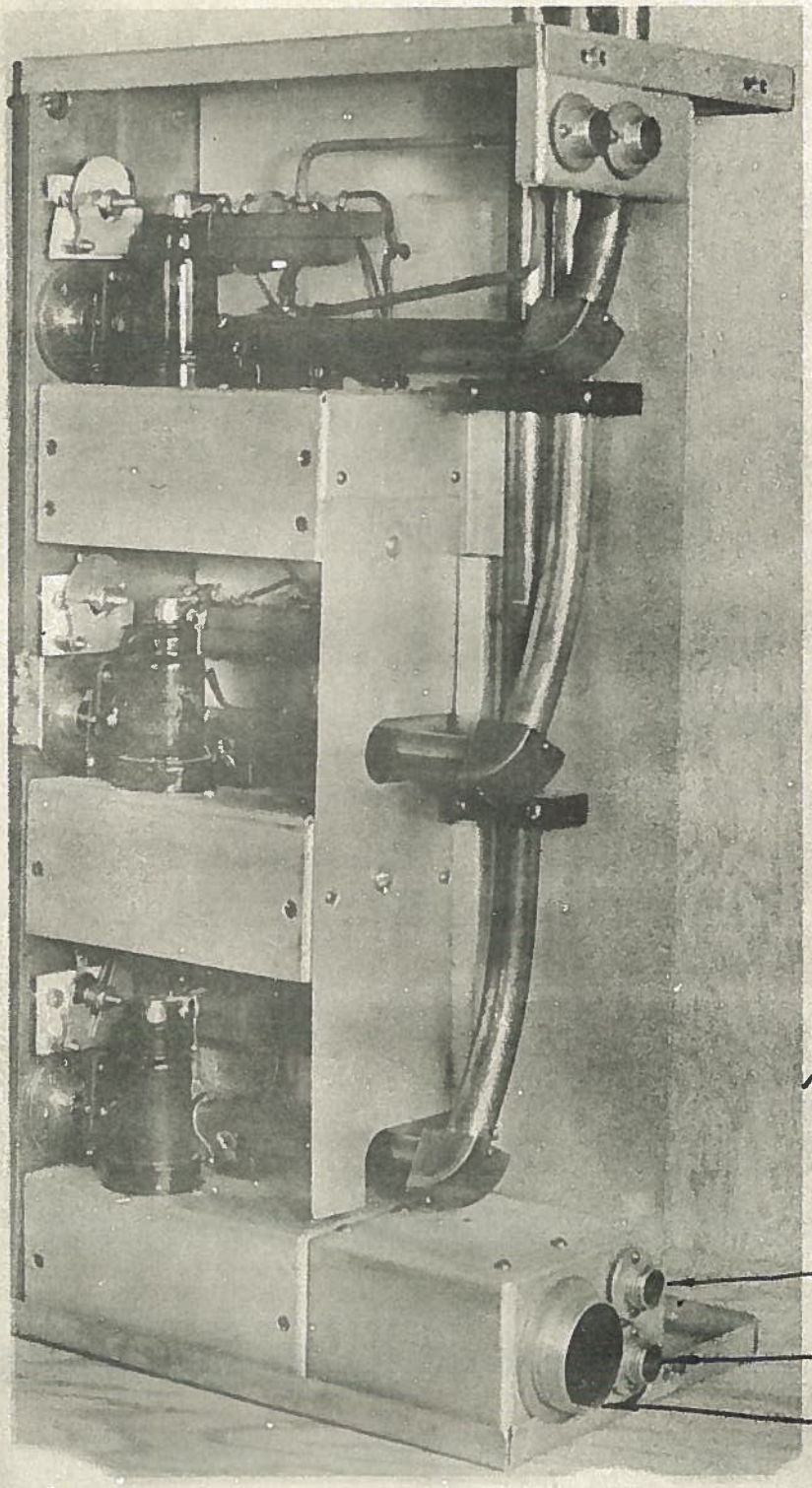
I.F. AMPLIFIERS ASSEMBLY

PLATE 5



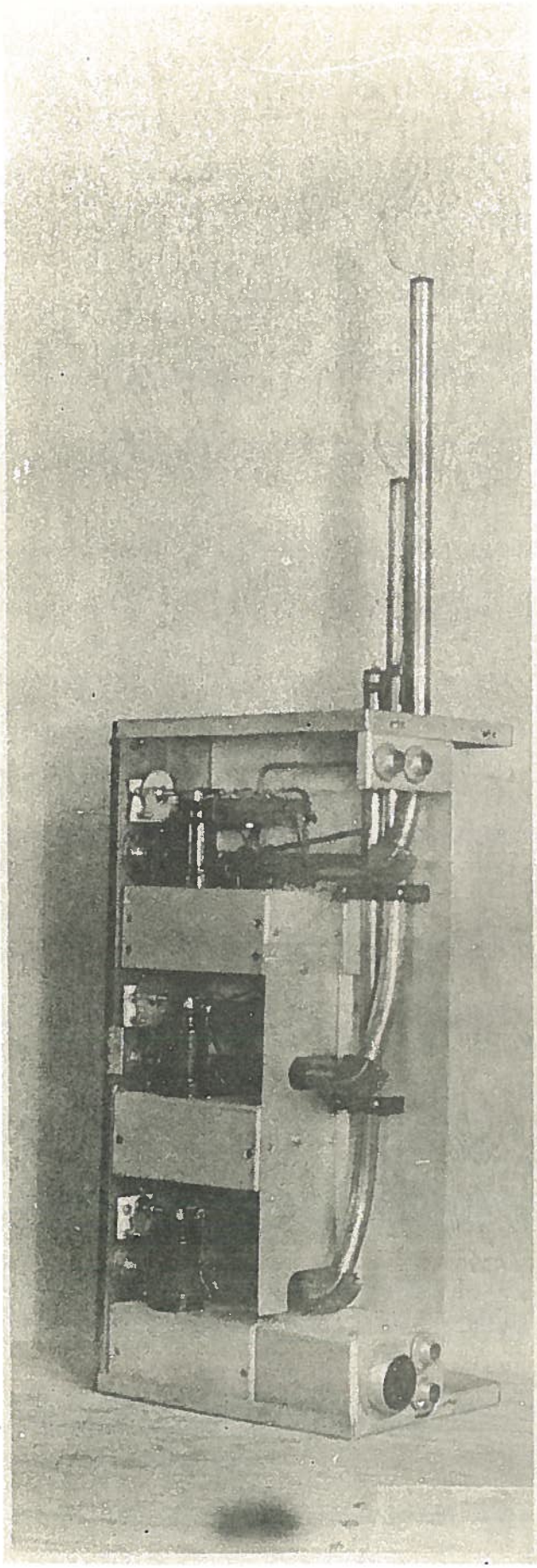
FRONT VIEW_R.F. AMPLIFIER

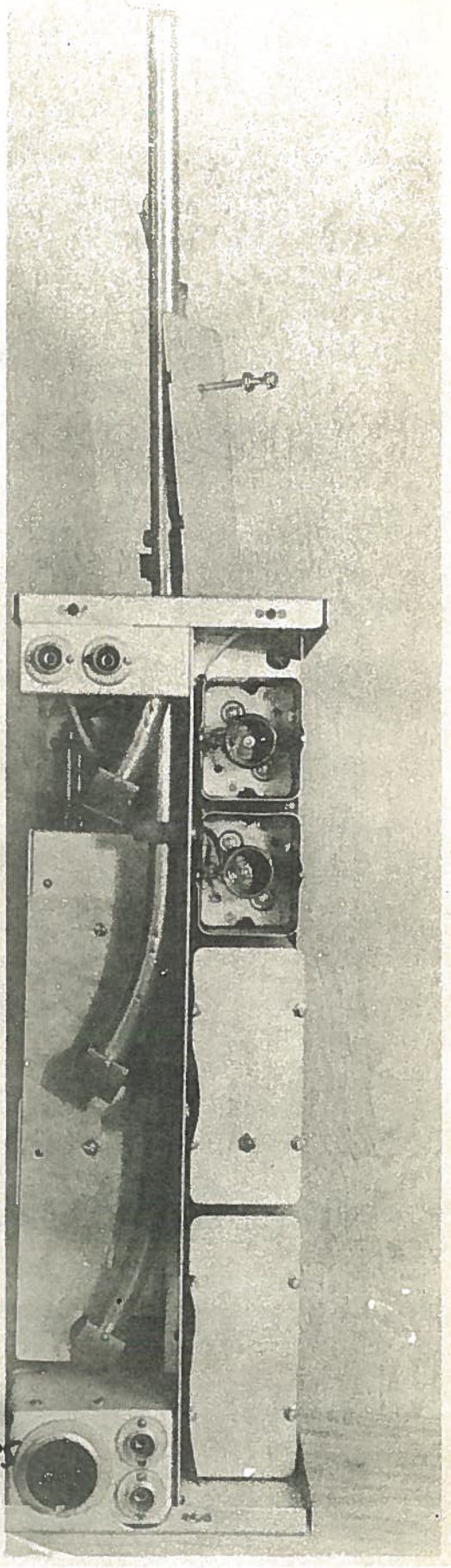
PLATE 6



SIDE VIEW. R.F. AMPLIFIER

PLATE 7

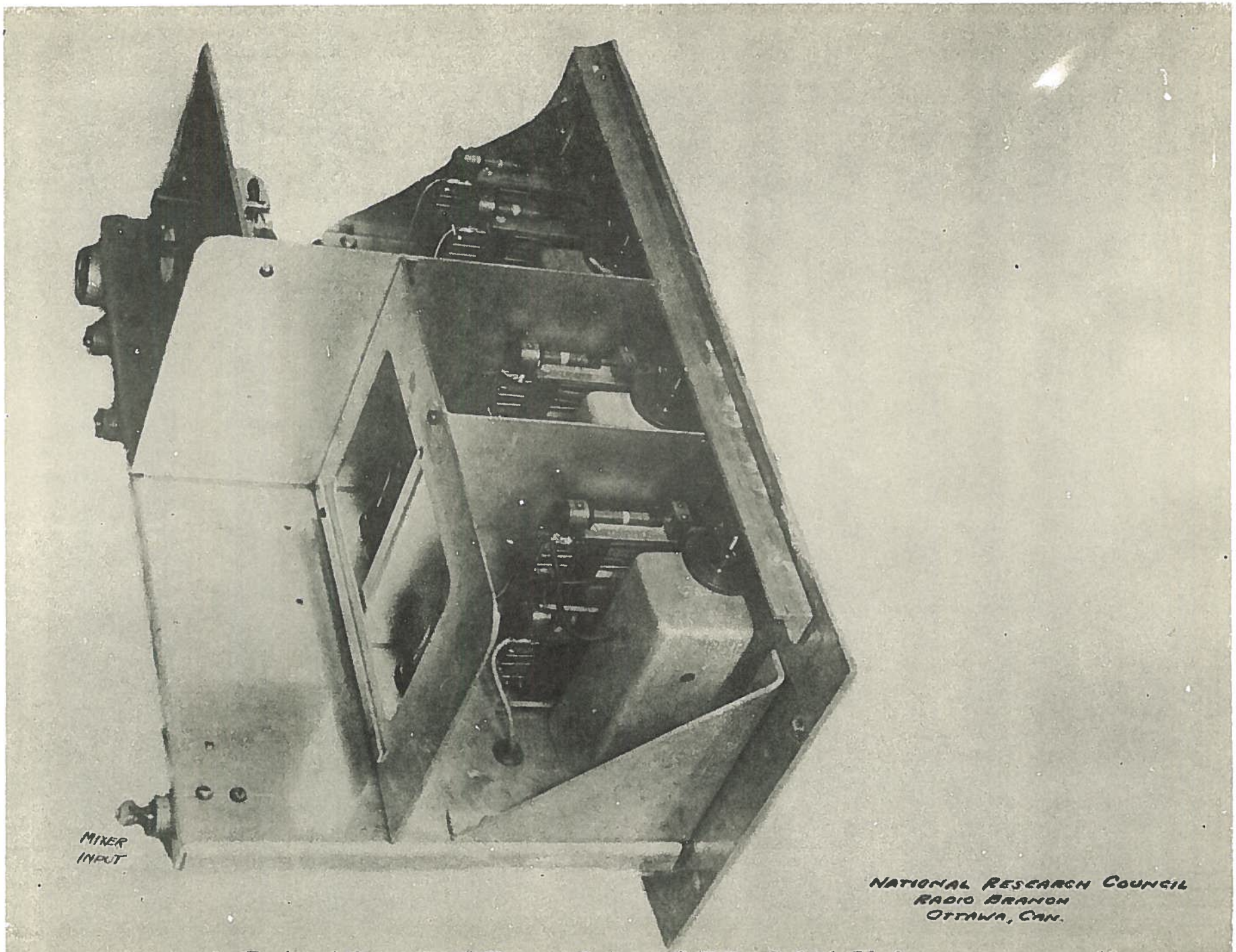




NATIONAL
RESEARCH
COUNCIL
RADIO BRANCH
OTTAWA, CAN.

DETAIL
VIEWS
R.F.
AMPLIFIERS

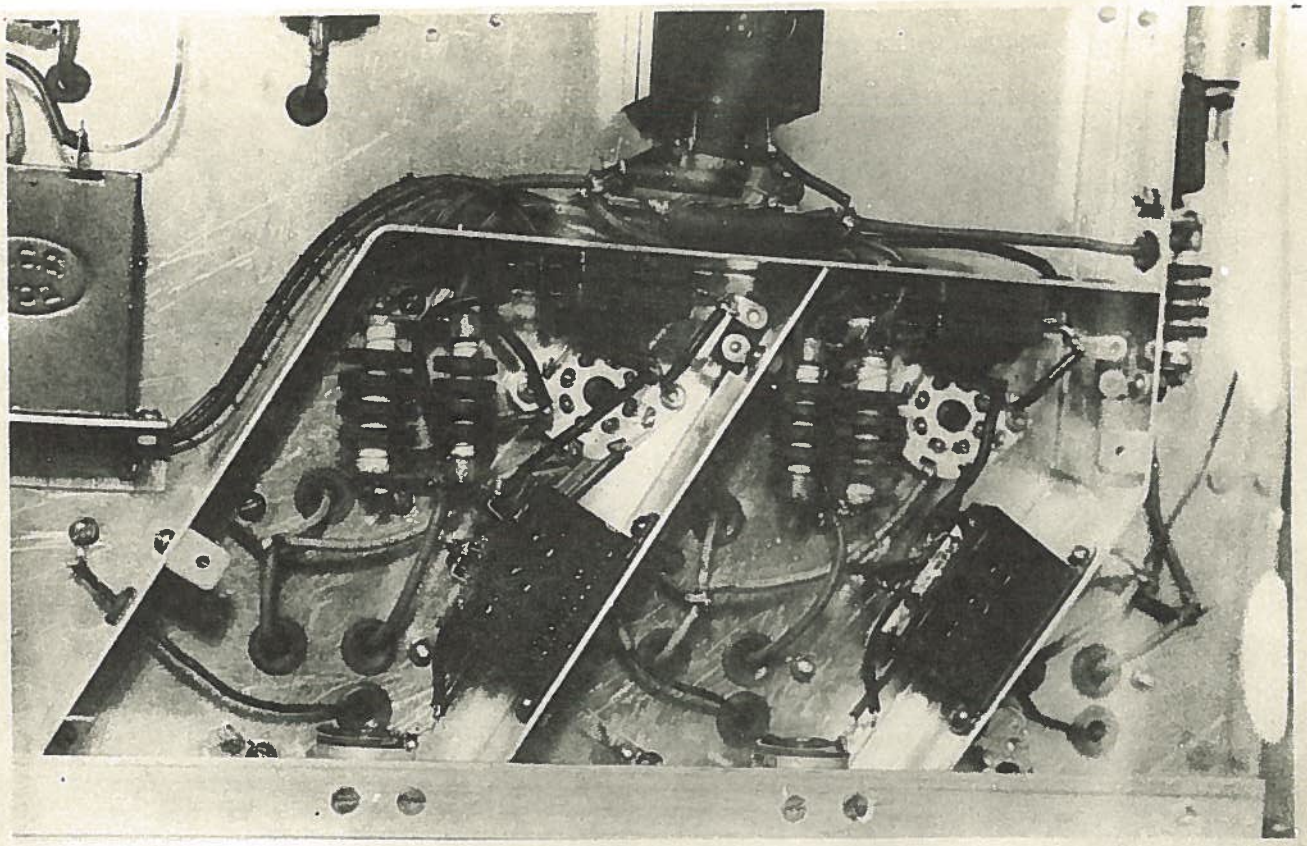
PLATE 8

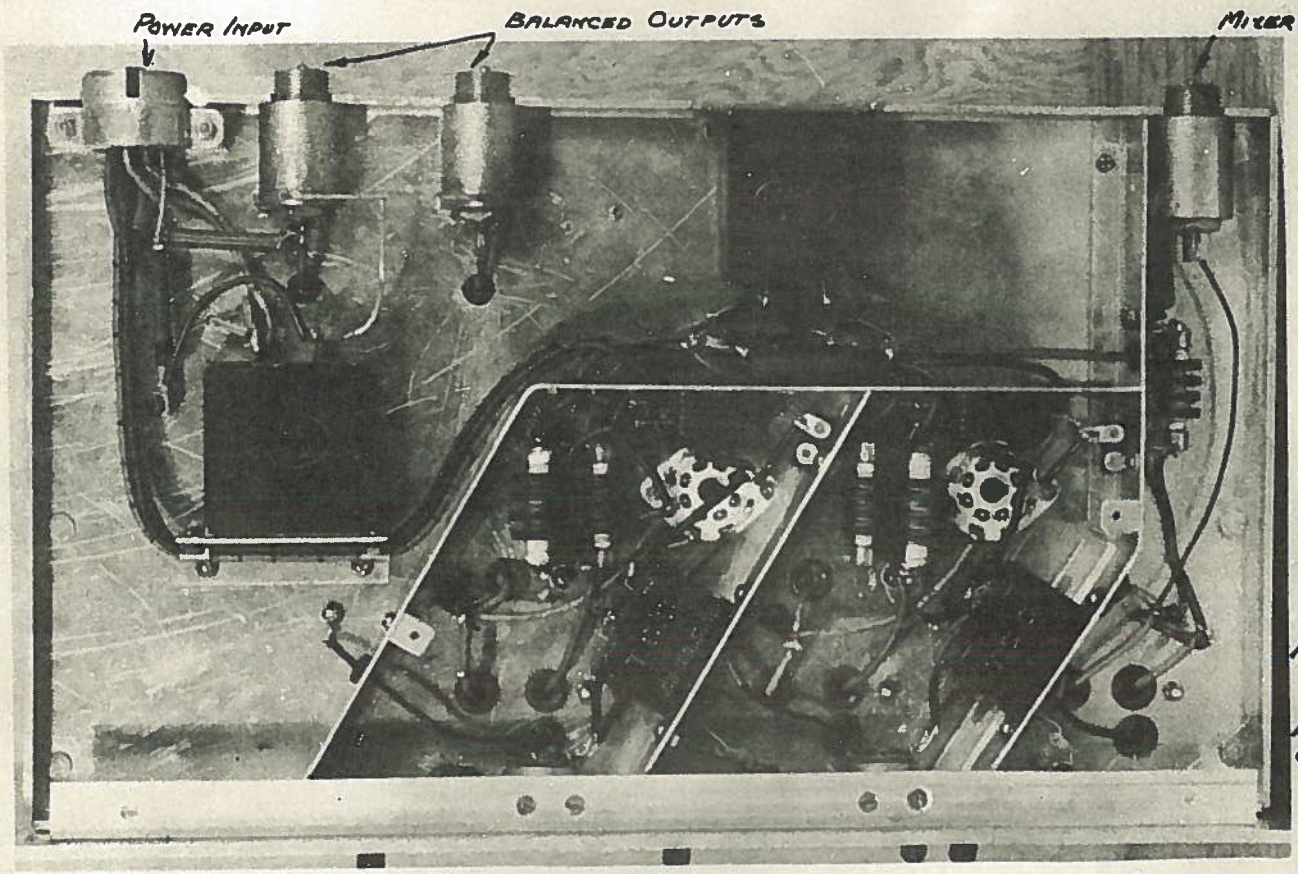


NATIONAL RESEARCH COUNCIL
RADIO BRANCH
OTTAWA, CAN.

I.F. AMPLIFIER - ISOMETRIC VIEW

PLATE 9.

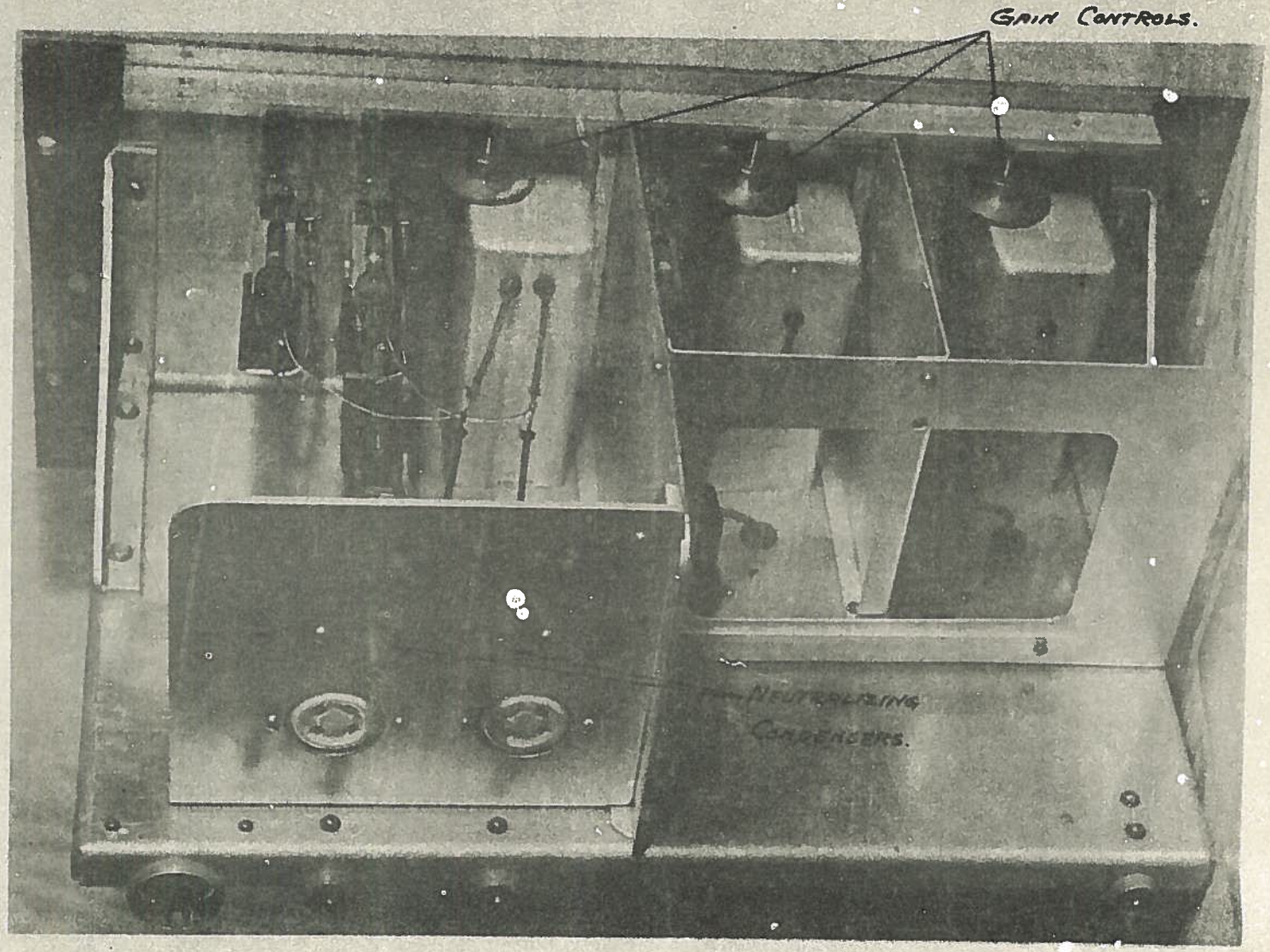




NATIONAL RESEARCH COUNCIL RADIO BR. OTTAWA, CAN.

BOTTOM VIEWS. I.F. AMPLIFIERS

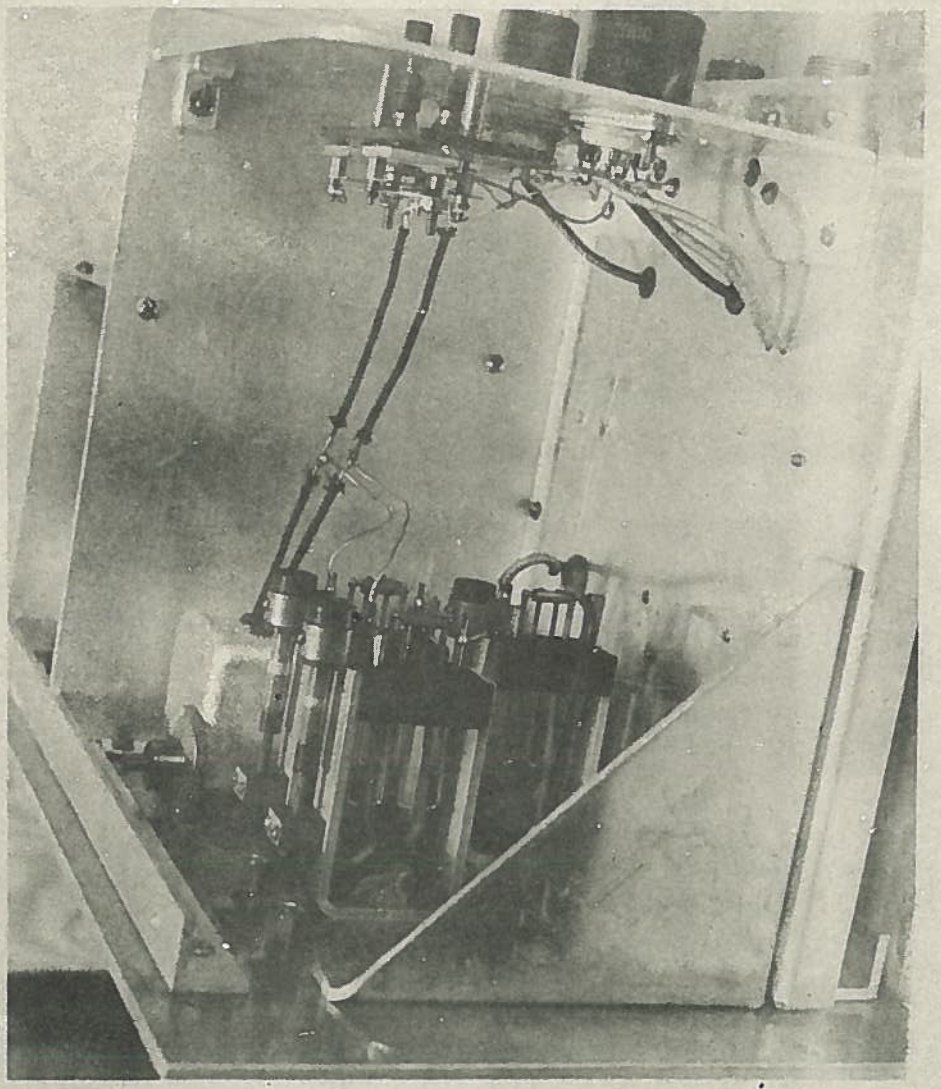
PLATE 10



I.F. AMPLIFIER REAR ISOMETRIC VIEW

NATIONAL RESEARCH
COUNCIL
RADIO BRANCH
OTTAWA, CAN.

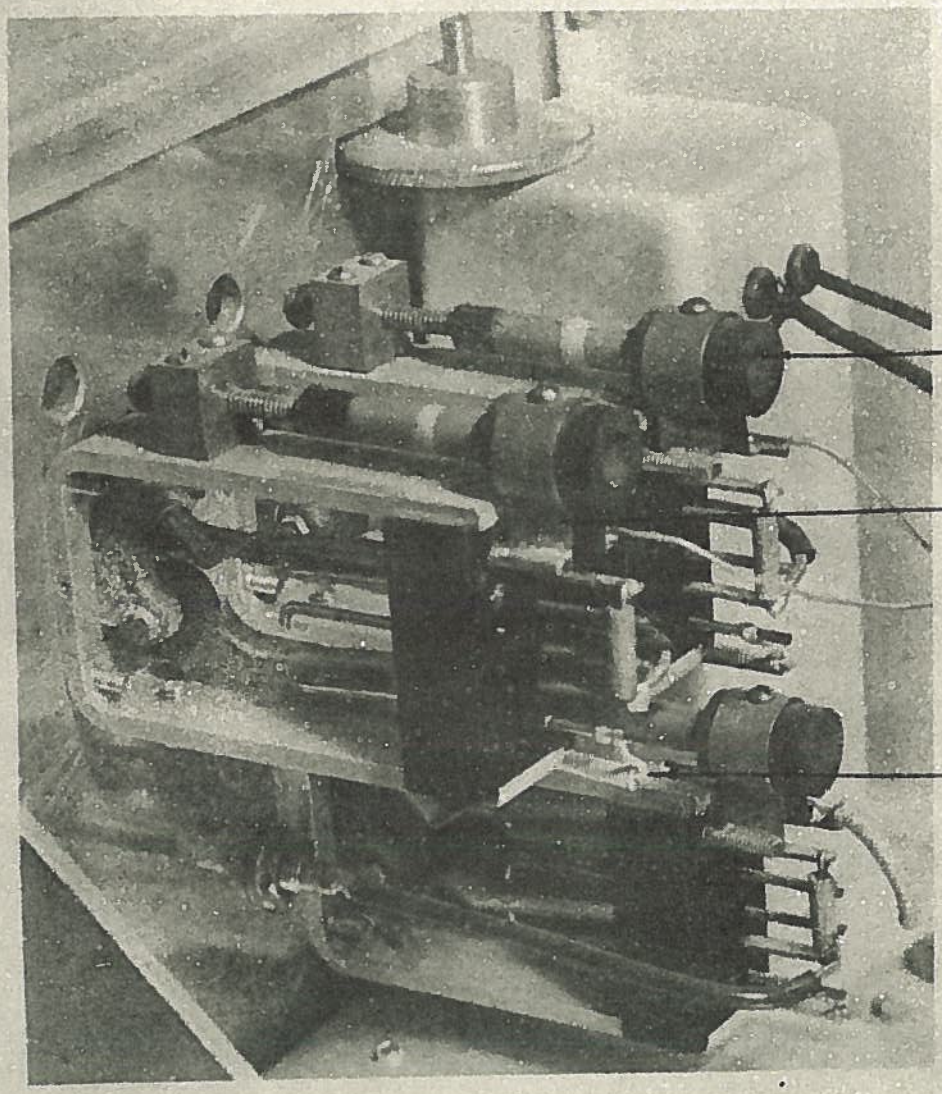
PLATE II



OUTPUT CIRCUIT

NATIONAL RESEARCH COUNCIL
RADIO BRANCH
OTTAWA, CAN.

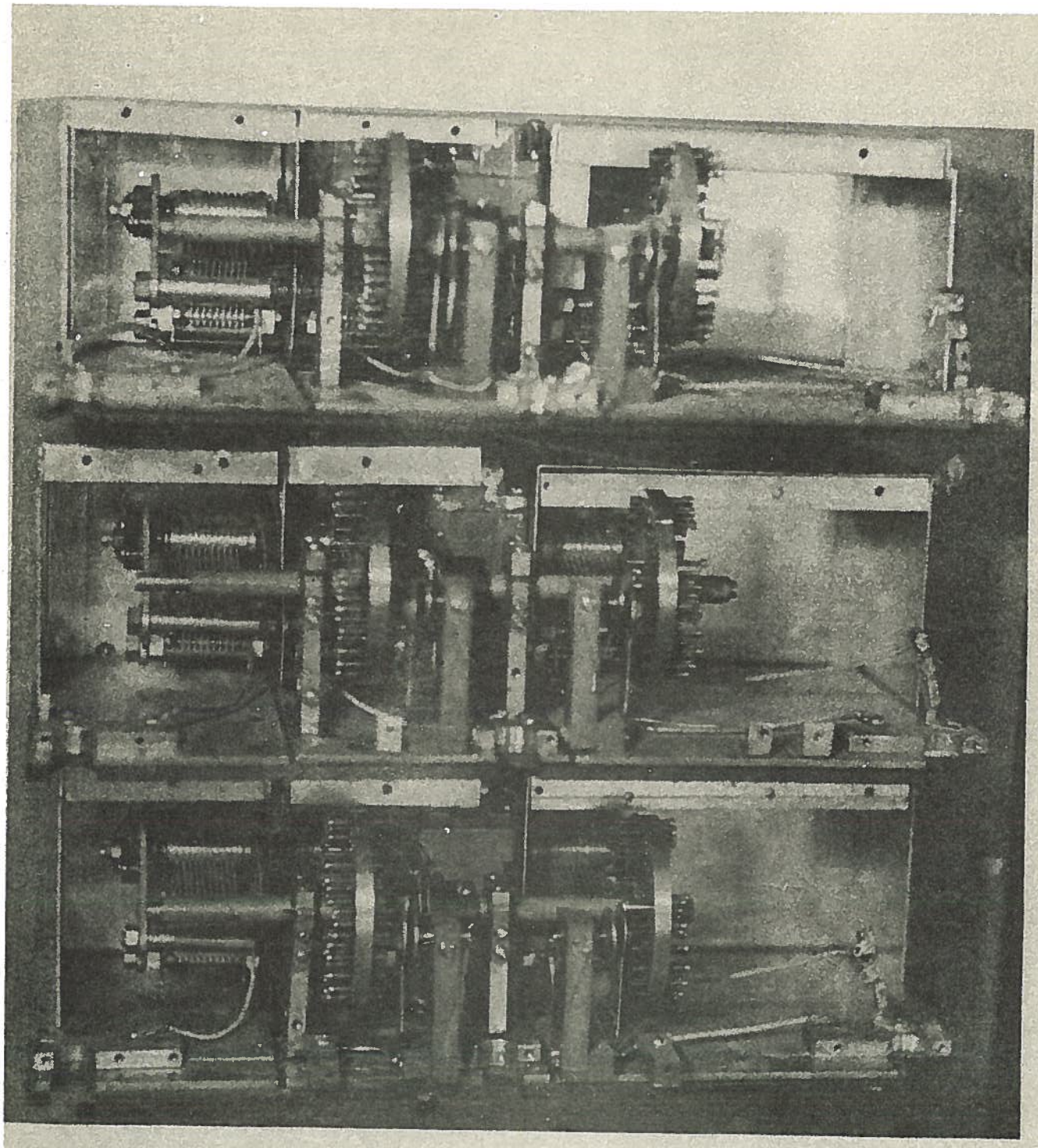
PLATE 12.



COMMONING SWITCHES

NATIONAL RESEARCH COUNCIL
RADIO BRANCH
OTTAWA, CAN.

PLATE 13

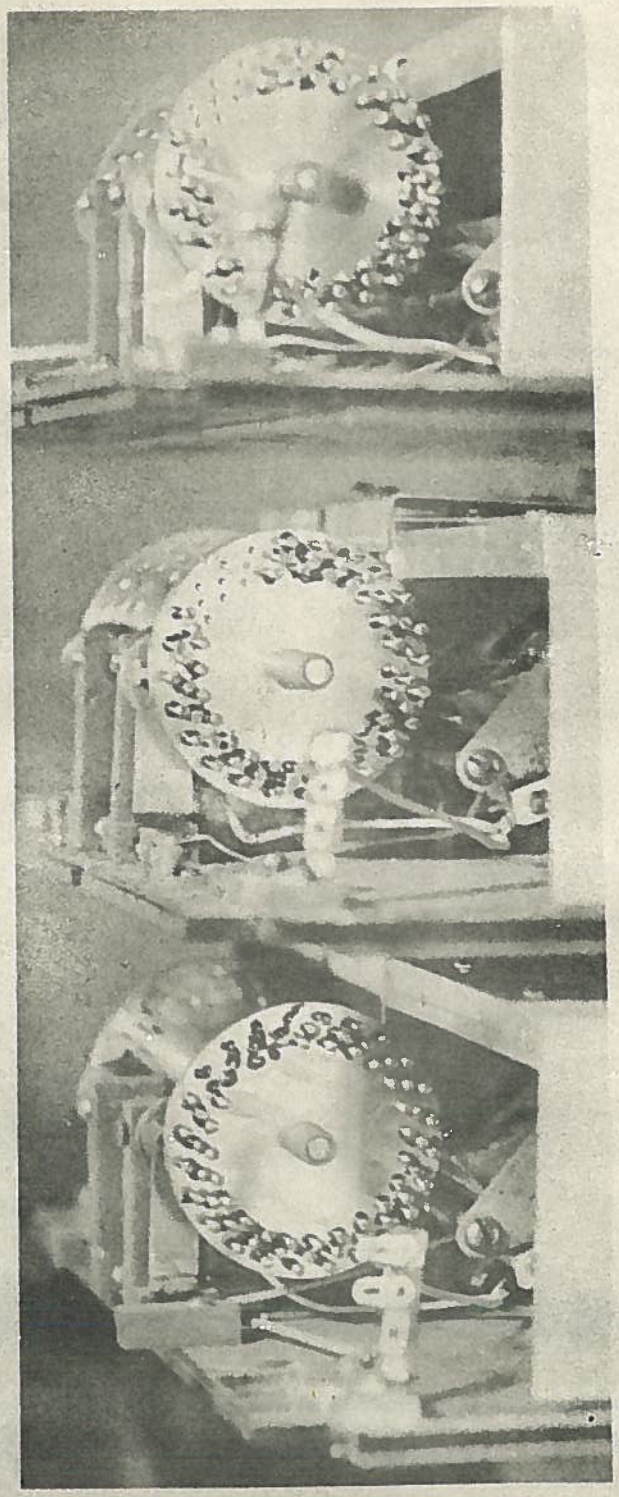


R.F. TUNING UNIT

REAR VIEW

NATIONAL RESEARCH COUNCIL
RADIO BRANCH
OTTAWA, CAN.

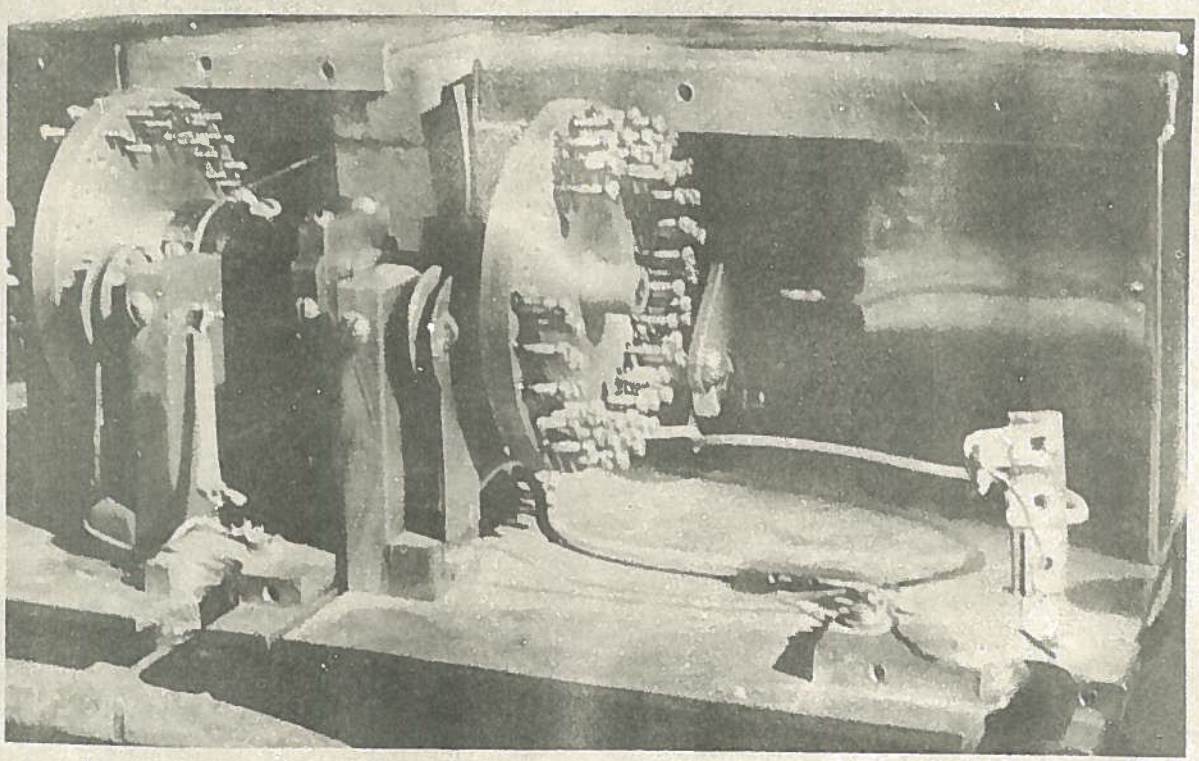
PLATE 14.



NATIONAL RESEARCH
COUNCIL
RADIO BRANCH
OTTAWA, CAN.

SIDE VIEW - CAM TRIMMERS
1st & 2nd R.F. & MIXERS

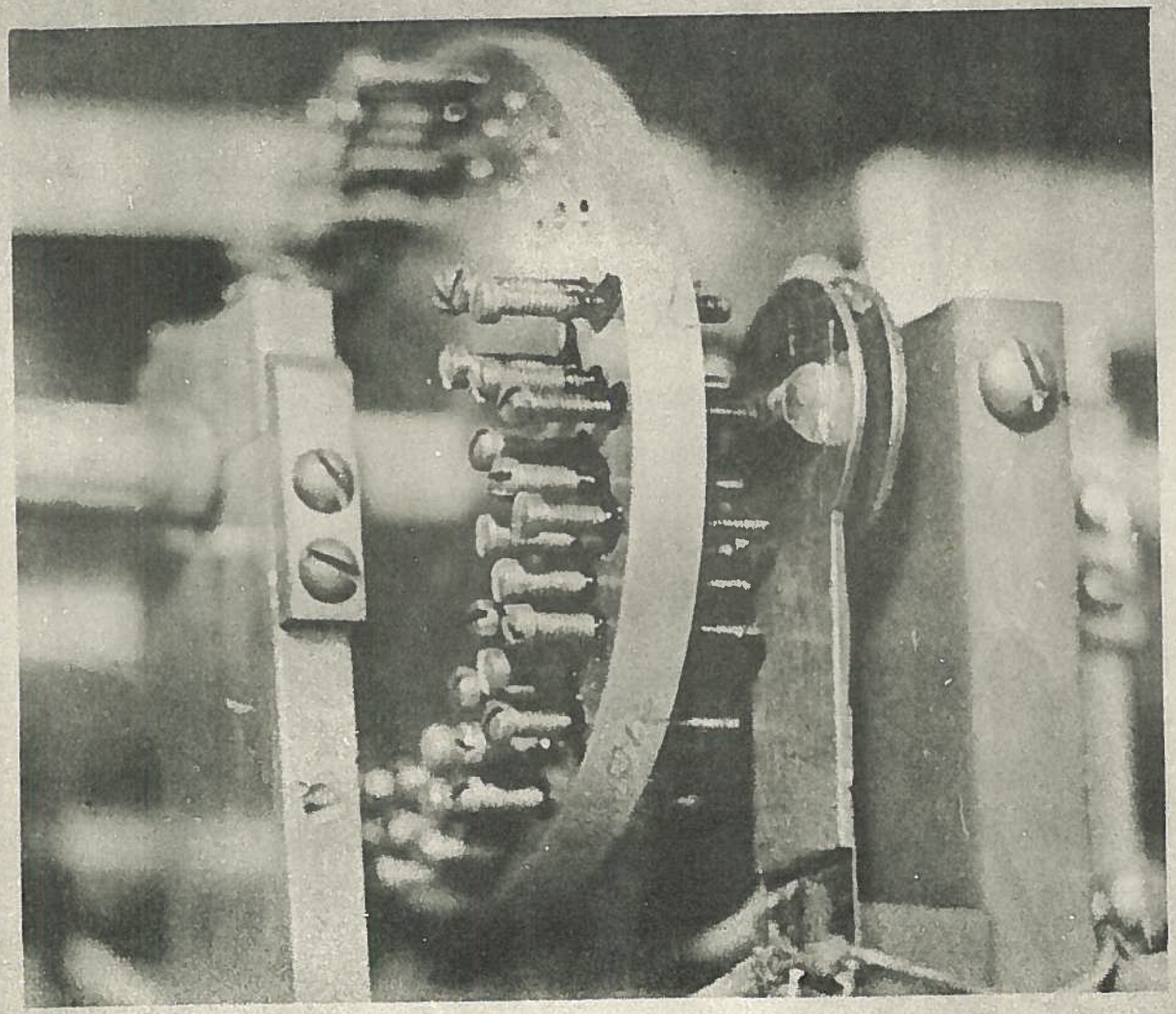
PLATE 15



CAM TRIMMERS.

NATIONAL RESEARCH COUNCIL
RADIO BRANCH
OTTAWA, CAN.

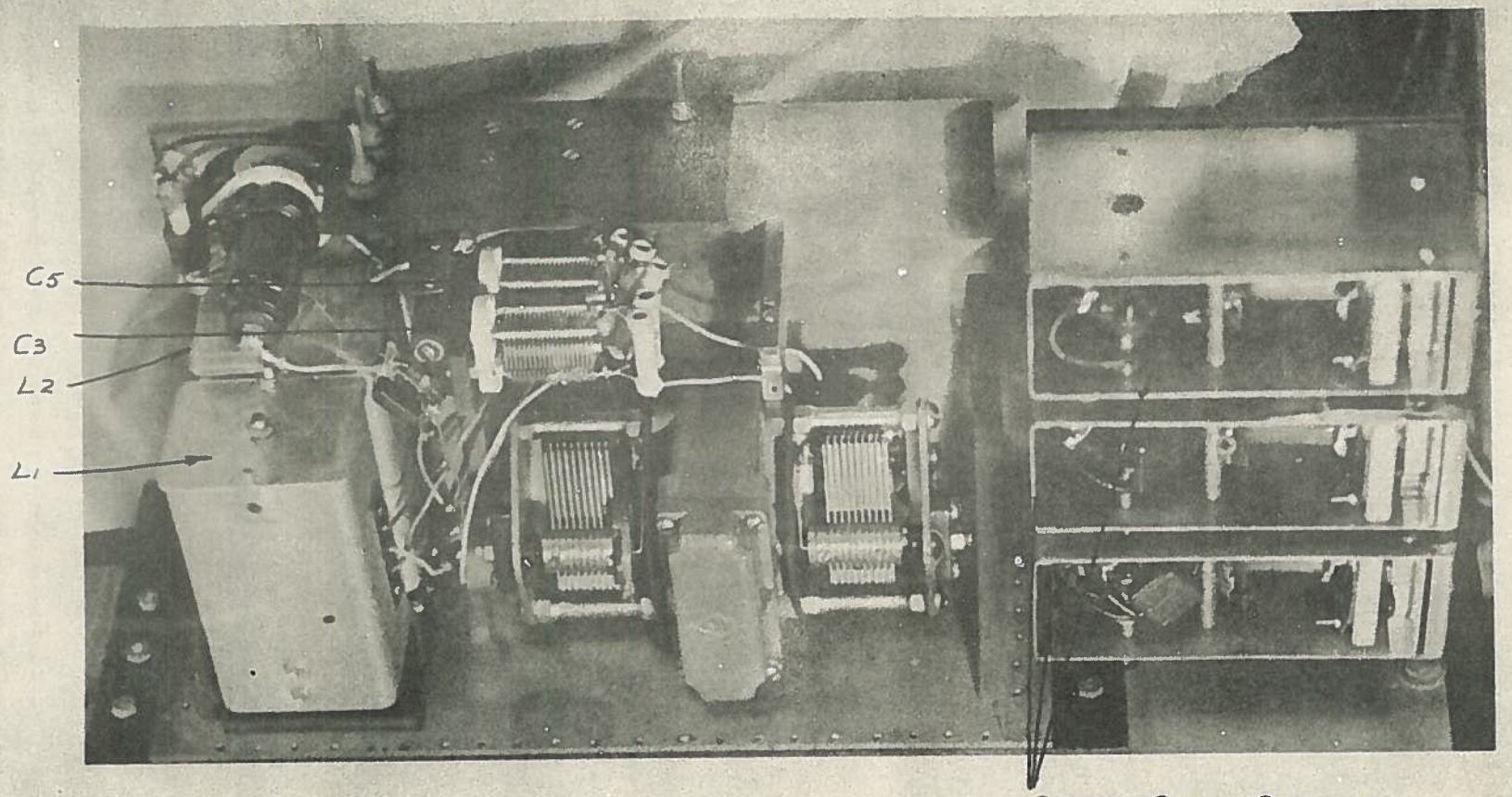
PLATE 16



CLOSE-UP - CAM TRIMMER

NATIONAL RESEARCH COUNCIL
RADIO BRANCH
OTTAWA CAN.

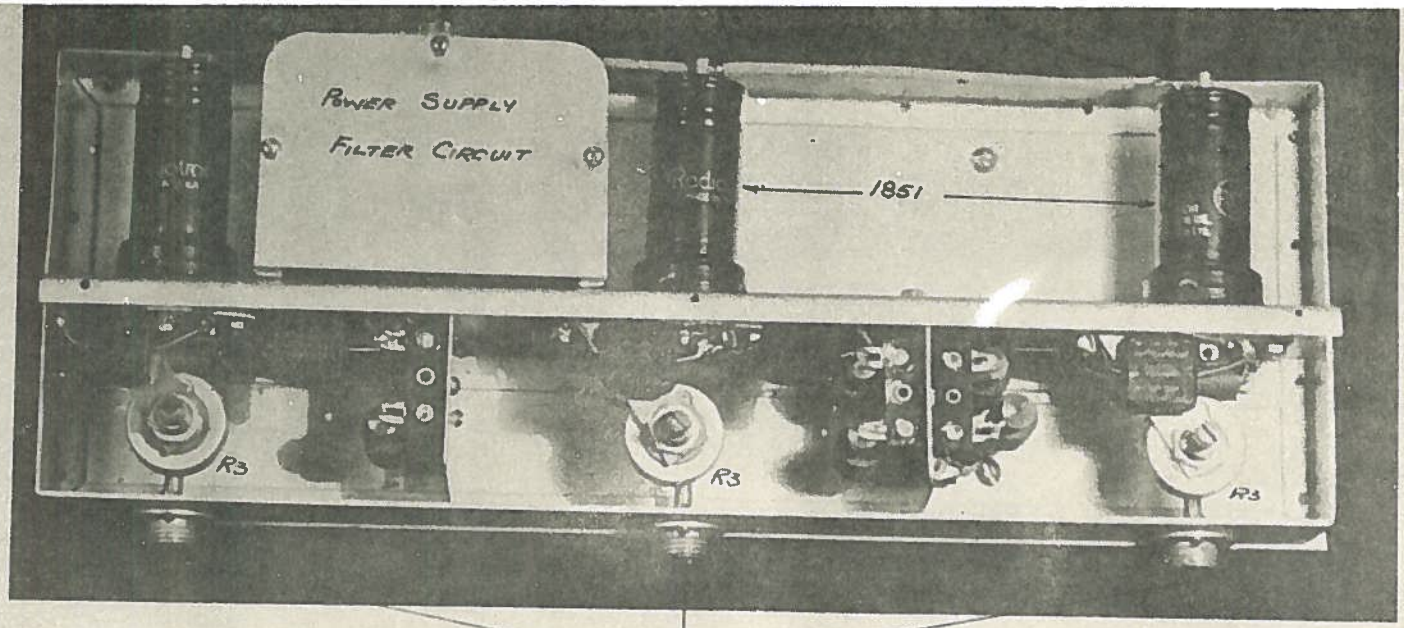
PLATE 17.



LOCAL OSCILLATOR & COARSE GAIN CONTROL

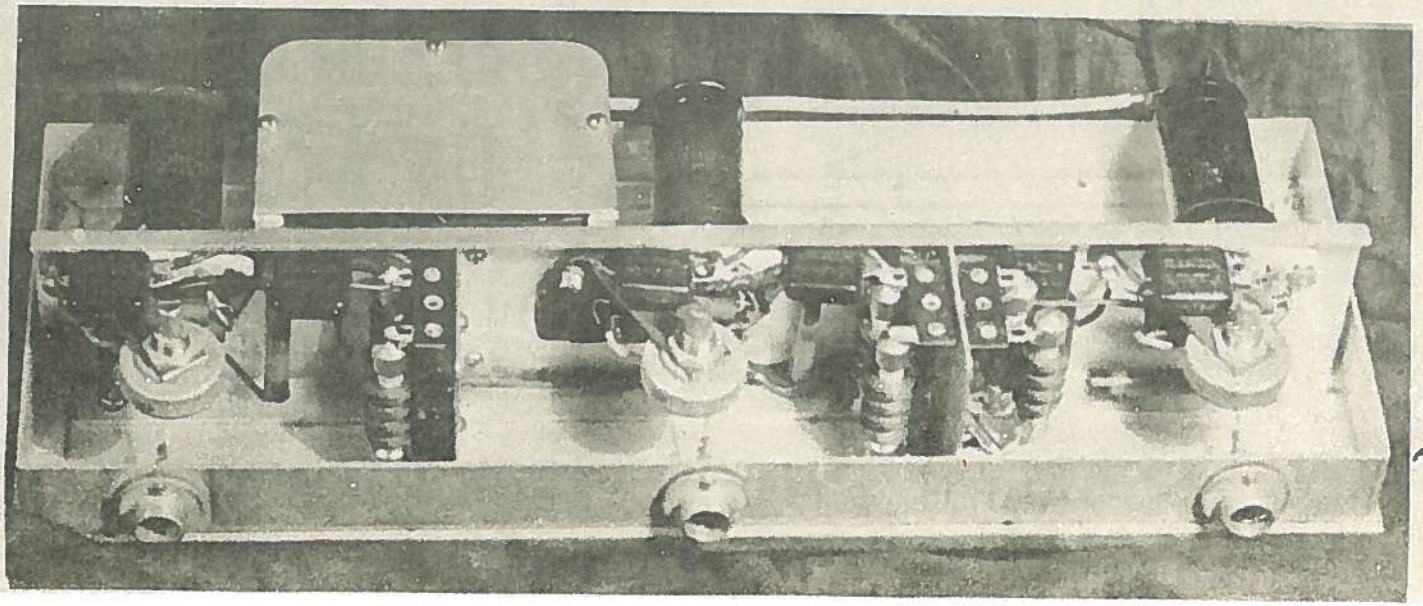
NATIONAL RESEARCH COUNCIL
RADIO BRANCH
OTTAWA, CAN.

PLATE 18



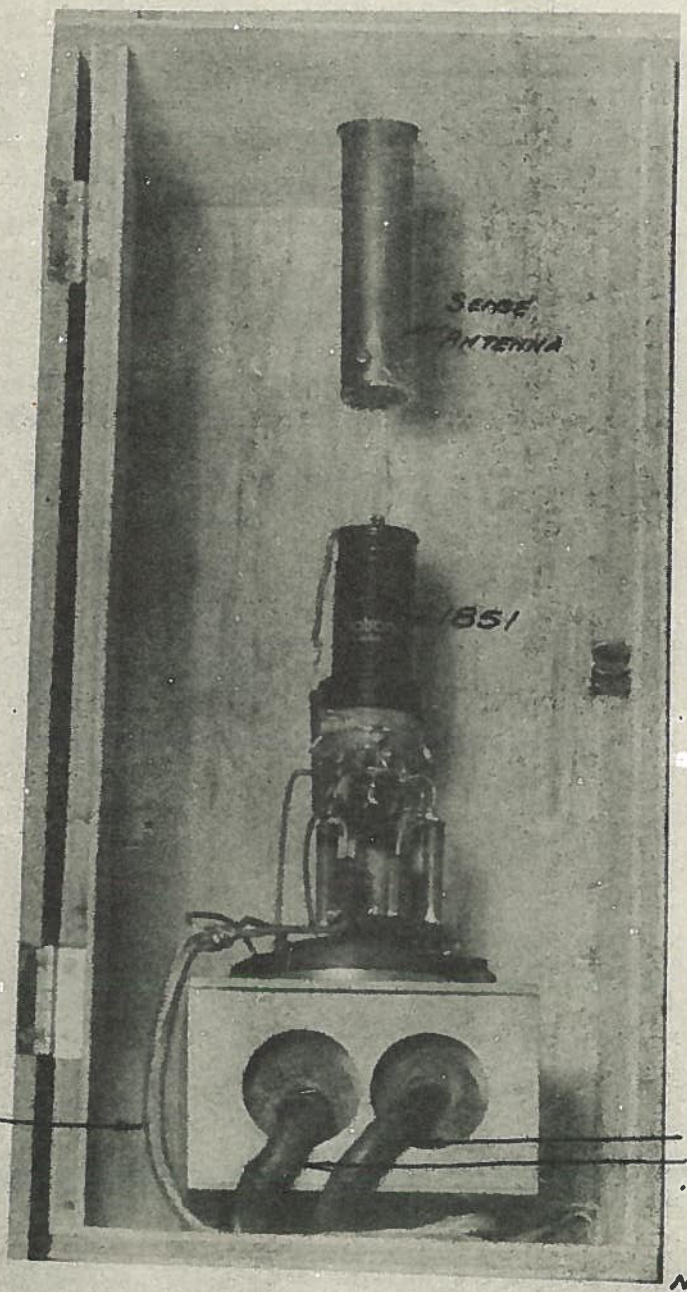
TO MIXER

BUFFER STAGE



NATIONAL RESEARCH
COUNCIL
RADIO BRANCH
OTTAWA, CAN.

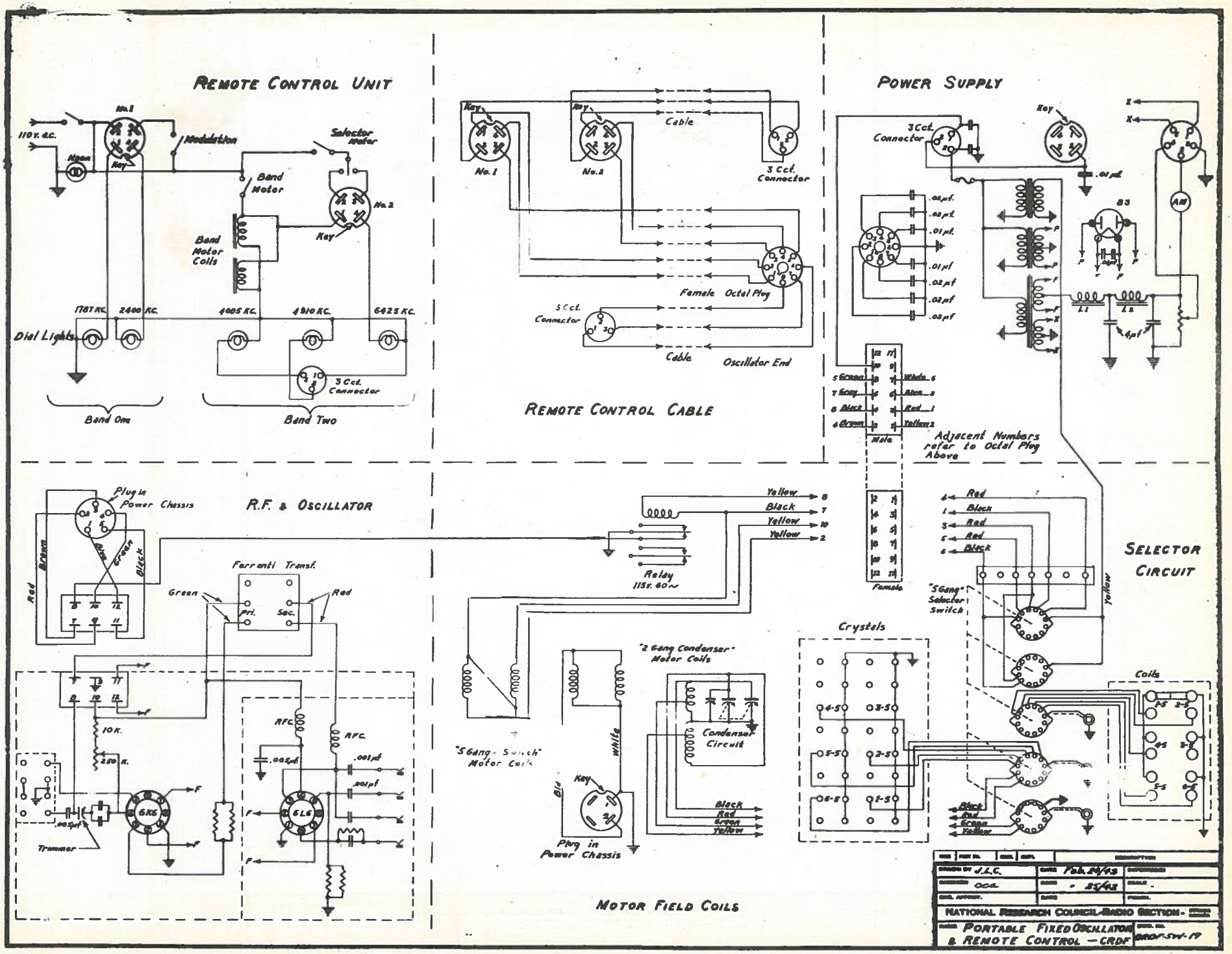
PLATE 19

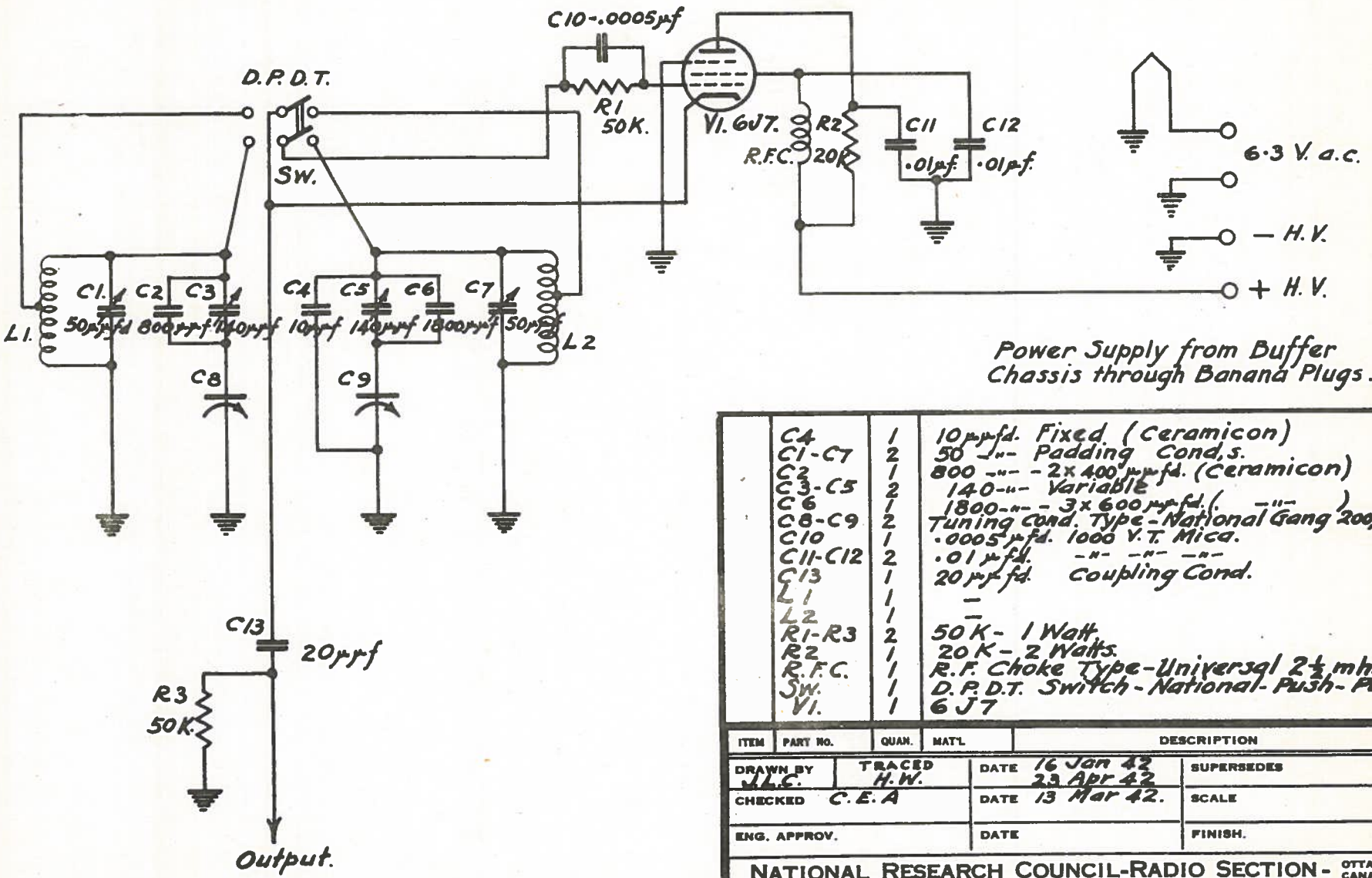


NATIONAL RESEARCH COUNCIL
RADIO BRANCH
OTTAWA, CAN.

SENSE ANTENNA AMPLIFIER.

PLATE. 20


REMOTE CONTROL UNIT
110 V. A.C.
No. 1
Neon
Key
Modulation
Selector Motor
Band Motor
No. 2
Key
Band Motor Coils
1787 KC.
2400 KC.
4005 KC.
4910 KC.
6425 KC.
Dial Lights
3 Ccl. Connector
Band One
Band Two
REMOTE CONTROL CABLE
Key
No. 1
Key
No. 2
Cable
3 Ccl. Connector
Female Octal Plug
3 Ccl. Connector
Cable
Oscillator End
POWER SUPPLY
3 Ccl. Connector
Key
.01 µf.
.05 µf.
.05 µf.
.01 µf.
.01 µf
.02 µf
.02 µf
.02 µf
83
AM
L1
L2
4 µf
5 Green
7 Gray
8 Black
4 Green
White 6
Blue 3
Red 1
Yellow 2
Male
Female
Adjacent Numbers refer to Octal Plug Above
R.F. & OSCILLATOR
Plug in Power Chassis
Red
Brown
Blue
Green
Black
Ferranti Transf.
Green
Pri.
Sec.
Red
10 K.
250 K.
RFC.
RFC.
.005 µf.
.001 µf
.001 µf
6K6
6L6
.005 µf
Trimmer
Relay 115v. 60~
Yellow
Black
Yellow
Yellow
"5 Gang - Switch" Motor Coils
"2 Gang Condenser" Motor Coils
Condenser Circuit
Blue
White
Key
Plug in Power Chassis
Black
Red
Green
Yellow
SELECTOR CIRCUIT
4 Red
1 Black
3 Red
5 Red
6 Black
"5 Gang" Selector Switch
Yellow
Crystals
4-5
3-5
5-5
2-5
6-5
1-5
Black
Red
Green
Yellow
Coils
1-5
2-5
3-5
4-5
5-5
6-5
MOTOR FIELD COILS
J.L.C.
Feb. 24/43
O.C.A.
- 25/43
NATIONAL RESEARCH COUNCIL-RADIO SECTION
PORTABLE FIXED OSCILLATOR & REMOTE CONTROL — CRDF
CRDF-SW-19



Power Supply from Buffer Chassis through Banana Plugs.

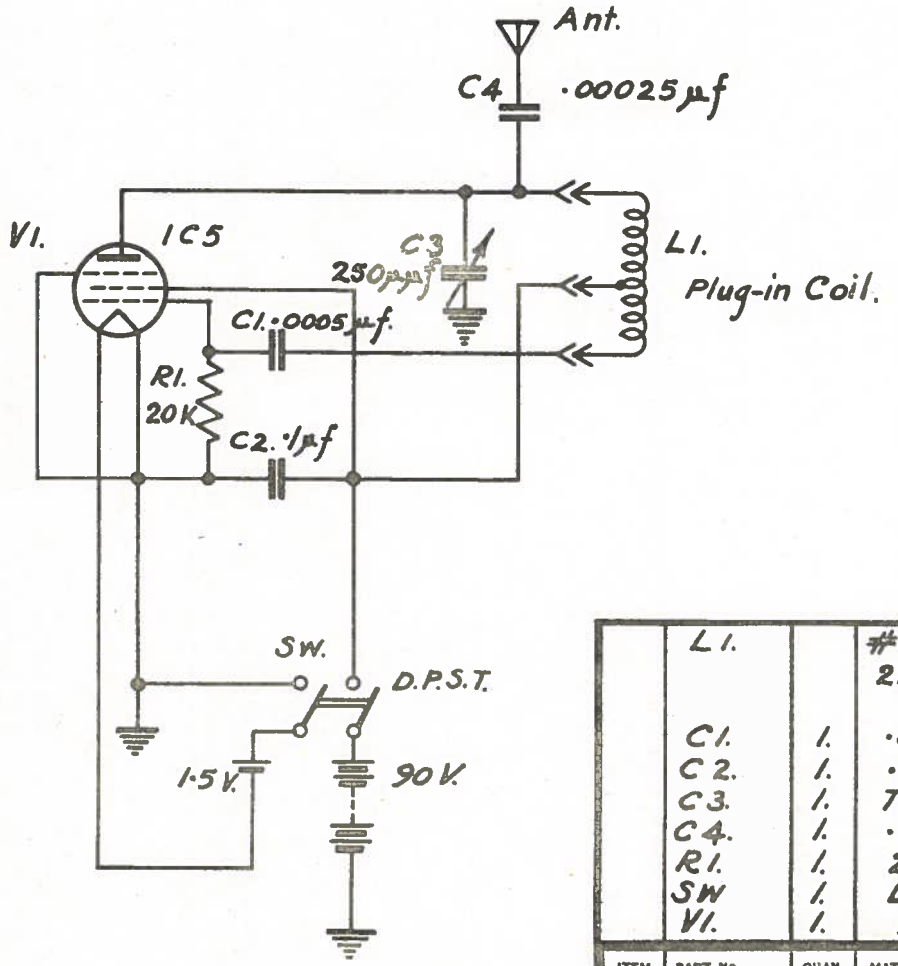
C4	1	10μμfd. Fixed (Ceramicon)	
C1-C7	2	50 -"- Padding Cond,s.	
C2	1	800 -"- - 2x400 μμfd. (Ceramicon)	
C3-C5	2	140-"- Variable	
C6	1	1800-"- - 3x600 μμfd. (-"-)	
C8-C9	2	Tuning Cond. Type - National Gang 200μμfd.	
C10	1	.0005 μfd. 1000 V.T. Mica.	
C11-C12	2	.01 μfd. -"- -"- -"-	
C13	1	20 μμfd. Coupling Cond.	
L1	1	—	
L2	1	—	
R1-R3	2	50K - 1 Watt.	
R2	1	20K - 2 Watts.	
R.F.C.	1	R.F. Choke Type - Universal 2½ mh.	
Sw.	1	D.P.D.T. Switch - National - Push-Pull	
V1.	1	6J7	

ITEM	PART NO.	QUAN.	MAT'L	DESCRIPTION

DRAWN BY J.L.C.	TRACED H.W.	DATE 16 Jan 42, 23 Apr 42	SUPERSEDES
CHECKED C.E.A		DATE 13 Mar 42.	SCALE
ENG. APPROV.		DATE	FINISH.

NATIONAL RESEARCH COUNCIL-RADIO SECTION - OTTAWA CANADA

NAME	DWG. NO.
LOCAL OSCILLATOR	C.R.D.F.-SW-20



Chassis.

NOTE

Batteries Mounted Inside
All Metal Carrying Case.

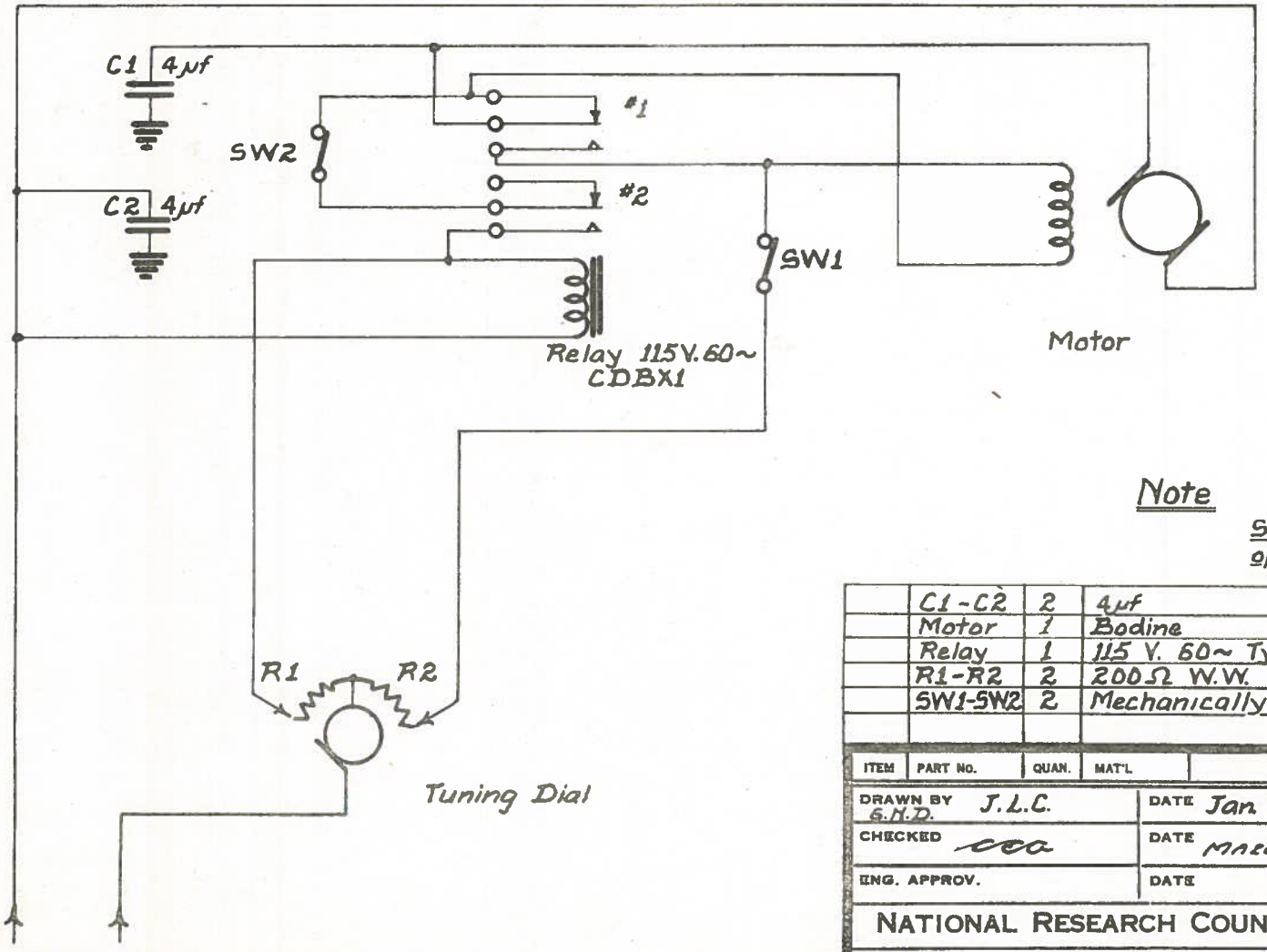
L1.		# 28 Enc. Wire on 1⅝" Plug-in-Form. 22 Turns tapped at 15th.	
C1.	1.	.0005 µfd. Mica.	
C2.	1.	.1 µfd Mica.	
C3.	1.	Tuning Condenser - 100 µµfd.	
C4.	1.	.00025 µfd. Mica.	
R1.	1.	20K 1 Watt.	
SW	1.	D.P.S.T. Switch	
V1.	1.	1C5	

ITEM	PART No.	QUAN.	MAT'L	DESCRIPTION

DRAWN BY J.L.C.	TRACED H.W.	DATE 16 Jan. 42 24 Apr. 42	SUPERSEDES
CHECKED		DATE 24 APR. 42	SCALE
ENG. APPROV.		DATE	FINISH.

NATIONAL RESEARCH COUNCIL-RADIO SECTION - OTTAWA CANADA

NAME	DWG. NO.
PORTABLE FIELD OSCILLATOR	CRDF-SW-21.



Note

Sw 1 & Sw 2 are Limit Switches operated by tuning mechanism

	C1-C2	2	4µf
	Motor	1	Bodine
	Relay	1	115 V. 60~ Type CDBX1
	R1-R2	2	200Ω W.W.
	SW1-SW2	2	Mechanically Operated Jack Switches

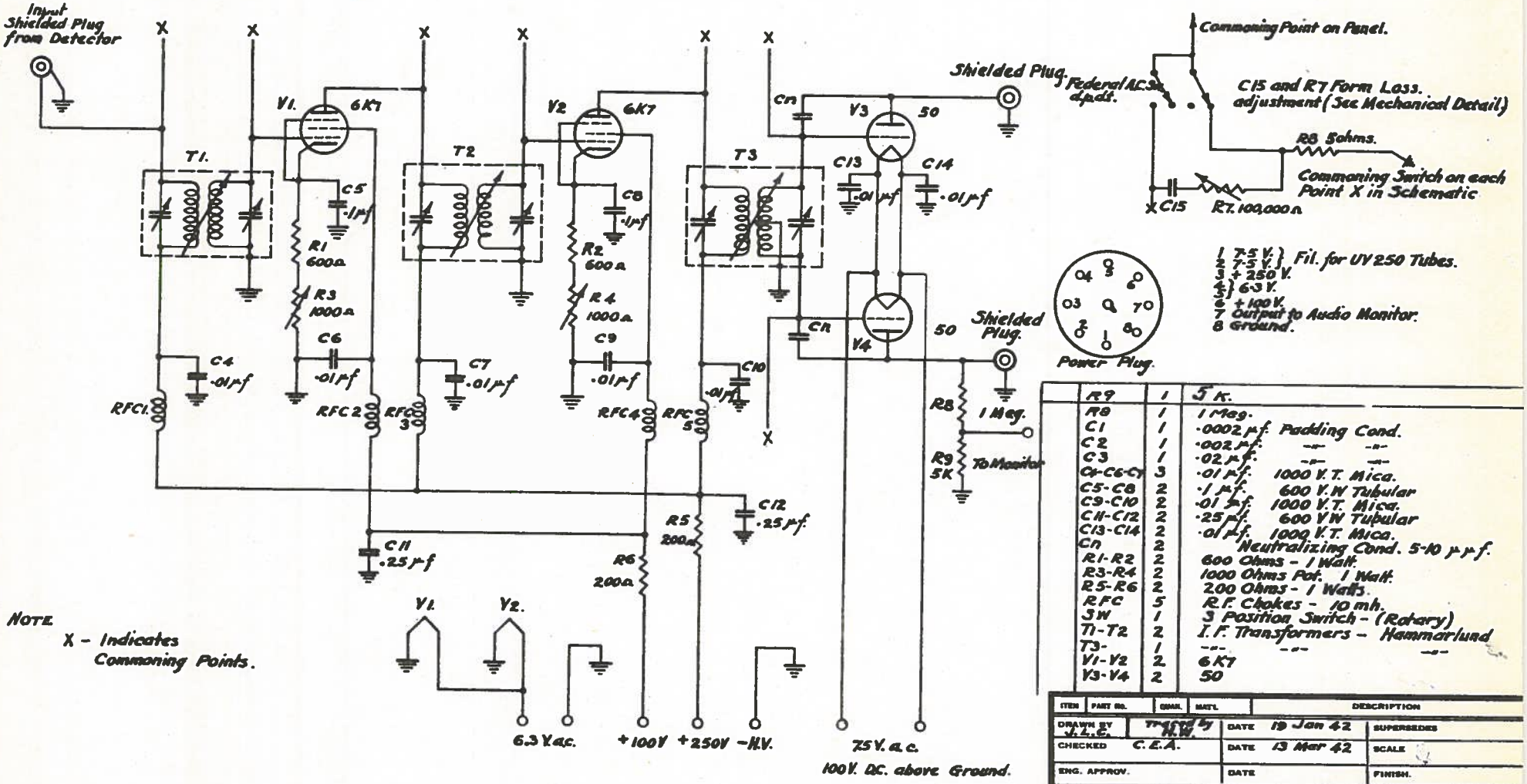
ITEM	PART No.	QUAN.	MAT'L	DESCRIPTION

DRAWN BY J.L.C. G.N.D.	DATE Jan. 20, 1942	SUPERSEDES
CHECKED cea	DATE MARCH 13/42	SCALE
ENG. APPROV.	DATE	FINISH.

NATIONAL RESEARCH COUNCIL-RADIO SECTION - OTTAWA CANADA

NAME: TUNING CONTROL

DWG. NO. CRDF-SW-22



NOTE.
X - Indicates Commoning Points.

R9	1	5 K.
R8	1	1 Meg.
C1	1	.0002 μf. Padding Cond.
C2	1	.002 μf. -"- -"-
C3	1	.02 μf. -"- -"-
C4-C6-C7	3	.01 μf. 1000 V.T. Mica.
C5-C8	2	.1 μf. 600 V.W Tubular
C9-C10	2	.01 μf. 1000 V.T. Mica.
C11-C12	2	.25 μf. 600 V.W Tubular
C13-C14	2	.01 μf. 1000 V.T. Mica.
Cn	2	Neutralizing Cond. 5-10 μμf.
R1-R2	2	600 Ohms - 1 Watt.
R3-R4	2	1000 Ohms Pot. 1 Watt.
R5-R6	2	200 Ohms - 1 Watts.
RFC	5	R.F. Chokes - 10 mh.
SW	1	3 Position Switch - (Rotary)
T1-T2	2	I.F. Transformers - Hammarlund
T3-	1	-"- -"- -"-
V1-V2	2	6K7
V3-V4	2	50

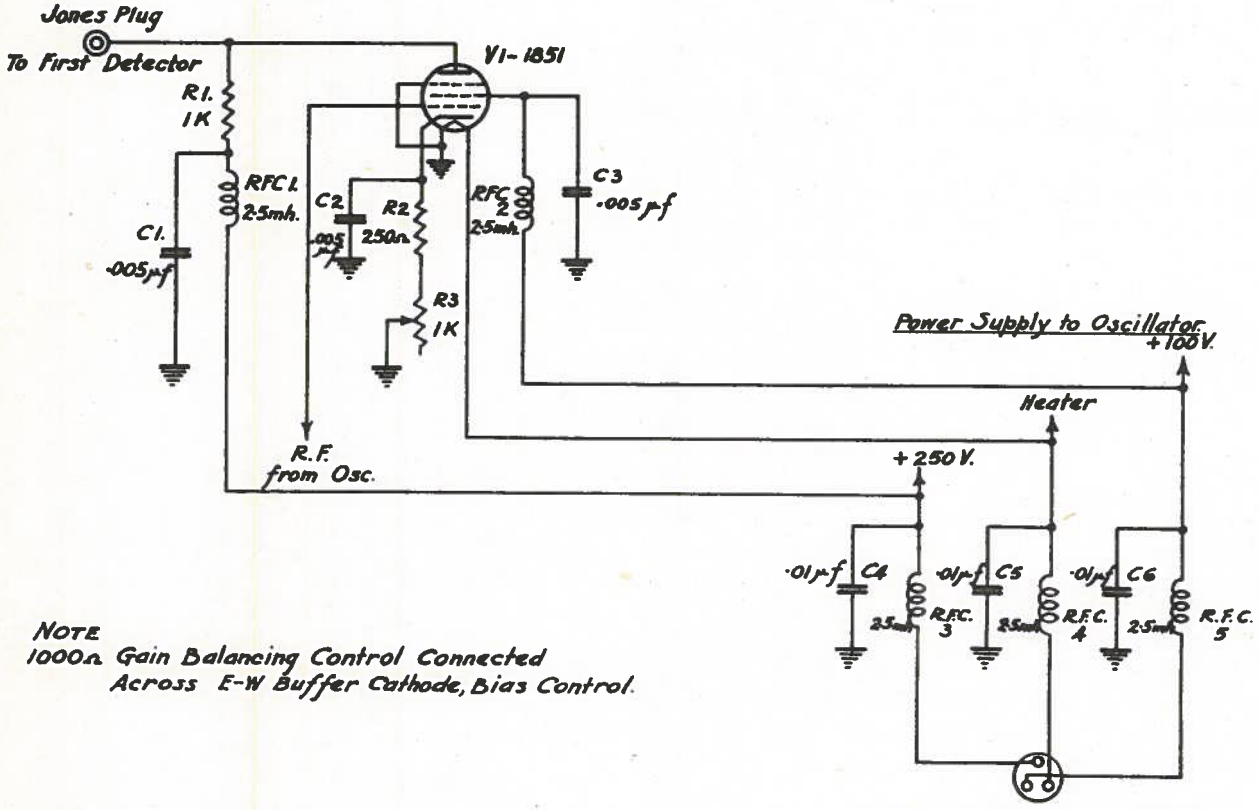
ITEM	PART No.	QUAN.	MAT'L	DESCRIPTION
DRAWN BY J.A.C.	TRACED BY H.W.	DATE 19 Jan 42		SUPERSEDES
CHECKED C.E.A.		DATE 13 Mar 42		SCALE
ENG. APPROV.		DATE		FINISH.

NATIONAL RESEARCH COUNCIL-RADIO SECTION - OTTAWA CANADA

NAME: 435 KC. I.F. AMP.

DWG. NO. CRDF. SW-23.

Revised 18 Mar. 42. {R9 ADDED. R8 ADDED. Value R7 ADDED.



NOTE
1000Ω. Gain Balancing Control Connected
Across E-W Buffer Cathode, Bias Control.

POWER FILTERING SYSTEM.

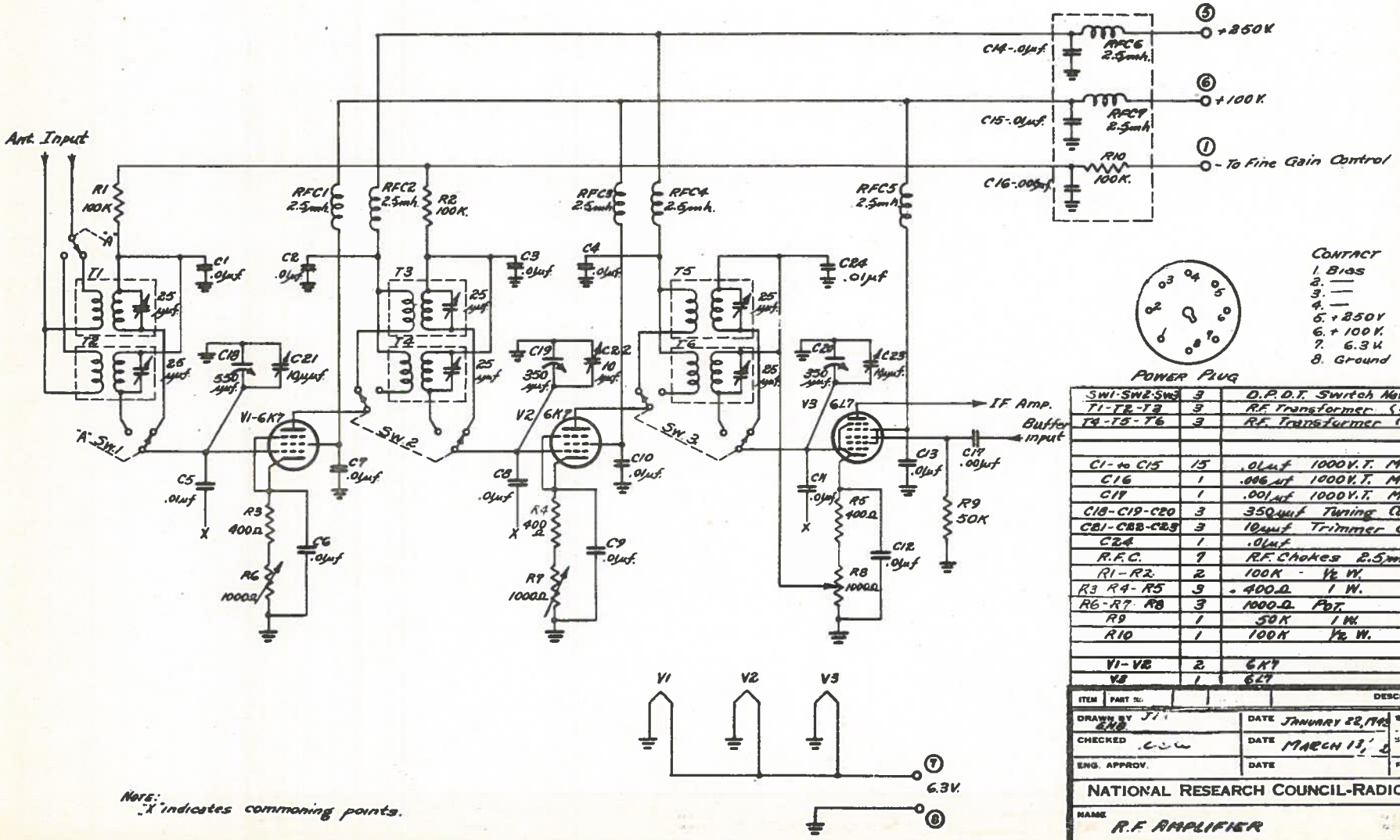
			CAPACITORS.
	C1-C2-C3	3	.005 μf 1000 V.T. Mica.
	C4-C5-C6	3	.01 μf -"- -"- -"-
			RESISTORS.
	R1.	1.	1K- 1 Watt.
	R2.	1.	250Ω. 1 -"-
	R3	1.	1K. Pot-1 Watt
			CHOKES
	RFC	5	R.F. Chokes 2.5mh. Type-Universal
			TUBES
	V1.	1.	1851

ITEM	PART No.	QUAN.	MATL	DESCRIPTION
DRAWN BY J.L.C.	TRACED H.W.	DATE Jan 15-41 22-Apr-42		SUPERSEDES
CHECKED C.E.A.		DATE 13-May-42		SCALE
ENG. APPROV.		DATE		FINISH.

NATIONAL RESEARCH COUNCIL-RADIO SECTION - OTTAWA CANADA

NAME: BUFFER STAGE

DWG. NO. CRDF-SW-24.



Note: "X" indicates commoning points.

Contact
1. Bias
2. —
3. —
4. —
5. +250V
6. +100V.
7. 6.3V.
8. Ground

Power Plug

SW1-SW2-SW3	3	D.P.D.T. Switch National Slide Switch
T1-T2-T3	3	R.F. Transformer (Special)
T4-T5-T6	3	R.F. Transformer (Special)
C1 - to C15	15	.01μf 1000V.T. Mica.
C16	1	.006 μf 1000V.T. Mica.
C17	1	.001 μf 1000V.T. Mica.
C18-C19-C20	3	350μμf Tuning Condensers
C21-C22-C23	3	10μμf Trimmer Condensers
C24	1	.01μf
R.F.C.	7	R.F. Chokes 2.5mh.
R1-R2	2	100K - ½ W.
R3 R4- R5	3	400Ω 1 W.
R6-R7 R8	3	1000Ω Pot.
R9	1	50K 1 W.
R10	1	100K ½ W.
V1-V2	2	6K7
V3	1	6L7

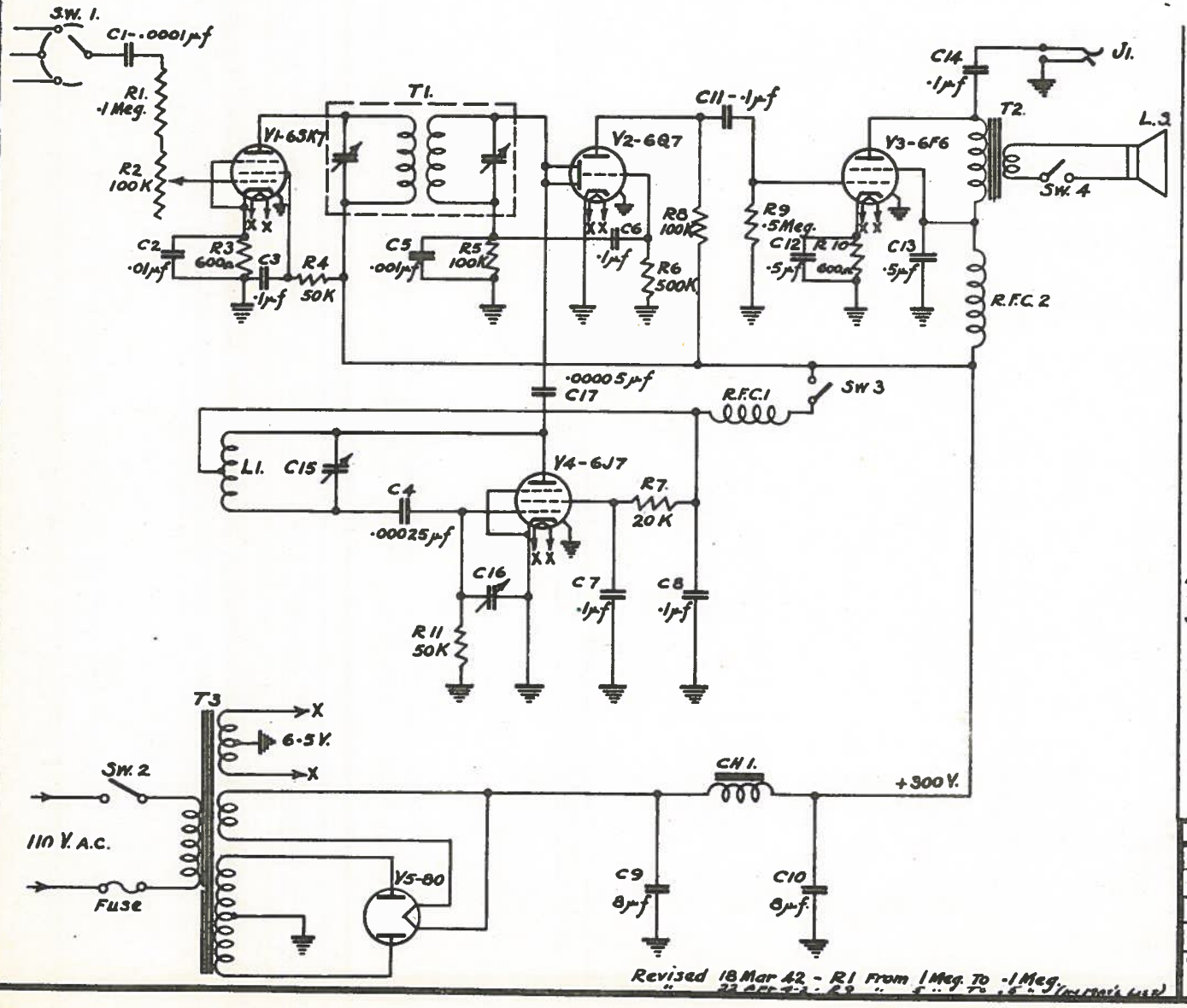
ITEM	PART NO.	DESCRIPTION
DRAWN BY E.H.B.		DATE JANUARY 22, 1945
CHECKED		DATE MARCH 13, 1945
ENG. APPROV.		DATE

SUPERSEDES
SCALE
FINISH.

NATIONAL RESEARCH COUNCIL-RADIO SECTION - OTTAWA CANADA

NAME R.F. AMPLIFIER

DWG. NO. CRO-S-W-[illegible]



C1.	.0001 μf 1000 V.T. Mica.
C2.	.01 --- --- --- ---
C3	.1 --- 600 V.W. Tubular
C4	.00025 --- 1000 V.T. Mica.
C5	.001 --- --- --- ---
C6-7-8	.1 --- 600 V.W. Tubular
C9-10	8. --- Electrolytics.
C11	.1 --- 600 V.W. Tubular
C12-13	.5 --- --- --- ---
C14	.1 --- --- --- ---
C15-16	Oscillator Tuning Condenser
C17	.00005 μf - 1000 V.T. Mica.
Ch.1.	70h (70 ma.)
J1.	Single Circuit Jack
L1	Special Oscillator Coil.
L.S.	Loud Speaker
R1	.1 Meg. 1 Watt.
R2	100 K Pot.
R3	600 Ω 2 Watt
R4	50 K 1 ---
R5	100 K 1 ---
R6	500 K 1 ---
R7	20 K 1 ---
R8	100 K 1 ---
R9	.5 Meg 1 ---
R10	600 Ω 2 ---
R11	50 K 1 ---
R.F.C.1-2	R.F. Chokes
Sw 1.	Rotary Switch
SW 2-3-4	Single-Pole Single Throw Switch
T1.	Meissner 435 KC I.F. Transformer
T2	Output Transformer
T3	#272 Hammond Power Transf.
V1	6SK7
V2	6Q7
V3	6F6
V4	6J7
V5	80

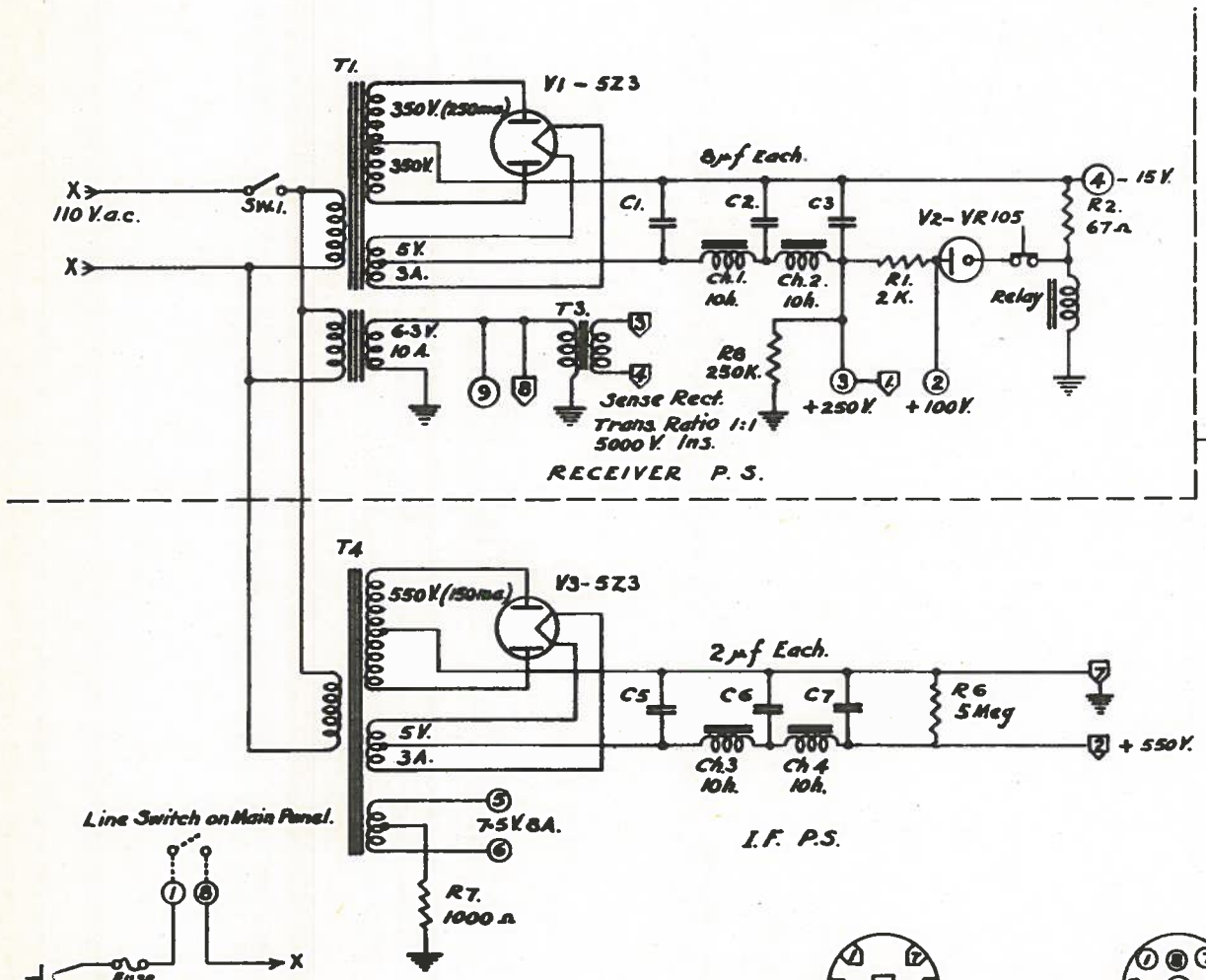
Revised 18 Mar 42 - R1 From 1 Meg. To .1 Meg.
" 22 Apr 42 - R9 " .5 " To .5 " (Incorrect Last)

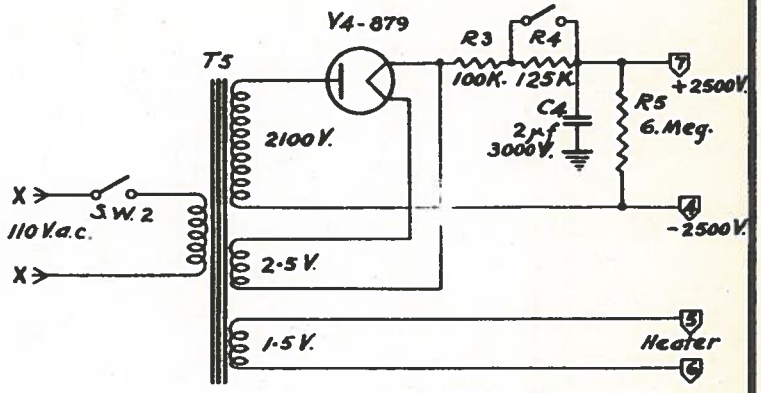
ITEM	PART NO.	QUAN.	MAT'L	DESCRIPTION
DRAWN BY GLD	TRACED M.W.	DATE 31 Jan 42, 22 Apr 42		SUPERSEDES
CHECKED CCC		DATE March 13/42		SCALE
ENG. APPROV.		DATE		FINISH.

NATIONAL RESEARCH COUNCIL-RADIO SECTION - OTTAWA CANADA

NAME: MONITOR

DWG. NO. CRDF-SW-26





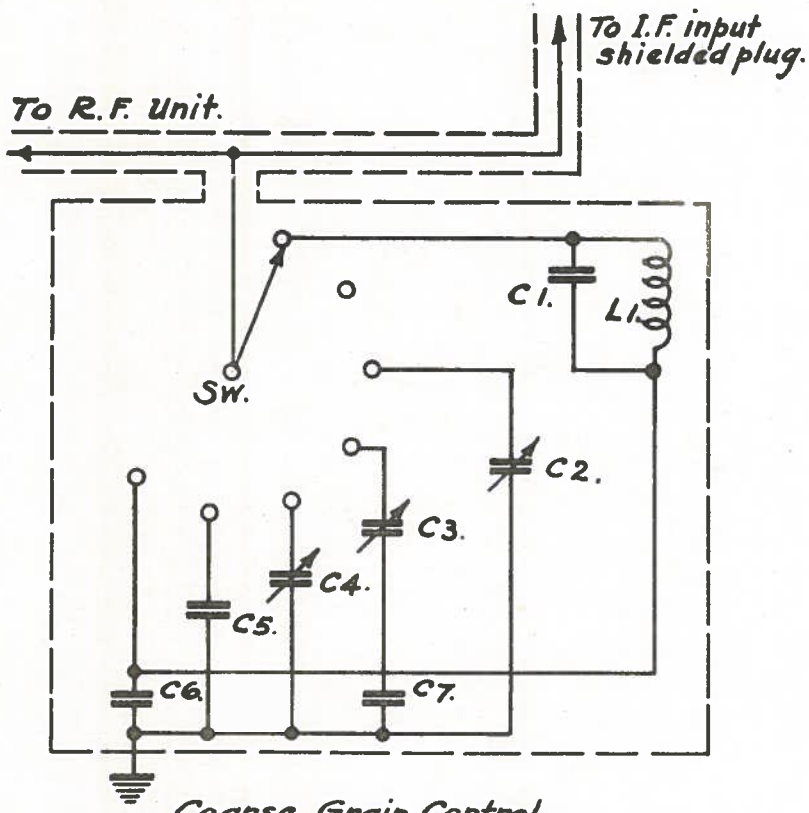
C1-C2-C3	3	8 μf - 600 V.W Electrolytics.
C4	1	2 μf. 3000 V.W. - Oil Filled.
C5-C6-C7	3	2 μf - 1000 V.W. -"- -"-
Ch1-Ch2	2	10h. 250 ma. Chokes
Ch3-Ch4	2	10h. 150 ma. -"-
Relay	1	6 V. ac. "DUNCO"
R1.	1	2 K 10 Watts
R2.	1	67 Ohms 10 Watts
R3	1	100 K 2 Watts
R4	1	125 K 2 -"-
R5	1	6. Meg - 2 -"-
R6	1	5 -"- - 1 -"-
R7	1	1000 Ohms - 20 Watts
R8	1	250 K.
Sw1-Sw2	2	S.P.S.T. Switch - AC Toggles.
T1.	1	Trans - Hammond (Special)
T2	1	-"- -"- Filament.
T3	1	-"- -"- 6-3-6-3-5000 V. Ins.
T4-T5	2	-"- (Specials)
V1-V3.	2	5Z3
V2	1	VR-105
V4	1	879
Fuses	2	- 5 Amp. (Cartridge.)

ITEM	PART No	QUAN	MAT'L	DESCRIPTION
DRAWN BY J.L.C	TRACED H.W.	DATE	20 Jan 42 / 22 Apr 42	SUPERSEDES
CHECKED cca		DATE	22-APR-42	SCALE
ENG APPROV		DATE		FINISH

NATIONAL RESEARCH COUNCIL-RADIO SECTION - OTTAWA CANADA

NAME: POWER SUPPLY. DWG. NO. CRDF-SW-28

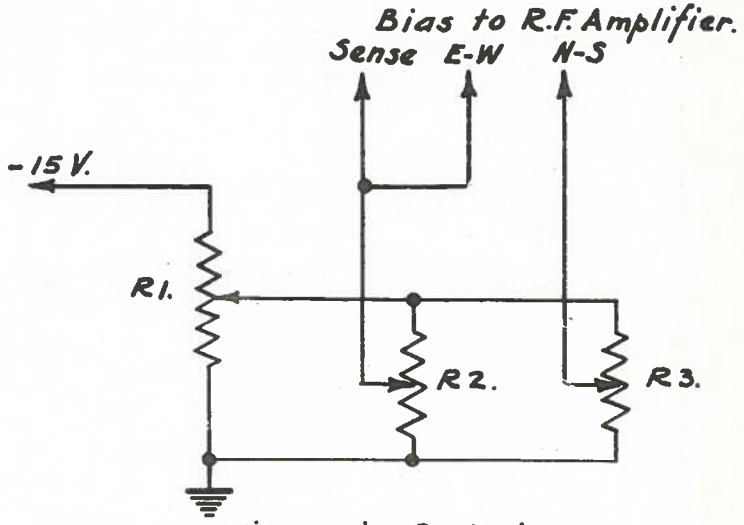
Revised 18 Mar. 42. R8 Added. Term. 7 & 8 reversed on line Switch.



Coarse Grain Control.

L1. 2½ sections of standard 2.5 mh. Hammond Choke, Type 1504.
C1. 25 μμfd. ceramican condenser.
C2 -"- -"- air trimmer cond.
C3 200 -"- mica -"- -"-
C4 1000 -"- -"- -"- -"-
C5 .006 mica condenser
C6 .03 -"- -"-
C7 .01 -"- -"-
SW. Single Pole, 7 Position, 3 gang.

Note. The three gangs are isolated by Bakelite Shafting.



Fine Gain Control.

R1. - 10,000 Ω General Radio Pot.
R2. - 100,000 Ω Pot.
R3 - 100,000 Ω Pot.

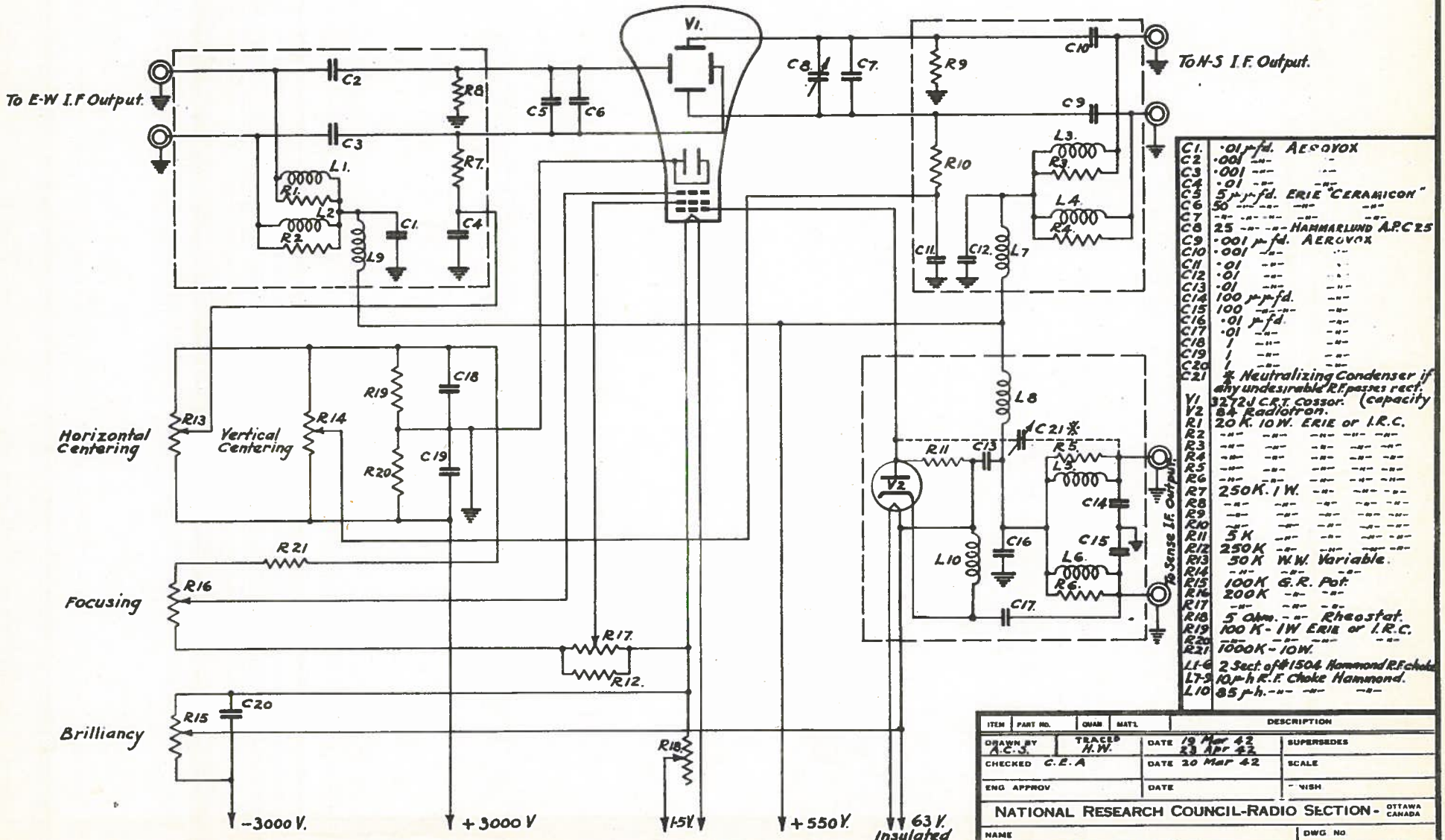
Revised 18 Mar. 42 Dr'g. # changed.

ITEM	PART No.	QUAN.	MAT'L	DESCRIPTION
DRAWN BY A.C.S	TRACED H.W.	DATE 12 Mar. 42, 23 Apr. 42		SUPERSEDES
CHECKED C.E.A.		DATE 13 Mar. 42		SCALE
ENG. APPROV.		DATE		FINISH.

NATIONAL RESEARCH COUNCIL-RADIO SECTION - OTTAWA CANADA

NAME: GAIN CONTROLS

DWG. NO. CRDF-SW-29



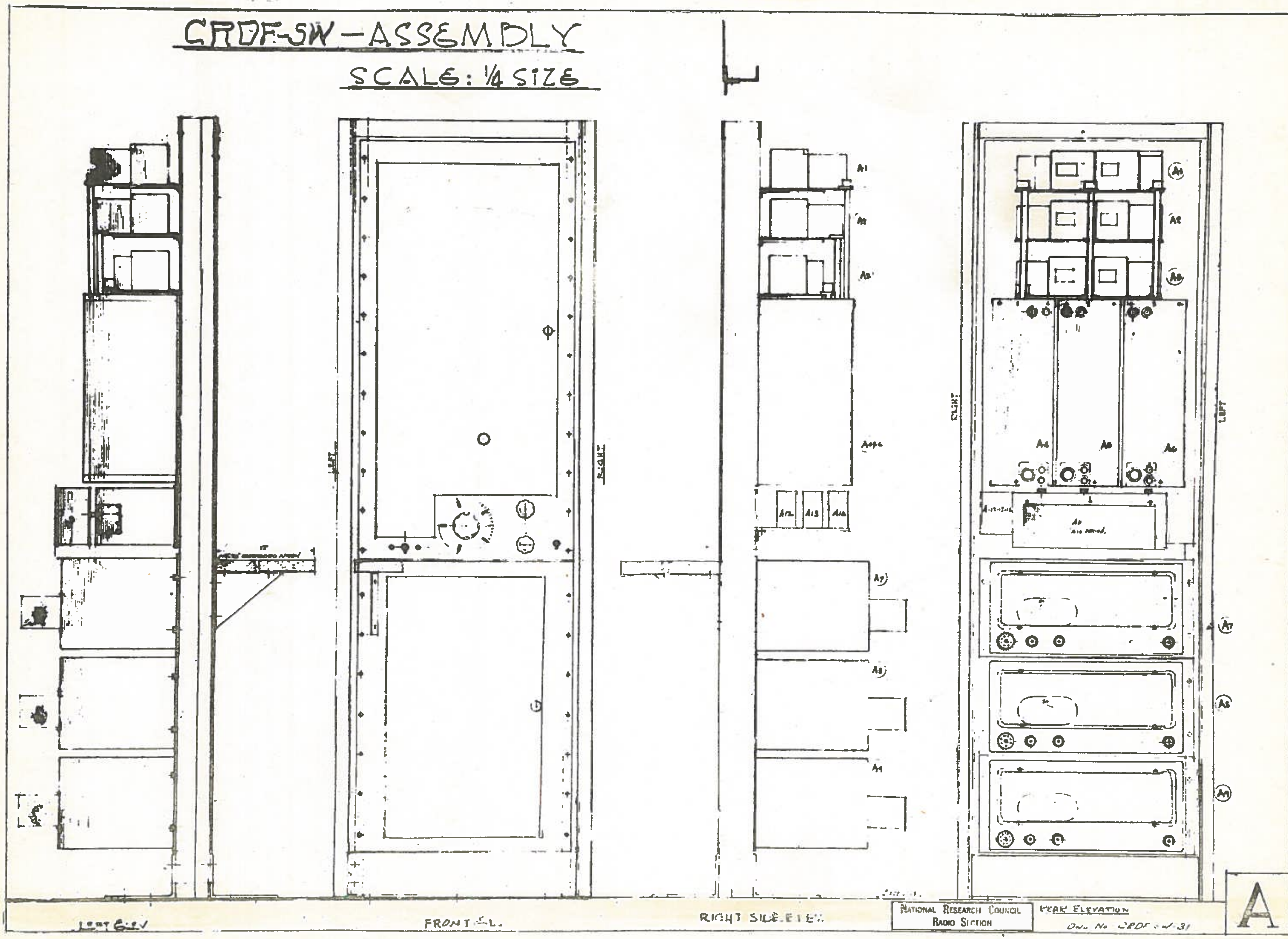
C1.	·01 μfd. AEROVOX
C2	·001 --- ---
C3	·001 --- ---
C4	·01 --- ---
C5	5 μμfd. ERIE "CERAMICON"
C6	50 --- --- ---
C7	--- --- --- ---
C8	25 --- --- HAMMARLUND A.P.C.25
C9	·001 μfd. AEROVOX
C10	·001 --- ---
C11	·01 --- ---
C12	·01 --- ---
C13	·01 --- ---
C14	100 μμfd. ---
C15	100 --- ---
C16	·01 μfd. ---
C17	·01 --- ---
C18	1 --- ---
C19	1 --- ---
C20	1 --- ---
C21	* Neutralizing Condenser if any undesirable R.F. passes rect.
V1	3272J C.R.T. Cossor. (capacity
V2	84 Radiotron.
R1	20 K. 10 W. ERIE or I.R.C.
R2	--- --- --- --- ---
R3	--- --- --- --- ---
R4	--- --- --- --- ---
R5	--- --- --- --- ---
R6	--- --- --- --- ---
R7	250K. 1 W. --- --- ---
R8	--- --- --- --- ---
R9	--- --- --- --- ---
R10	--- --- --- --- ---
R11	5 K --- --- --- ---
R12	250 K --- --- --- ---
R13	50 K W.W. Variable.
R14	--- --- ---
R15	100 K G.R. Pot.
R16	200 K --- ---
R17	--- --- ---
R18	5 Ohm. --- Rheostat.
R19	100 K - 1 W ERIE or I.R.C.
R20	--- --- --- ---
R21	1000 K - 10 W.
L1-6	2 Sect. of #1504 Hammond R.F. choke
L7-9	10 μ-h R.F. Choke Hammond.
L10	85 μ-h. --- --- ---

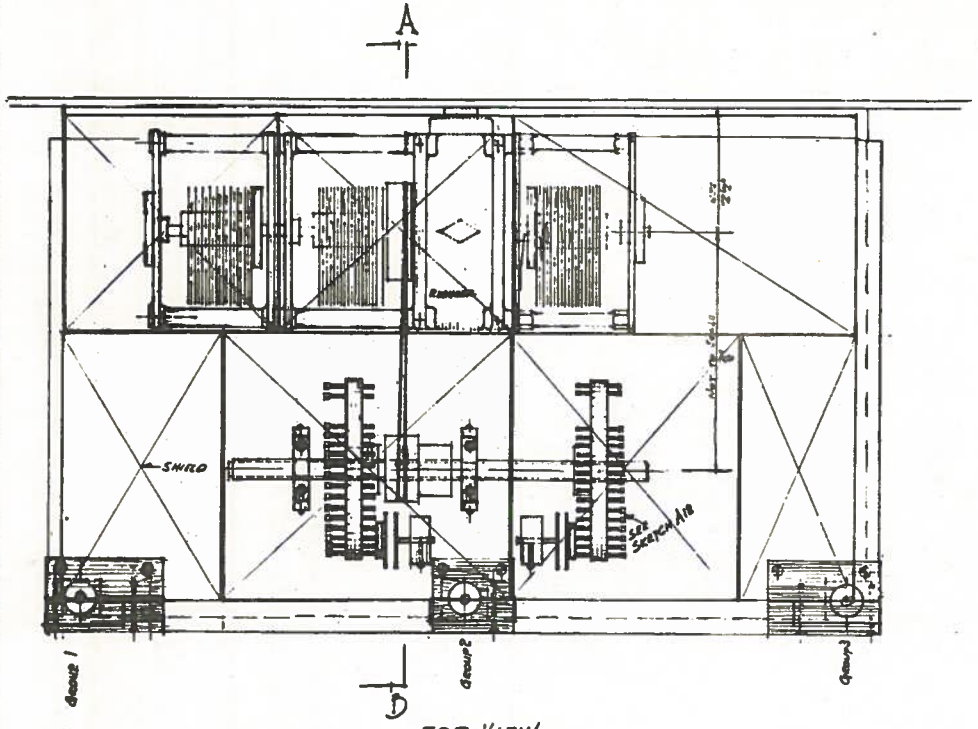
ITEM	PART NO.	QUAN	MAT'L	DESCRIPTION
DRAWN BY A.C.S.	TRACED H.W.	DATE 19 Mar 42, 23 Apr 42		SUPERSEDES
CHECKED C.E.A		DATE 20 Mar 42		SCALE
ENG APPROV		DATE		FINISH

NATIONAL RESEARCH COUNCIL-RADIO SECTION - OTTAWA CANADA

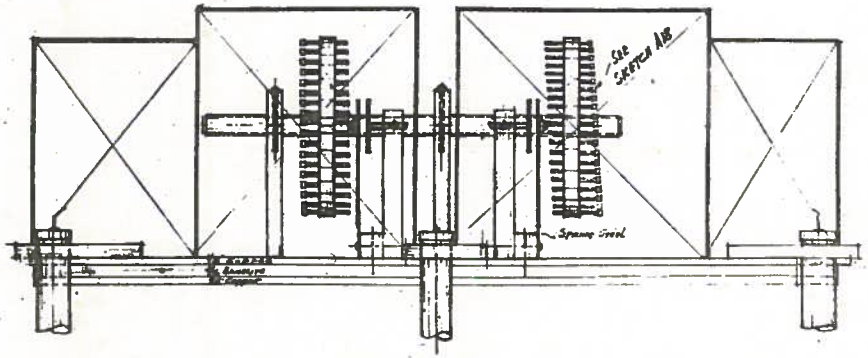
NAME: CATHODE RAY TUBE BOX CIRCUIT

DWG NO: CRDF-3W 30

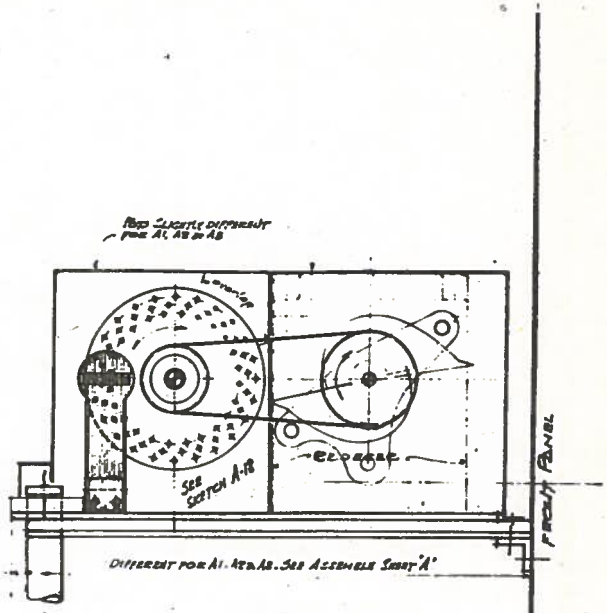

CRDF-SW-ASSEMBLY
SCALE: 1/4 SIZE
LEFT
RIGHT
A1
A2
A3
A6
A7
A8
A9
LEFT ELEV
FRONT EL.
RIGHT SIDE ELEV
NATIONAL RESEARCH COUNCIL
RADIO SECTION
REAR ELEVATION
A



TOP VIEW



REAR VIEW



SECTION THRU 'A-B'

A-1

A-2

A-3

R.F. TUNING UNITS

FOR LOCATION See Assembly Sheet 'A'

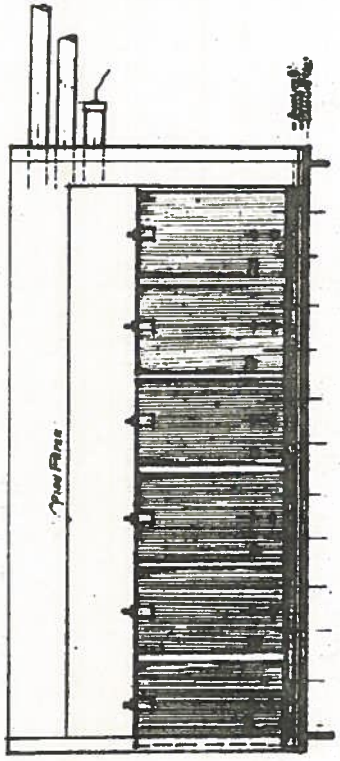
PARTS OF A1. A2. A3

NATIONAL RESEARCH COUNCIL RADIO SECTION	DWG. No CRDF-SH-32

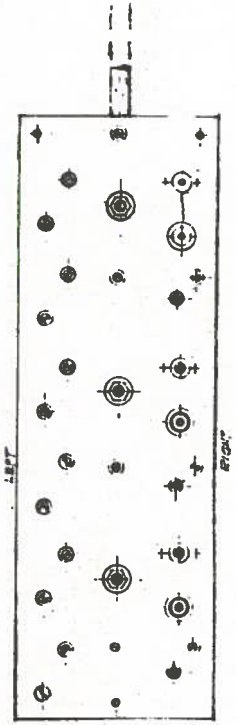
15 MAR 38

R.F. UNITS No 2 & 3

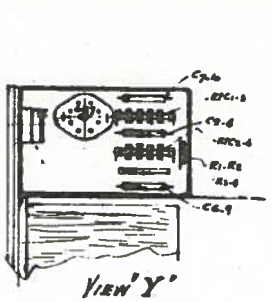
No 1 is similar but opposite hand



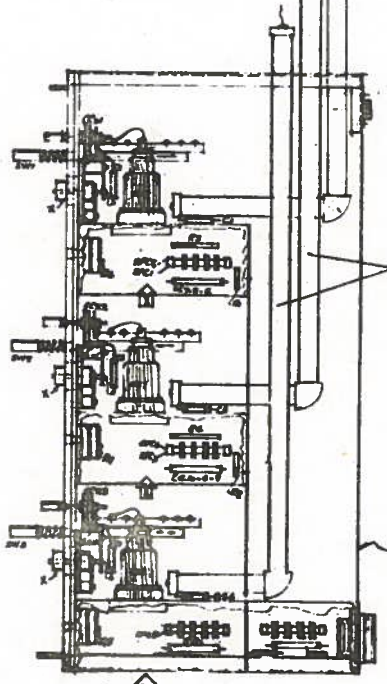
LEFT SIDE

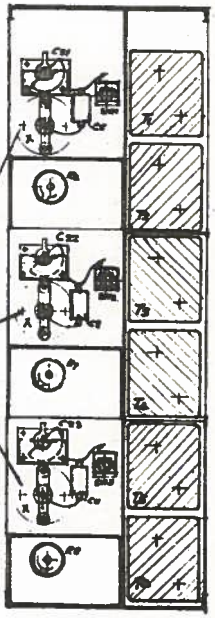


FRONT

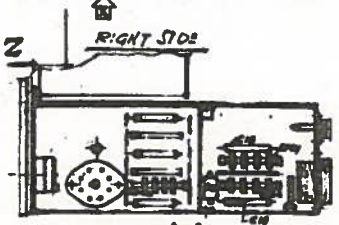


VIEW 'Y'





SECTION 'Z'

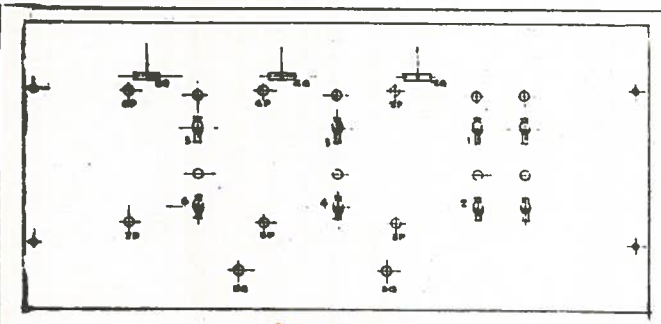


VIEW 'X'

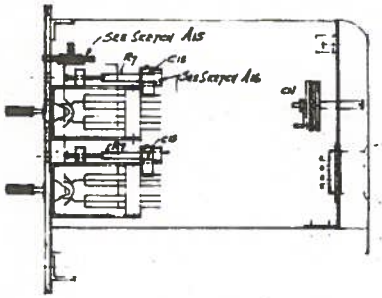
PARTS MARKED A-4, 5 & 6 ON ASSEMBLY DWG A

A-4
A-5
A-6

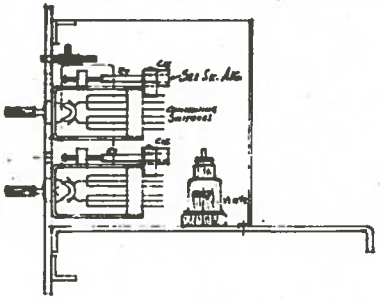
NATIONAL RESEARCH COUNCIL RADIO SECTION	DWG. NO. CADC-SM-93



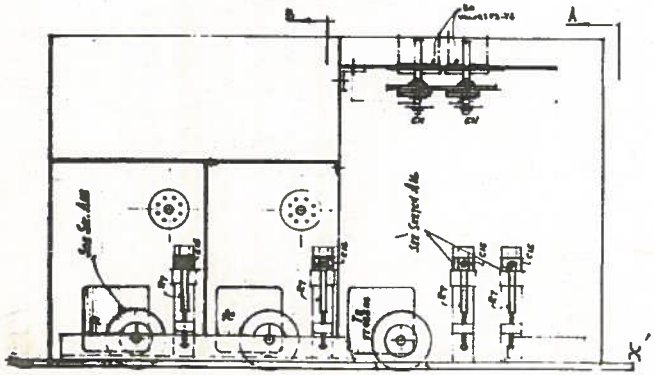
FRONT PANEL



VIEW AT 'A'

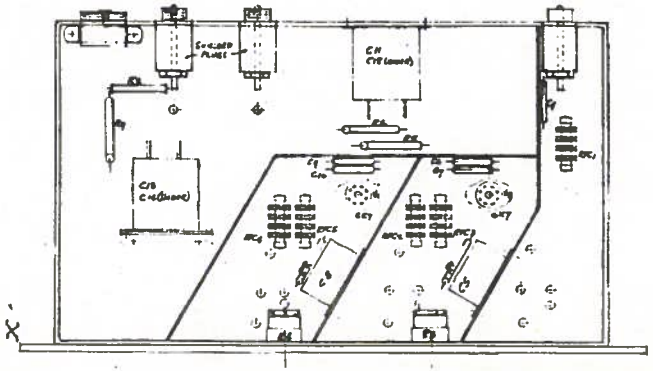


VIEW AT 'B'



TOP VIEW

SCALE: 1/2 SIZE



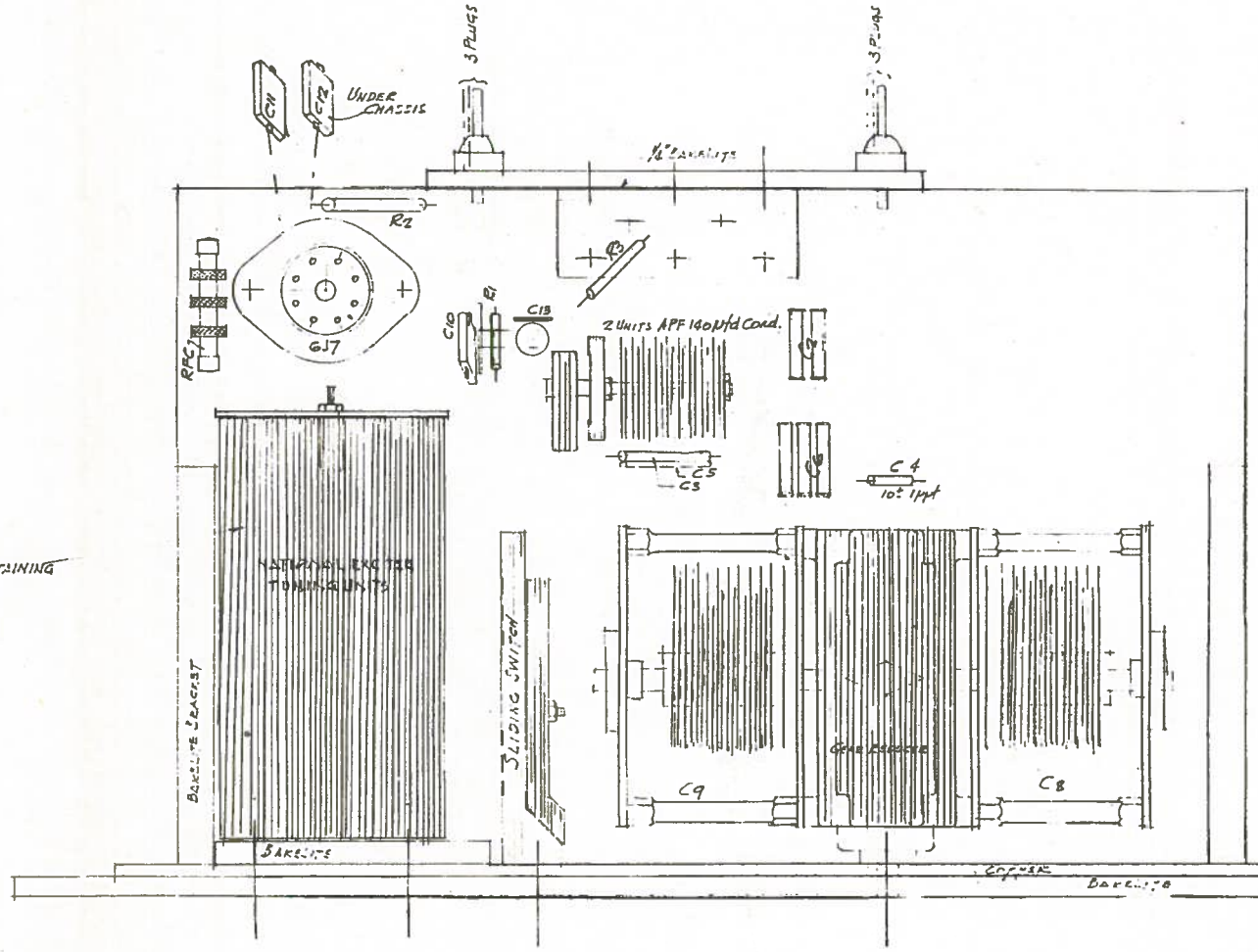
VIEW OF UNDERSIDE

A7
A8
A9

I.F. UNITS
PARTS NOS. A7, A8 & A9
ON ASSEMBLY SHEET 'A'
(3 UNITS ALIKE)

NATIONAL RESEARCH COUNCIL
RADIO SECTION

REFER TO SCHEMATIC WIRING DIAGRAM
FOR IDENTIFICATION OF PARTS
JP MARCH '42 CHECKED 34



2 UNITS CONTAINING
L2 & C7
AND
L1 & C1

NOTES:
REFER TO SCHEMATIC DIAGRAMS
FOR IDENTIFICATION OF PARTS

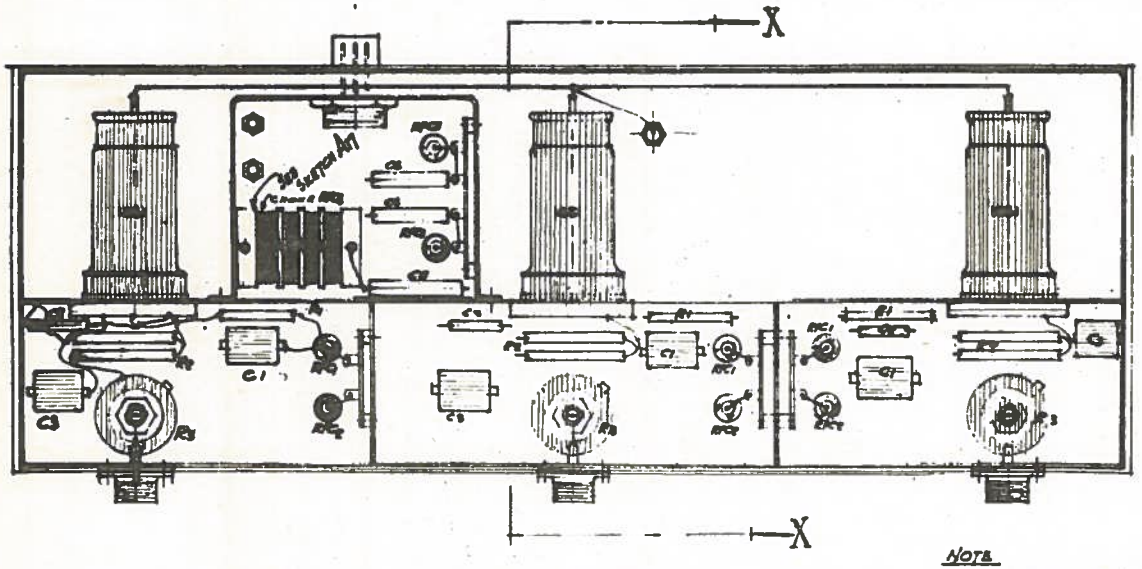
A-10

NATIONAL RESEARCH COUNCIL
RADIO SECTION

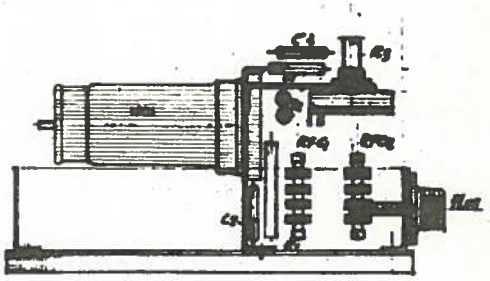
LOCAL OSCILLATOR

SEE PART NO A-10 ON ASSEMBLY SHEET A.

MARCH 10-'42 HP



TOP VIEW



SECTION ON X.X

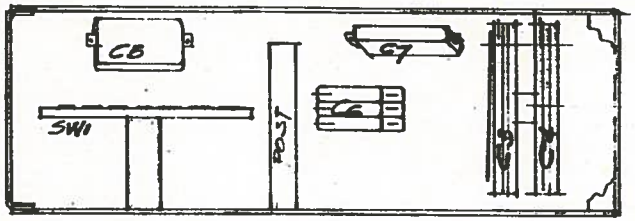
NOTE
REFER TO SCHEMATIC DIAGRAMS
FOR IDENTIFICATION OF PARTS

(A-11)

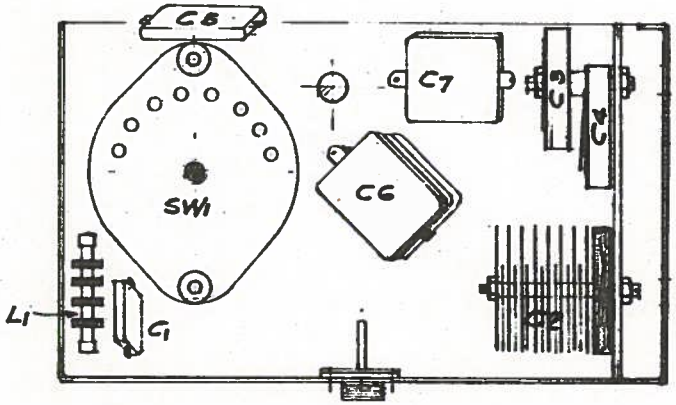
LOCAL OSCILLATOR
BUFFER UNIT

UNIT Nr. 'A 11'
ON ASSEMBLY SHEET 'A'

NATIONAL RESEARCH COUNCIL RADIO SECTION	DWG. No FROM SV. 36



Top View



A-12

A-13

A-14

COARSE GAIN CONTROL

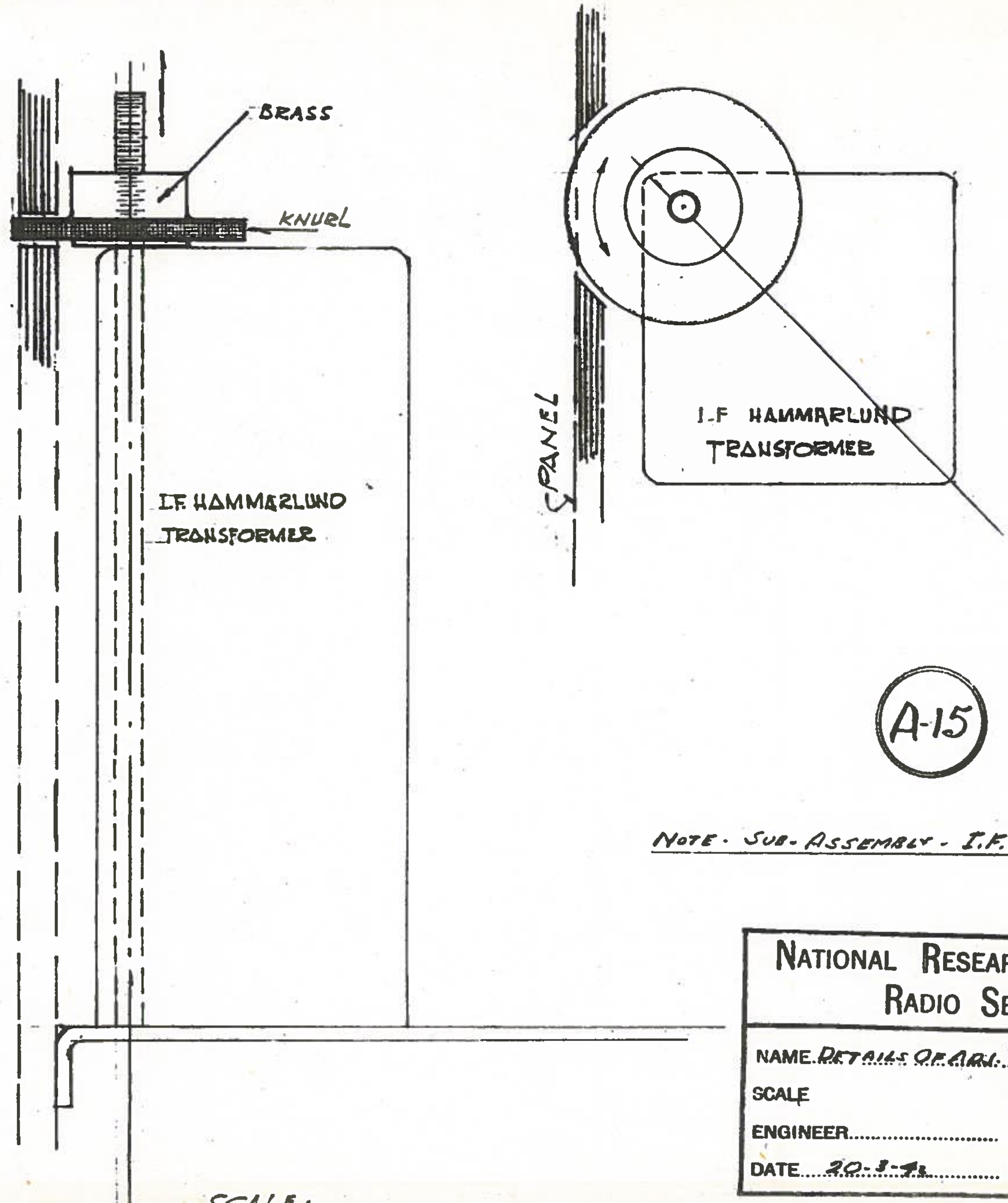
PARTS MK A-12 13-14 ON ASS. SHEET A

REFER TO SCHEMATIC DIAGRAMS FOR IDENTIFICATION OF PARTS

NATIONAL RESEARCH COUNCIL
RADIO SECTION

MARCH 16. 1942. 1/2

DWG No. C.R.D.F. SW-37



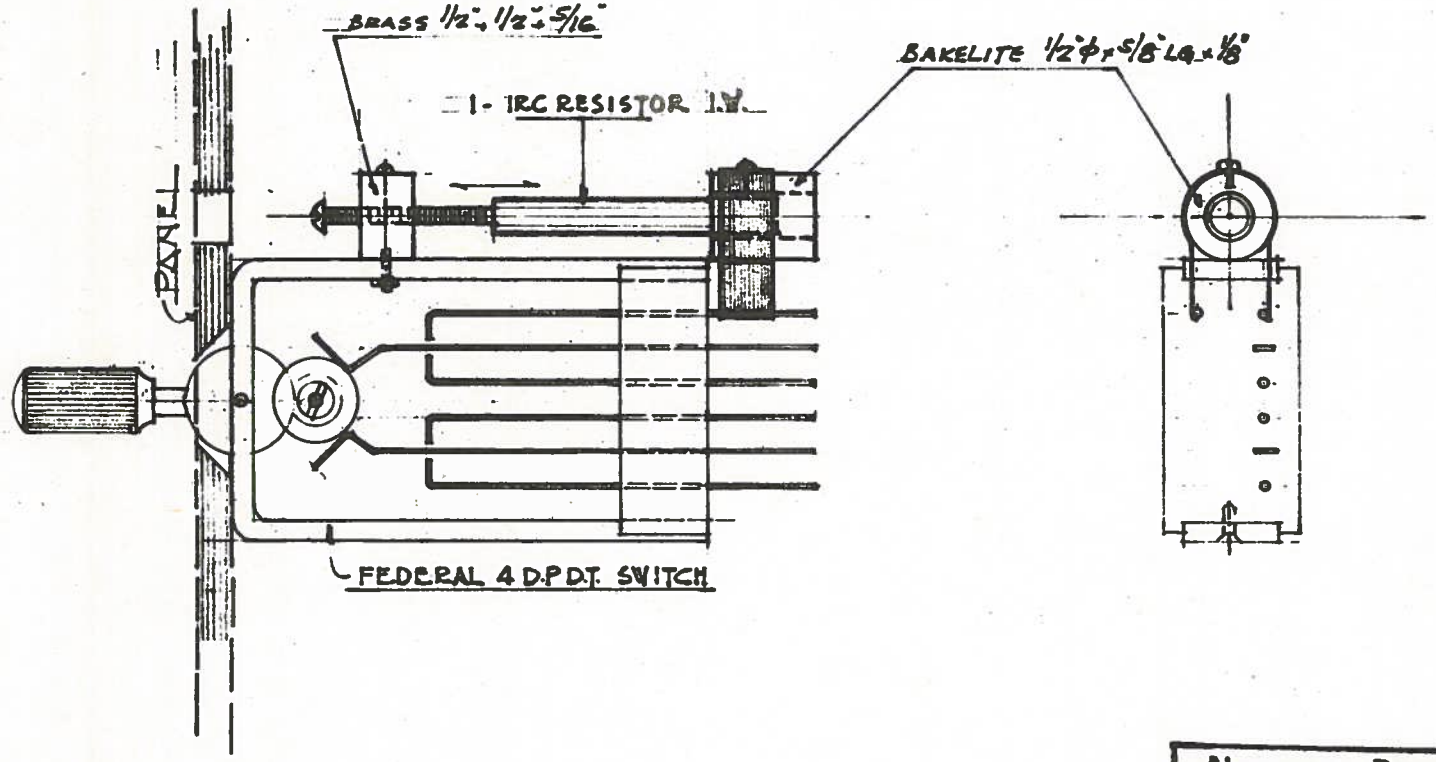
SCALE:

(A-15)

NOTE - SUB-ASSEMBLY - I.F. CHASSIS

NATIONAL RESEARCH COUNCIL
RADIO SECTION

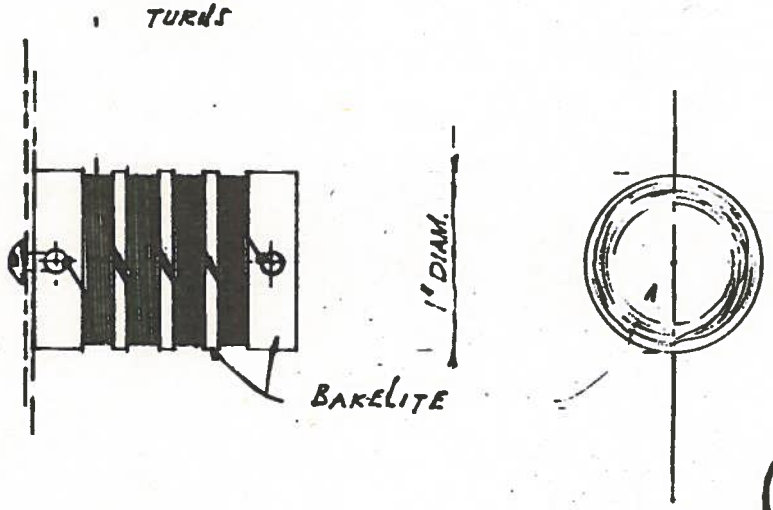
NAME Details Of Adj. For I.F. Transformer
SCALE
DRN. BY
ENGINEER
DATE 20-3-4[illegible]
NO. CRDESW- 38



A-16

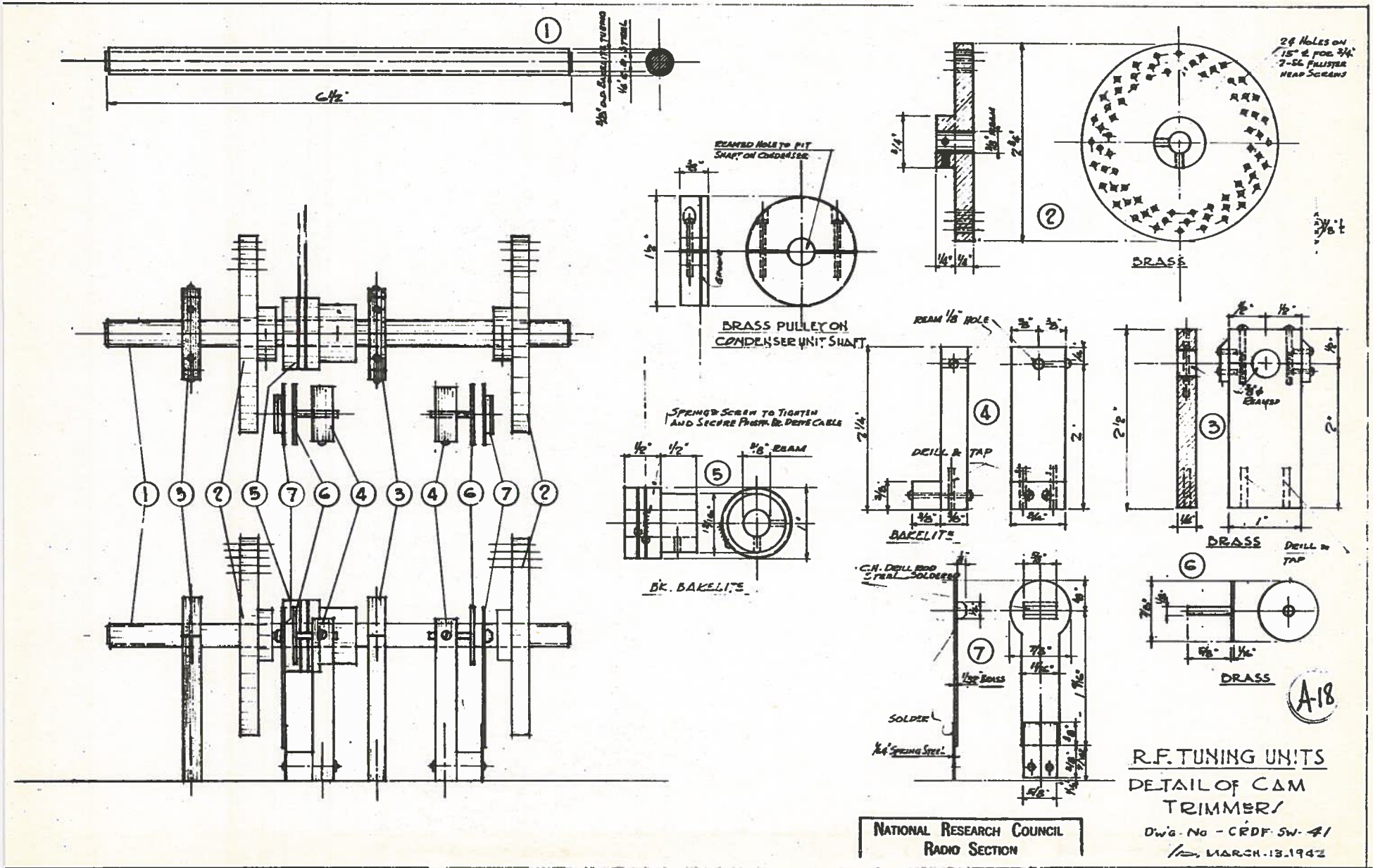
NATIONAL RESEARCH COUNCIL RADIO SECTION	
NAME Commuting Switches	
SCALE	DRN. BY L.P.
ENGINEER	
DATE 3-3-42	NO. CRPF SW-39

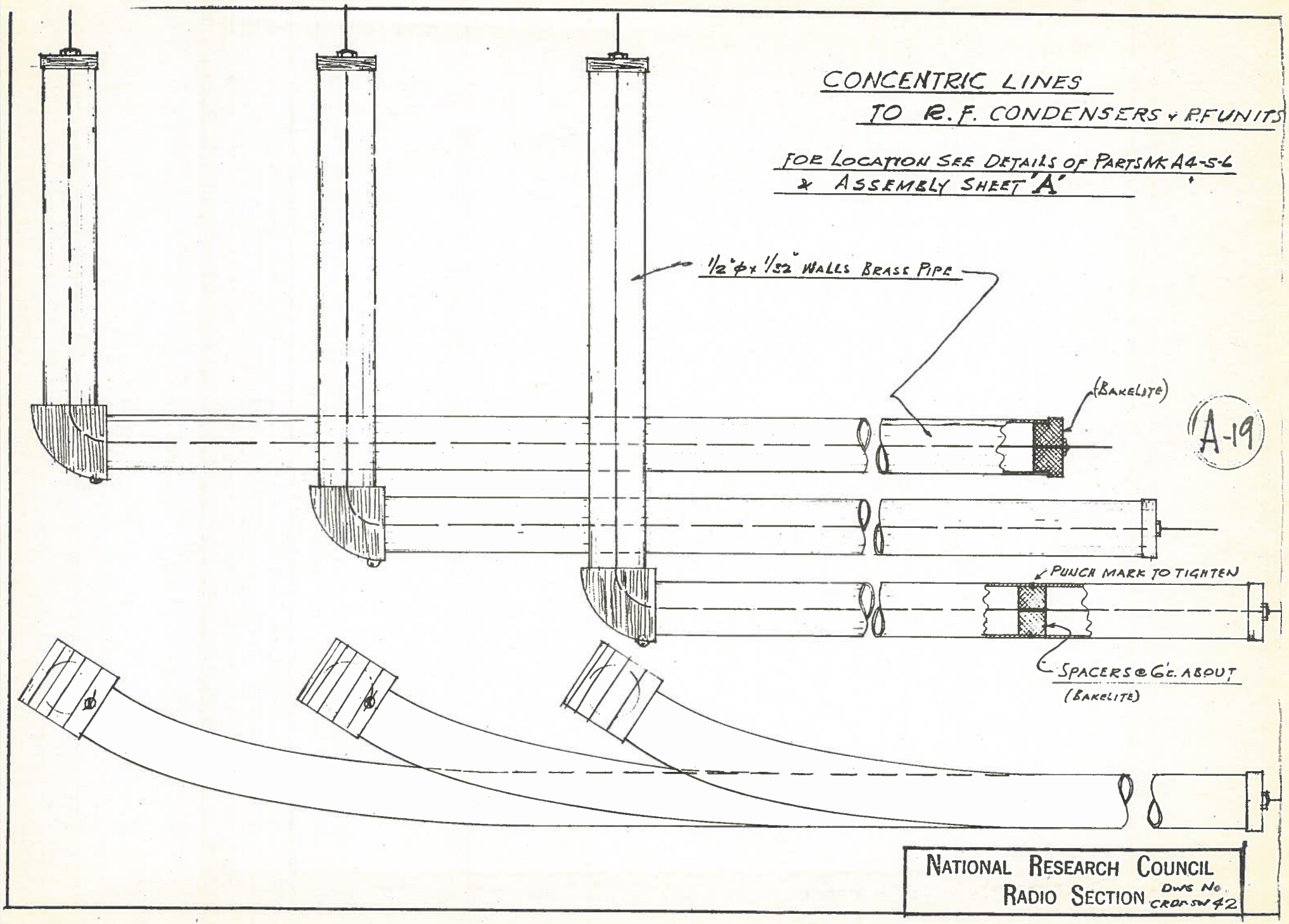
CHOKE FOR BUFFER UNIT OF LOCAL OSCILLATOR (AM)

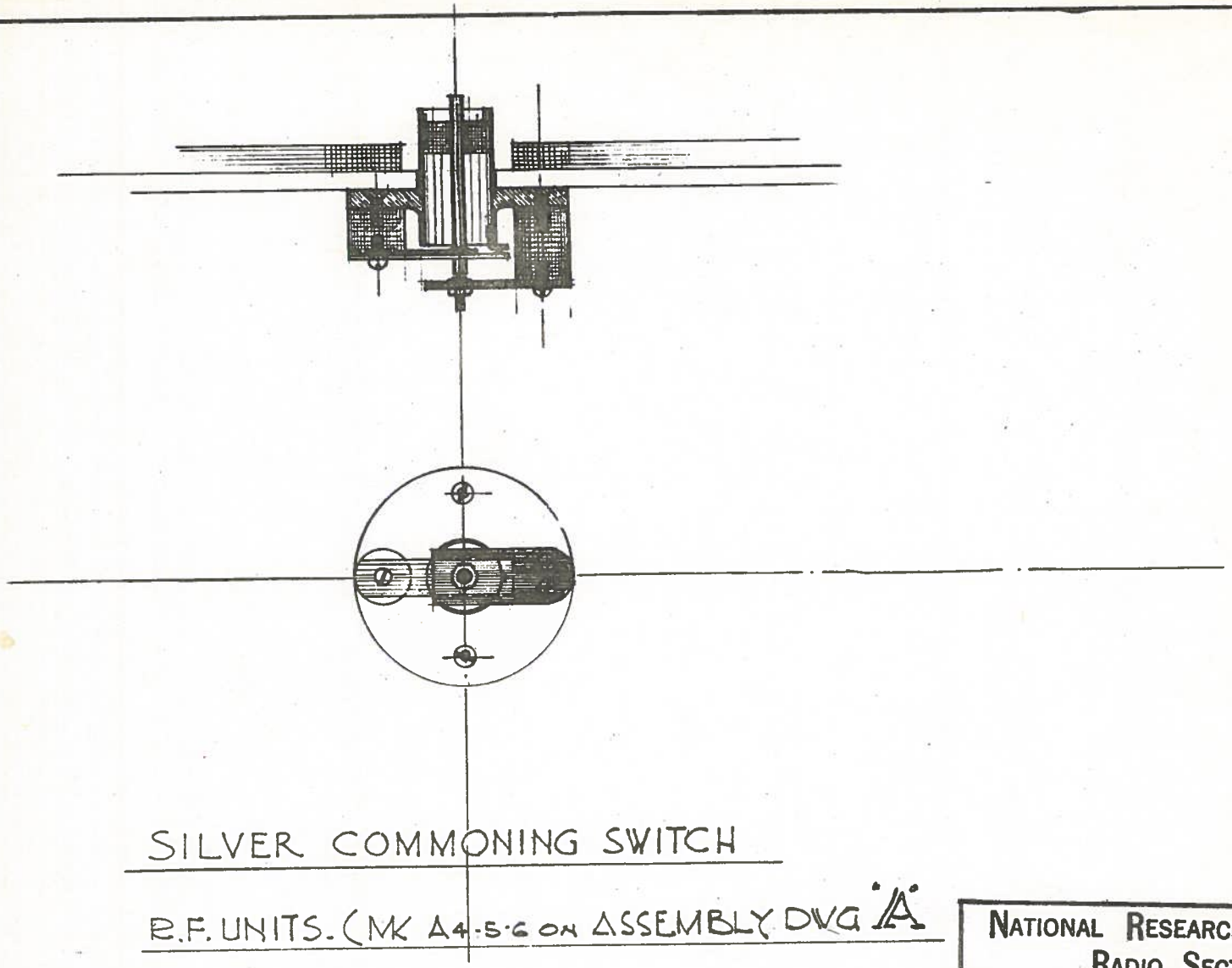


A-17.

NATIONAL RESEARCH COUNCIL RADIO SECTION	
NAME	CHOKE FOR BUFFER UNIT OF LOCAL OSCILLATOR
SCALE	DRN. BY JP
ENGINEER	
DATE 11-3-42	NO. DRG. SH. 40


1
2
3
4
5
6
7
BRASS
BRASS PULLEY ON CONDENSER UNIT SHAFT
BAKELITE
BK. BAKELITE
DRASS
DRILL & TAP
SOLDER
NATIONAL RESEARCH COUNCIL
RADIO SECTION
R.F. TUNING UNITS
DETAIL OF CAM TRIMMERS
Dwg. No - CRDF-SW-41
MARCH-13-1942
A-18


CONCENTRIC LINES
TO R.F. CONDENSERS & R.F UNITS
FOR LOCATION SEE DETAILS OF PARTS MK A4-5-6
& ASSEMBLY SHEET 'A'
1/2" ϕ x 1/32" WALLS BRASS PIPE
(BAKELITE)
A-19
PUNCH MARK TO TIGHTEN
SPACERS @ Ct. ABOUT
(BAKELITE)
NATIONAL RESEARCH COUNCIL
RADIO SECTION
DWG No.
CRDF SW 42

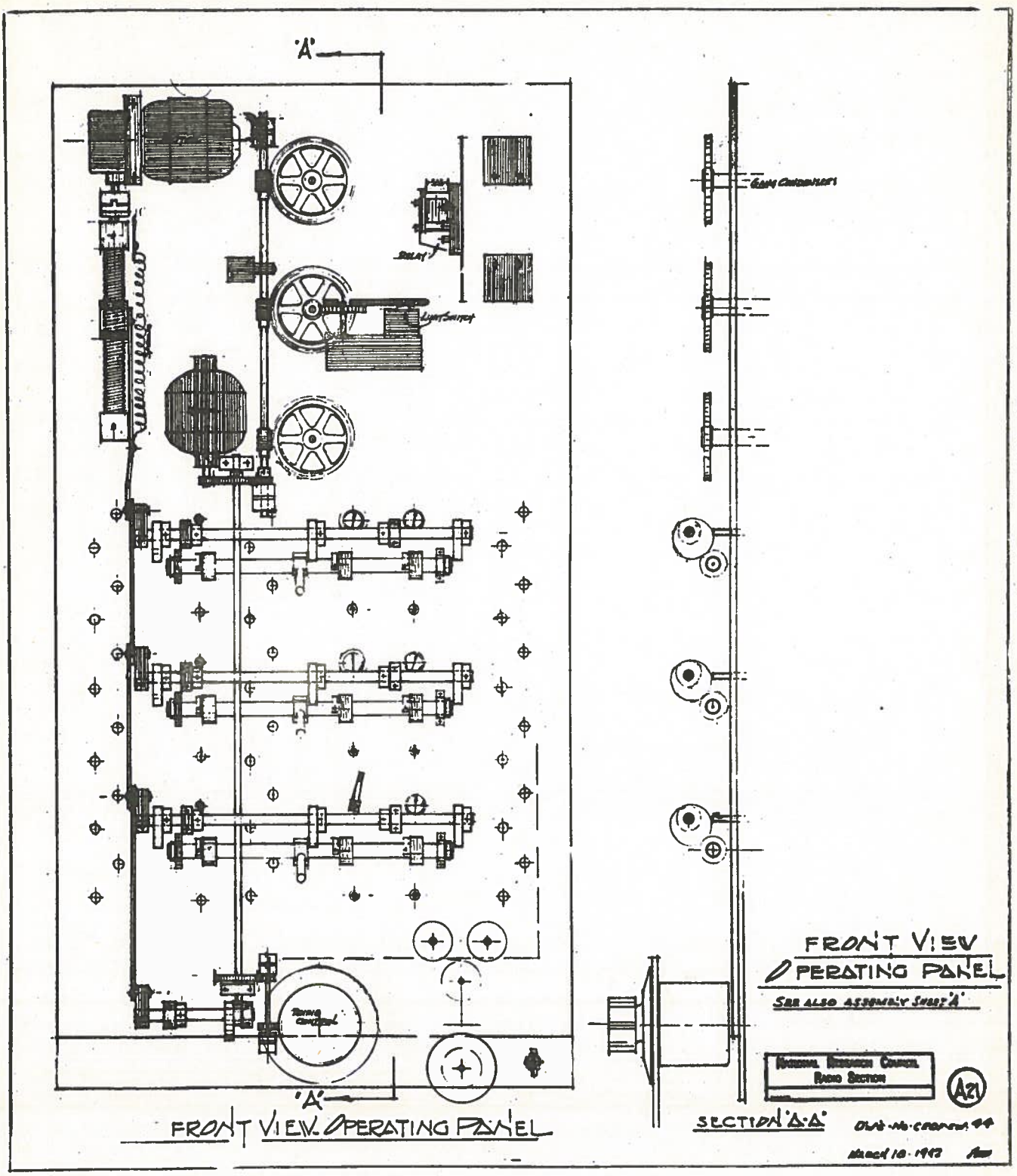


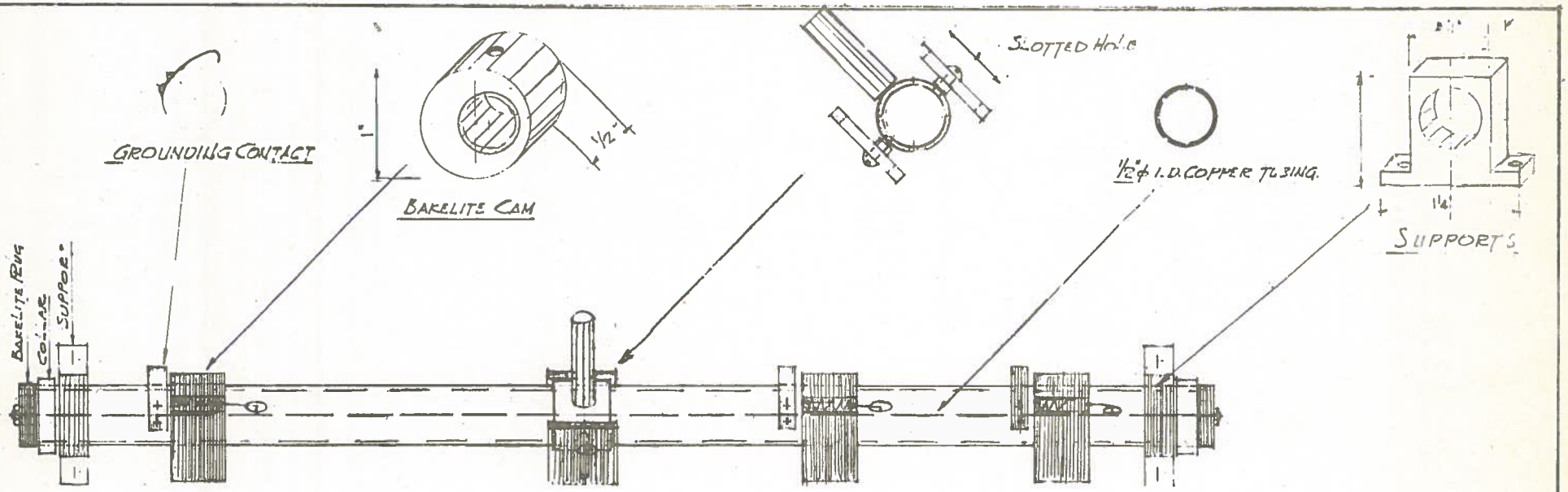
A-20

SILVER COMMONING SWITCH

R.F. UNITS. (MK A4-5-6 ON ASSEMBLY DVG 'A'

NATIONAL RESEARCH COUNCIL RADIO SECTION	
NAME R.F. UNITS - COMMONING SWITCH	
SCALE	DRN. BY J.P.
ENGINEER	
DATE 20/5/42	NO. OF DRG. 29


'A'
'A'
FRONT VIEW OPERATING PANEL
SECTION 'A-A'
FRONT VIEW
OPERATING PANEL
SEE ALSO ASSEMBLY SHEET 'A'
NATIONAL RESEARCH COUNCIL
RADIO SECTION
A21
March 10 1942

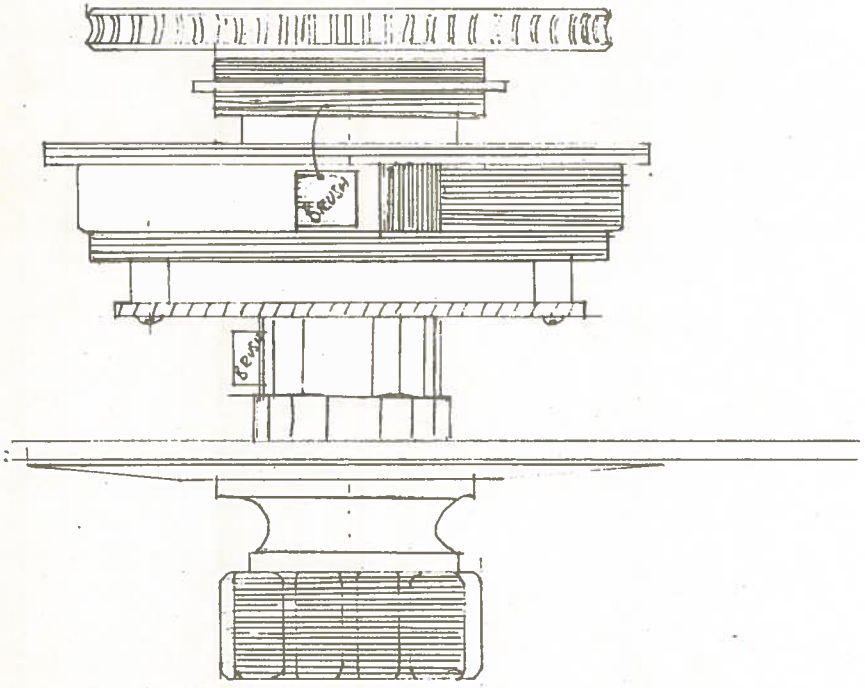


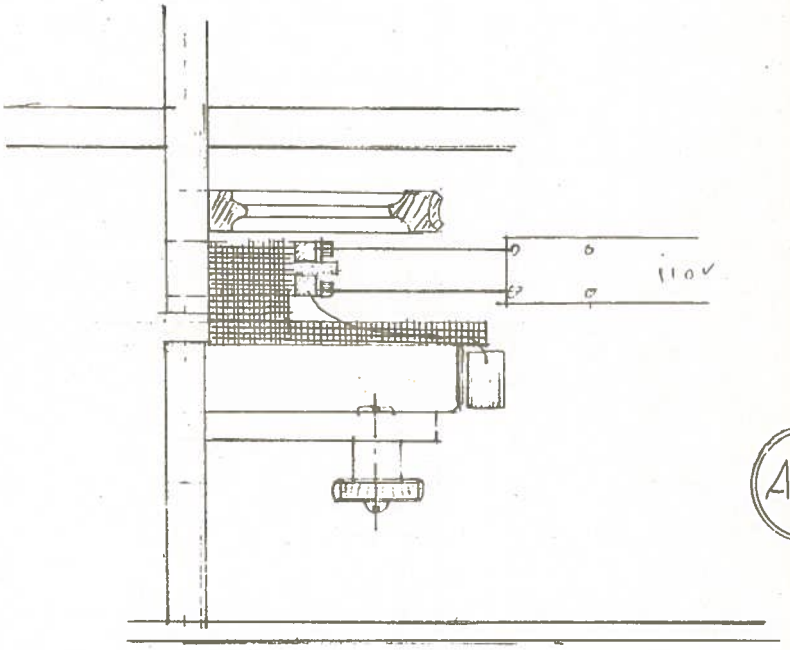
(A-22)

COMMONING SWITCH

(FOR LOCATION SEE SHEET A-21)

NATIONAL RESEARCH COUNCIL RADIO SECTION	
NAME Commoning Switch	
SCALE.	DRN. BY I.P.
ENGINEER	
DATE 4.8.42	NO. OF DRG. SH. 4 5





A-23

TUNING CONTROL

See Dwg A21 for Location

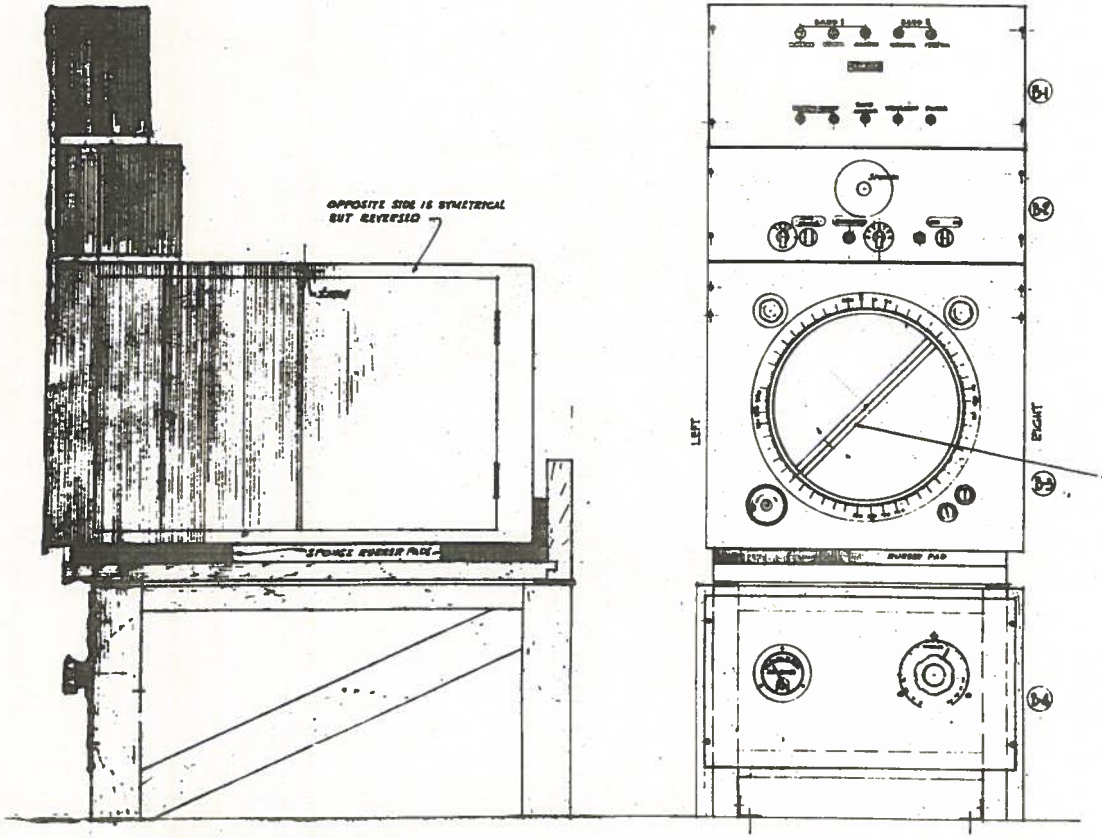
NATIONAL RESEARCH COUNCIL
RADIO SECTION

NAME Tuning Control

SCALE ..... DRN. BY J.P.

ENGINEER .....

DATE 12/3/42 ..... NO. CROK-SW-46



RIGHT SIDE ELEVATION

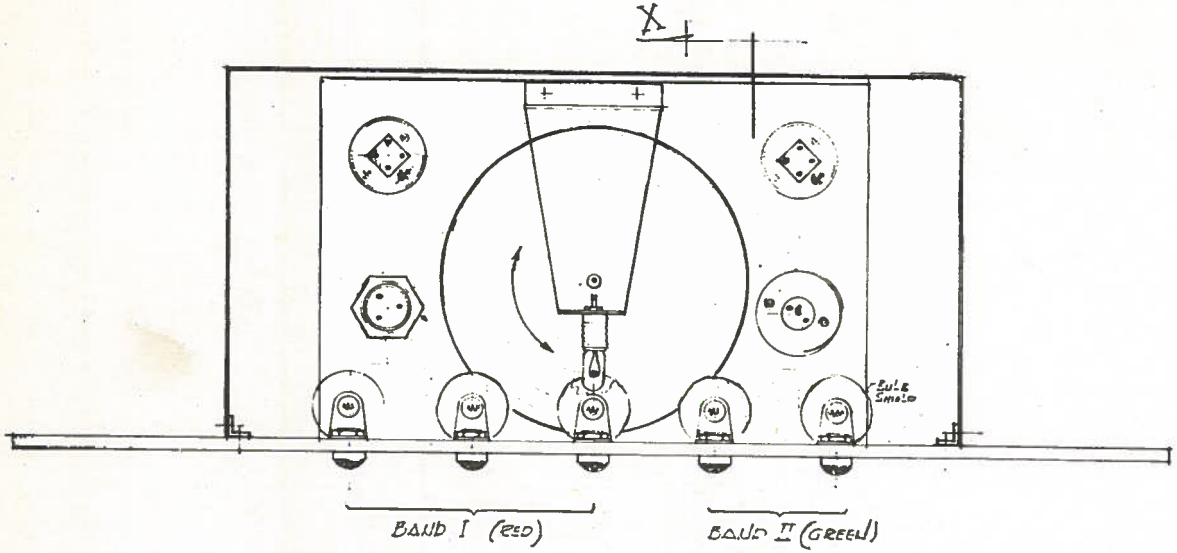
FRONT ELEV

SCALE:

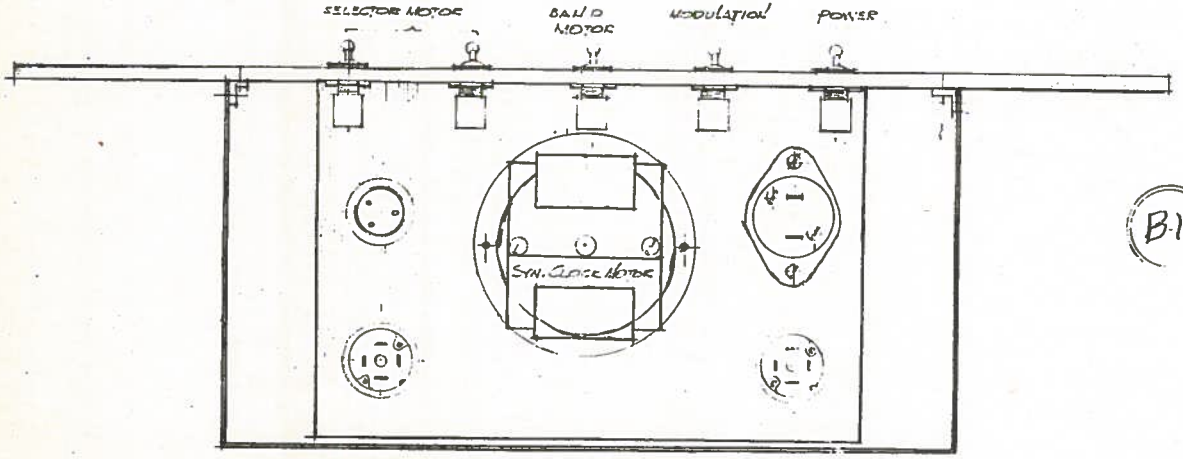
General Assembly
Receiver Pulse Oscillator Control Panel (81)
Monitor (82)
C.R. Tube Unit (83)
Voltage Regulator (84)

NATIONAL RESEARCH COUNCIL
RADIO SECTION

B

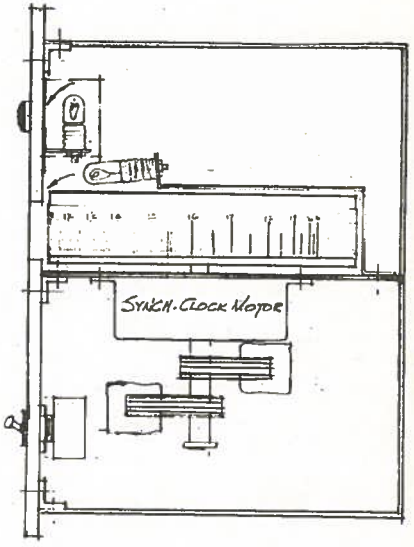


TOP VIEW



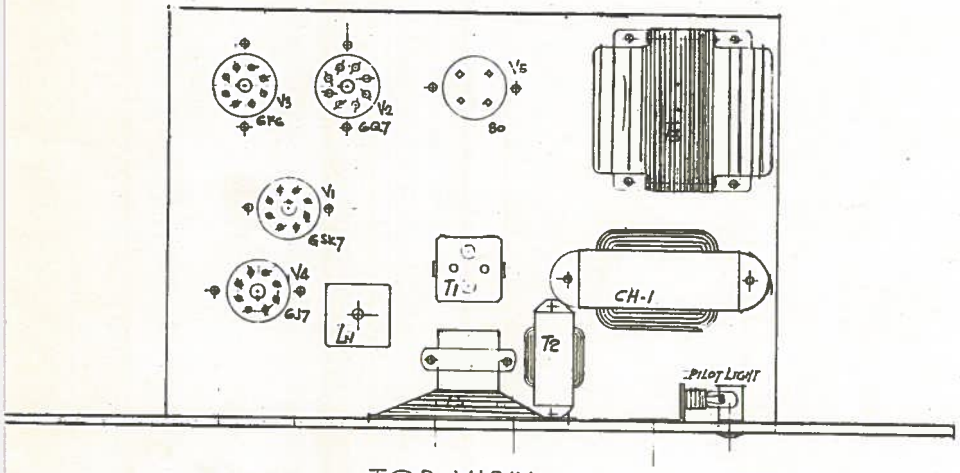
BOTTOM VIEW

B-1

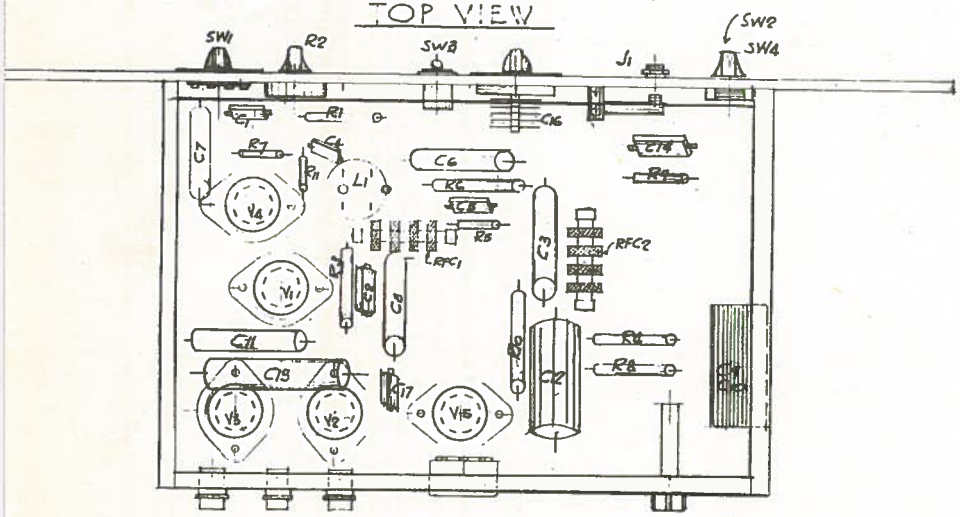


SECT. THRU -X-

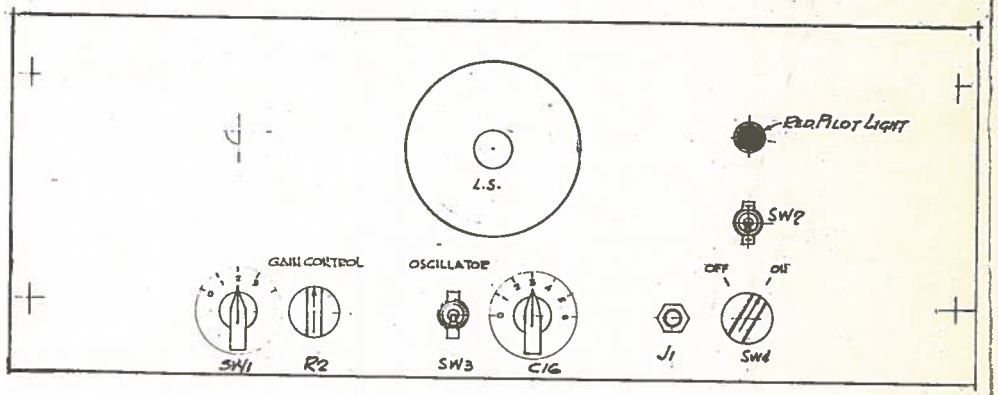
NATIONAL RESEARCH COUNCIL RADIO SECTION	
NAME	REMOTE FIELD OSCILLATOR SELECTANCE UNIT
SCALE	DRN. BY L.P.
ENGINEER	
DATE 7-1-41	NO. OF DWG. 5



TOP VIEW



VIEW of UNDERSIDE



FRONT VIEW

B-2

MONITOR

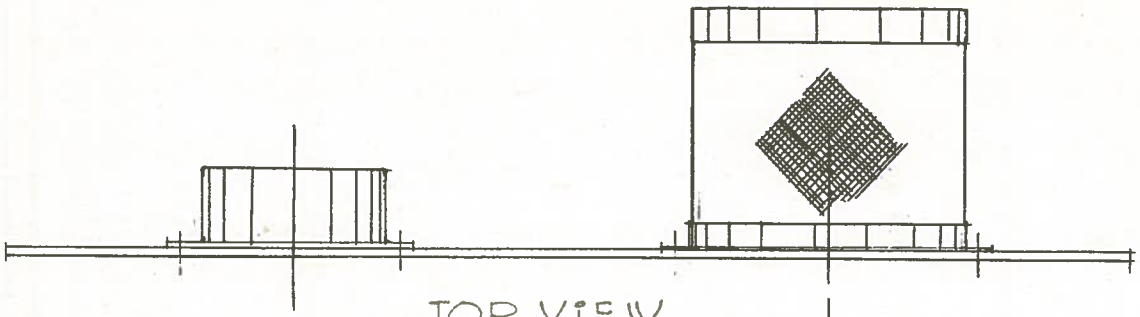
MK B-2 ON ASSEMBLY SHEET 'B'

NOTE:
FOR IDENTIFICATION OF PARTS, REFER TO SCHEMATIC WIRING DIAGRAMS

MARCH-17/42

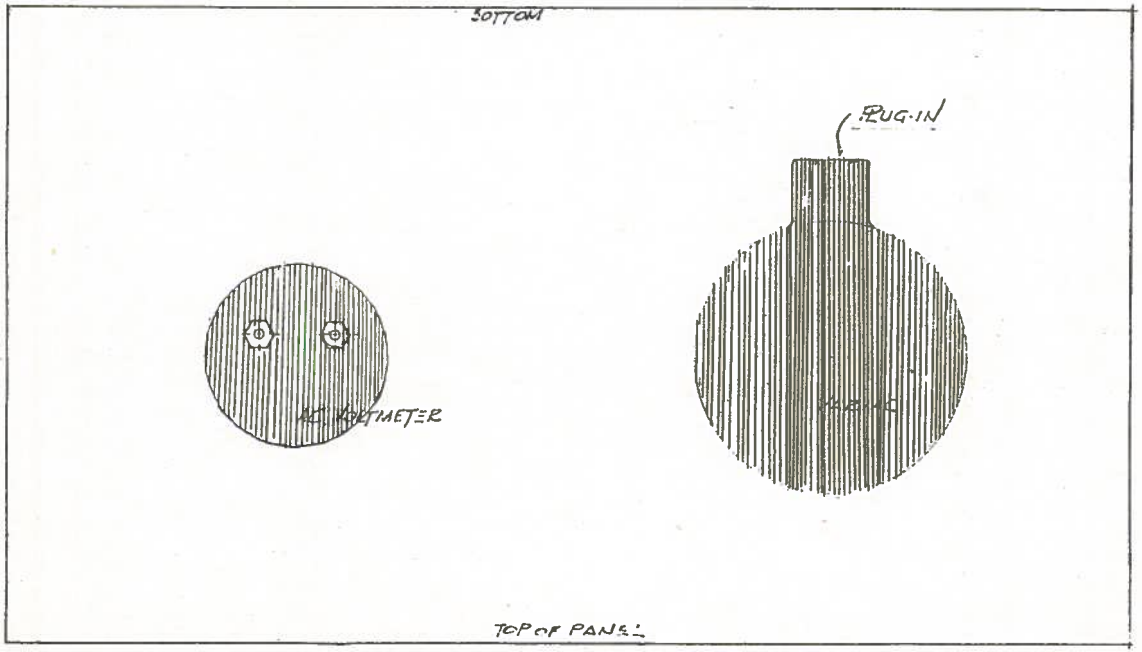
SCALE:

NATIONAL RESEARCH COUNCIL RADIO SECTION	DWG NO CRDF-S-V-49



TOP VIEW

(FOR FRONT VIEW SEE ASSEMBLY DWG B)



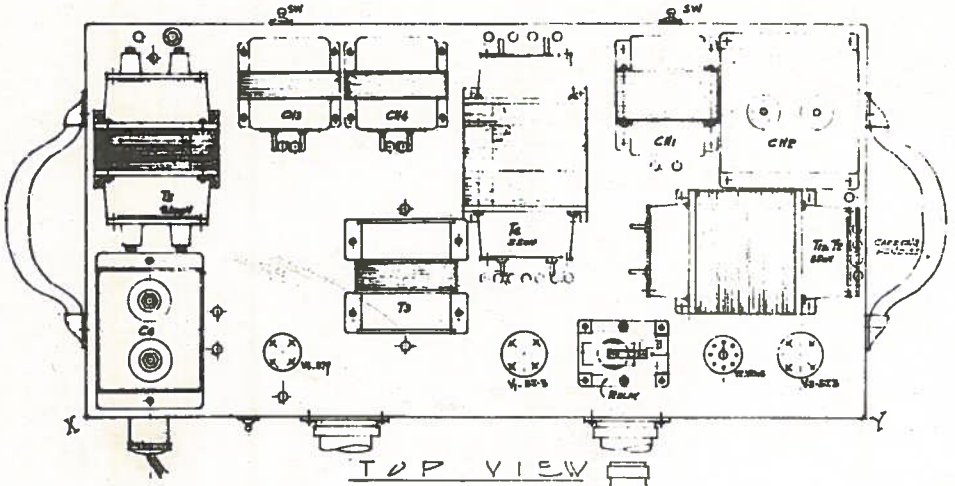
REAR VIEW

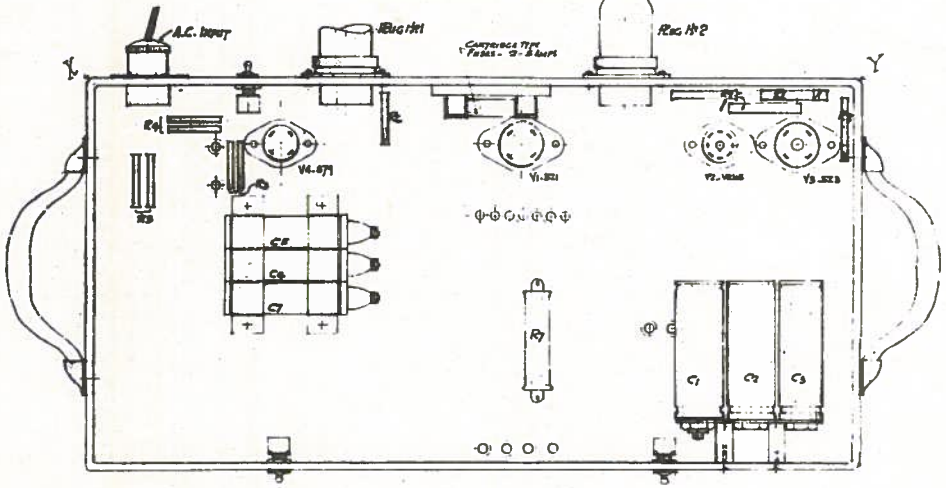
PART B4 ON ASSEMBLY B

B4

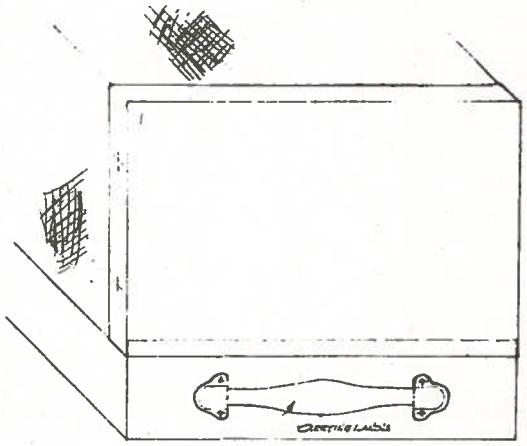
NATIONAL RESEARCH COUNCIL
RADIO SECTION

NAME VOLTAGE REGULATOR UNIT PANEL
SCALE ..... DRN. BY J.P.
ENGINEER .....
DATE 11/4/42 NO. CRDF-SW-31.





VIEW OF UNDERSIDE



NOTE:
FOR IDENTIFICATION OF PARTS
REFER TO SCHEMATIC DIAGRAMS

POWER PACK

SCALE: ½ SIZE

C

NATIONAL RESEARCH COUNCIL RADIO SECTION	DWG. NO. CRDF SW-51