OPERATING INSTRUCTIONS

MARCONI DOUBLE DIVERSITY TELEGRAPH RECEIVER

Canadian Marconi Company
Yamachiche Que.
November 13th. 1934

OPERATING INSTRUCTIONS

MARCONI DOUBLE DIVERSITY TELEGRAPH RECEIVER

A general description of the receiver is given under "Technical Description" and a complete set of drawings is also attached to the above. These instructions are intended to aid in the operation of this type of receiver when in commercial use.

The tuning of this type of receiver may appear to be somewhat difficult at first. This is largely owing to the narrow band widths employed. It is suggested that each member of the staff co-operate in keeping the tuning record of the receiver up-to-date by entering the settings of any new station tuned in.

The receiver is of the double super-heterodyne type and its principle of operation is the same as any other super-heterodyne receiver. By reference to drawings No. 2477 and 2478 it will be seen that the receiver employs four stages of R.F. amplification, 1st. detector, 1st. heterodyne, six stage 250 KC 1st. I.F. amplifier, 2nd. detector, 2nd. heterodyne, four stage ~~50~~ 70 KC amplifier, 3rd. detector and recording circuits.

A different type of feeder termination is employed from that used on the older receivers. The present type of termination has been adopted in order that a more satisfactory signal-to-static ratio may be obtained. The feeder is terminated on a separate inductance inductively coupled to the grid inductance of the 1st. R.F. amplifier. Both circuits are ~~both~~ tuned to resonance by means of variable condensers. The coupling between the two circuits may be varied by means of a control on the front panel marked "A COUP" . The feeder coil is tapped and by means of

a plug arrangement any number of turns, up to the full number on the coil, may be used to vary the wave range. The feeder tap is controlled by a sliding phosphor bronze finger mounted inside the coil and by means of the control marked "FEEDER TAP" the feeder tap may be varied from zero to five turns. An indicator on the front panel shows the number of turns connected across the feeder. In practice it may be found that the feeder tap for best signals is only a portion of a single turn and that the correct adjustment may seriously decrease the signals being received on other receivers connected to the same antenna system. To overcome this difficulty it is advisable to increase the feeder tap somewhat to prevent loss of signal on other receivers.

The coupling between the feeder circuit and the 1st. R.F. amplifier should be kept as loose as possible, consistent with good operating conditions. When heavy static is experienced it is necessary that very loose coupling be employed if the best possible circuit conditions are to be obtained. If tight coupling is employed heavy static crashes are likely to cause cross modulation in the 1st. R.F. amplifier valve and should this take place the selectivity following the 1st. R.F. amplifier will be of no use in reducing this type of interference. The same remarks are also equally applicable to a strong interfering station.

During the testing of the receivers it was found that the gain control of the 1st. R.F.A. should be adjusted so that the feed is approximately .5 mla. In this condition the amplifier gain is considerably reduced but the loss in signal strength is more than compensated for by the great reduction of noise obtained. It was also observed that signals seemed to be more constant in strength when the amplification of this stage was reduced. This, however,

may not apply to all conditions.

The total gain of the receiver is of the order of 250 DB, a voltage gain of 3.16×10^{12}, It is easily understood that it is impossible to make use of all this amplification owing to receiver noise, which is mostly valve noise commonly known as "Schottky effect" . The total amplification possible to use is about 120 DB and even at this value there will be considerable valve noise present. These remarks should be kept in mind when using the receiver. The large number of stages employed are not for the purpose of obtaining a high gain but rather to obtain good selectivity.

As mentioned in the "Technical Description" four stages of R.F. amplification are employed. This number of stages have been used to secure adequate selectivity and freedom from image interference. Under normal conditions it should not be necessary to use the full gain of the amplifier but there are times when it is desirable to keep the R.F.A. gain rather high and reduce the amplification elsewhere.

As a further aid to the reduction of static, and other types of interference, the input to the 1st detector is doubled tuned. The detector coupling coil is inductively coupled to the grid circuit of the 1st. detector. This coupling may be varied by means of the control marked "DET COUP". Remarks concerning the adjustment of the feeder circuit also apply here, if anything more so owing to the fact that the 1st. detector is biased to act as a modulator and is therefor more susceptible to cross modulation from static. Much can be done by correct usage of the feeder and detector coupling circuits in reducing the amount of static mutilated slip received.

The 1st. heterodyne circuit requires no explanation. It is of the standard type. The "VER" control covers only a very small band in comparison with the older type of receivers

and when searching for a station this must be borne in mind. Normally the lower Heterodyne position is used for reception.

The 1st. I.F. amplifier has been fitted with an adjustable attenuator having a range of 0 to -80 DB. This is the main gain control of the receiver and should be used whenever it is desired to vary the gain. The total gain of the 1st. I.F.A. is approximately 90 DB and at no time should the full amplification be used.

For tuning purposes a monitoring circuit has been included in the 2nd. detector circuit. When it is desired to pick up a new station this circuit should be used. Switch the 2nd. heterodyne control of R1 or R2, depending on which receiver is being used, to the "TUNE" position, switch off the 1 KC modulator, otherwise an uncomfortably loud 1 KC tone will be heard in the headphones plugged into the monitoring circuit of the 2nd. detector, then switch the 2nd. detector control to "TUNE". The monitoring circuit will now be ready to receive any signals from the 2nd. detector. When the station has been correctly tuned in switch the controls back to the "RUN" position. The headphones are now plugged into the monitoring jack mounted on the front panel of the main bridge unit. If the station being received is using a pure C.W. carrier it may be desirable to switch on the 1 KC modulator. When the controls have been switched to the "RUN" position it will be necessary to put considerable attenuation in on the 1st. I.F.A., otherwise serious overloading will result.

The same proceedure is carried out in tuning the other receiver. This brings the signals from each receiver up to the 3rd. detectors of the main bridge unit. Three key switches mounted one above the other on the left hand

side of the front panel of the main bridge unit, control the receiver outputs and combining circuits. The top key switch is marked "MAIN B" the centre switch "MON" and the bottom switch "AUX B." When the key switch marked "MAIN B" is in the up position R1 (receiver on left hand side) is connected to the main bridge unit, in the down position R2 (receiver on right) is connected to the main bridge unit and R1 is disconnected. In the central position both receivers are connected to the main bridge unit. The "MON" switch is used to monitor either receiver or the combined outputs. The "AUX B" key switch is used only when it is desired to operate the two receivers independently of each other. If the main bridge is being used with R1 and it is desired to use the aux. bridge with R2 the aux. bridge key switch is set to R2. When the aux. bridge is not being used care must be taken to see that the "AUX B" switch is always in the central position (OFF) otherwise two batteries will be connected to one of the 3rd, detectors which will cause trouble.

Suitable bias controls are mounted on the front panel of the main bridge unit for varying the bias, over a 5 volt range, applied to 3rd. detectors. The third detectors are also each fitted with a grid limiter circuit. The limiter consists of a .1 mfd. condenser shunted by a .5 meg. resistor connected in series with the ground return of the grid circuit. The purpose of the grid limiter is to reduce overloading of the 3rd. detector. A very strong signal will cause the detector to draw grid current and if the limiter is in circuit this grid current will flow through the .5 meg. resistor producing a voltage drop equal to IxR. This voltage drop is applied to the grid of the valve as extra bias thus tending to prevent the valve being overloaded by increasing

the negative bias. The purpose of the condenser is to prevent the extra bias applied to the grid of the valve being removed during the space periods between the characters. The time constant of the circuit is 50 milliseconds which is sufficient to cover most speeds of keying. When rapid or very deep fading is experienced the grid limiter should be cut out of circuit otherwise it may cause drop-outs on the slip. Care should also be taken to see that the gain of the receiver is not too close to the point where a slight increase in signal strength will cause the detector circuit to block and thus cause sticks on the slip.

The limiter circuit of the bridge circuit is somewhat different from those previously employed in that a type 77 screen grid valve is used instead of a triode. The screen grid valve has been found to be very sensitive for this purpose. The limiter is operated by the voltage drop across a 30,000 ohm resistor in the detector plate circuit. This resistor is of the variable type and is used as a voltage divider for the grid of the limiter valve. By operating the control marked "L RES" it is possible to prevent the limiter functioning until a certain strength of signal is received. This is helpful in discriminating against noise and static.

Three marking valves have been installed with means provided for cutting them in or out of circuit one by one. For normal working two valves should give sufficient marking current to operate a mechanical relay efficiently, however should high speeds, above 180 W.P.M., be used, it would be desirable to increase the marking current and therefore all valves should be placed in circuit. The mark-space galvanometer is calibrated directly in milli-amps.

Should a valve relay be used instead of a mechanical relay the marking and spacing circuits are not used. The bias obtained from the limiter plate circuit would be used to operate the valve relay.

Four sets of plug-in coils are supplied to cover the wave range 13 to 80 meters. The coils have been marked as follows;- Each coil has been suitably engraved to permit quick identifiaation, for instance the heterodyne coils have been marked HET. The coils are also marked to show which side of receiver they belong left or right. The number of the receiver follows the receiver designation.

Example;-a coil marked L2 would mean that it belonged to the left hand receiver of receiver No 2.

To distinguish one range from another various coloured handles have been used as follows;-

Range	1	13 - 19 M	BLACK
"	2	19 - 30 M	Brown
"	3	30 - 50 M	Red
"	4	50 - 80 M	Black with white dot
New York only "	5	80 - 100 M	Black with Red dot.

By using coloured handles it becomes a simple matter to check over the coils to see if a wrong coil has been plugged in.

The following feeds are correct for the telegraph receiver.

R.F.	1	8 m/a	(Bar. rec'r 6 m/a)
	2	6	" " 6
	3	6	" " 6
	4	6	
Det	1	2.5	
	2	2.5	
1st Het		6	
1st I.F.A.	1	2.5	
	2	4.5	
	3	2.5	
	4	4.5	
	5	4.5	
	6	4.5	
	7	4.5	
2nd Det	D 1	1.0	
	D 2	1.0	
L.F.A.		3.0	

2nd Het.	O 1	6 m/a	
	A 1	1.0	
	A 2	1.0	
	M	4.0	With mod. switch in.
	O 2	6.0	
	A 1	2.0	
	A 2	2.0	
2nd I.F.A.	1	4.5	(Bar rec'r 6.0 m/a
	2	4.5	" " 6.0
	3	4.5	" " 6.0
	4	4.5	" " 6.0
	5	0	with no signal
	6	0	" " "
Bridge Unit	M 1	3.0	
	M 2	3.0	
	L	.25	on signal

The above values may vary as much as plus or minus 15% without causing trouble. The feed of new valves has been found to vary considerably.

The 2nd heterodyne unit employs oscillators of the constant frequency type. This type of oscillator has been used to insure little trouble being experienced with drifting frequency.

The 180 KC oscillator once correctly adjusted should seldom need attention and the practice of frequently adjusting the 2nd het. is to be discouraged as much as possible in the operation of the receivers. The 2nd het. is common to both receivers and any incorrect adjustment of the 2nd het. will adversely effect the operation of both receivers.

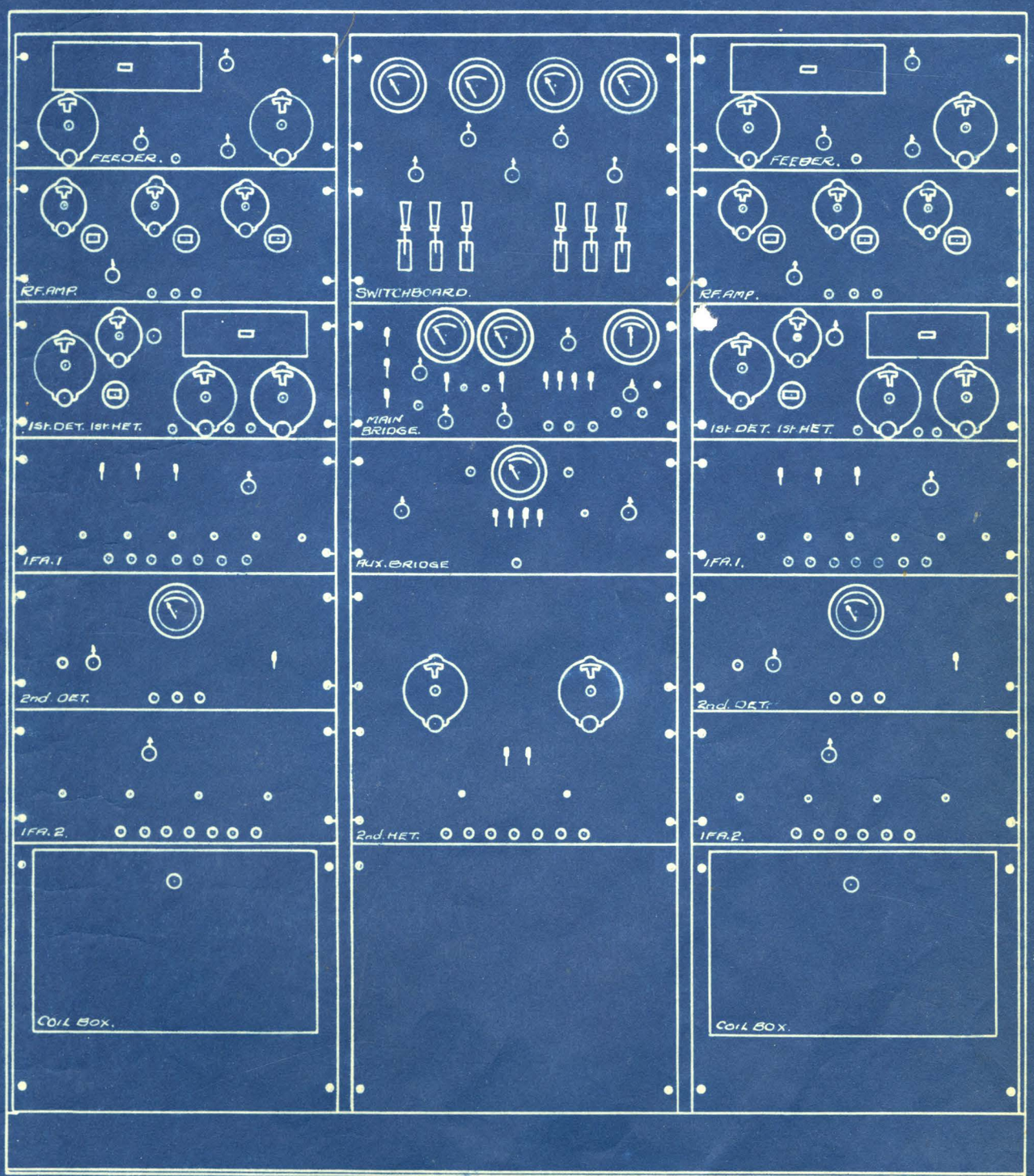
DRWG. No. 2463

PANEL LAYOUT
DOUBLE DIVERSITY TELEGRAPH RECEIVER.

CANADIAN MARCONI COMPANY.

DR. WS.	CK.	YAM. No 108

6/8/34.



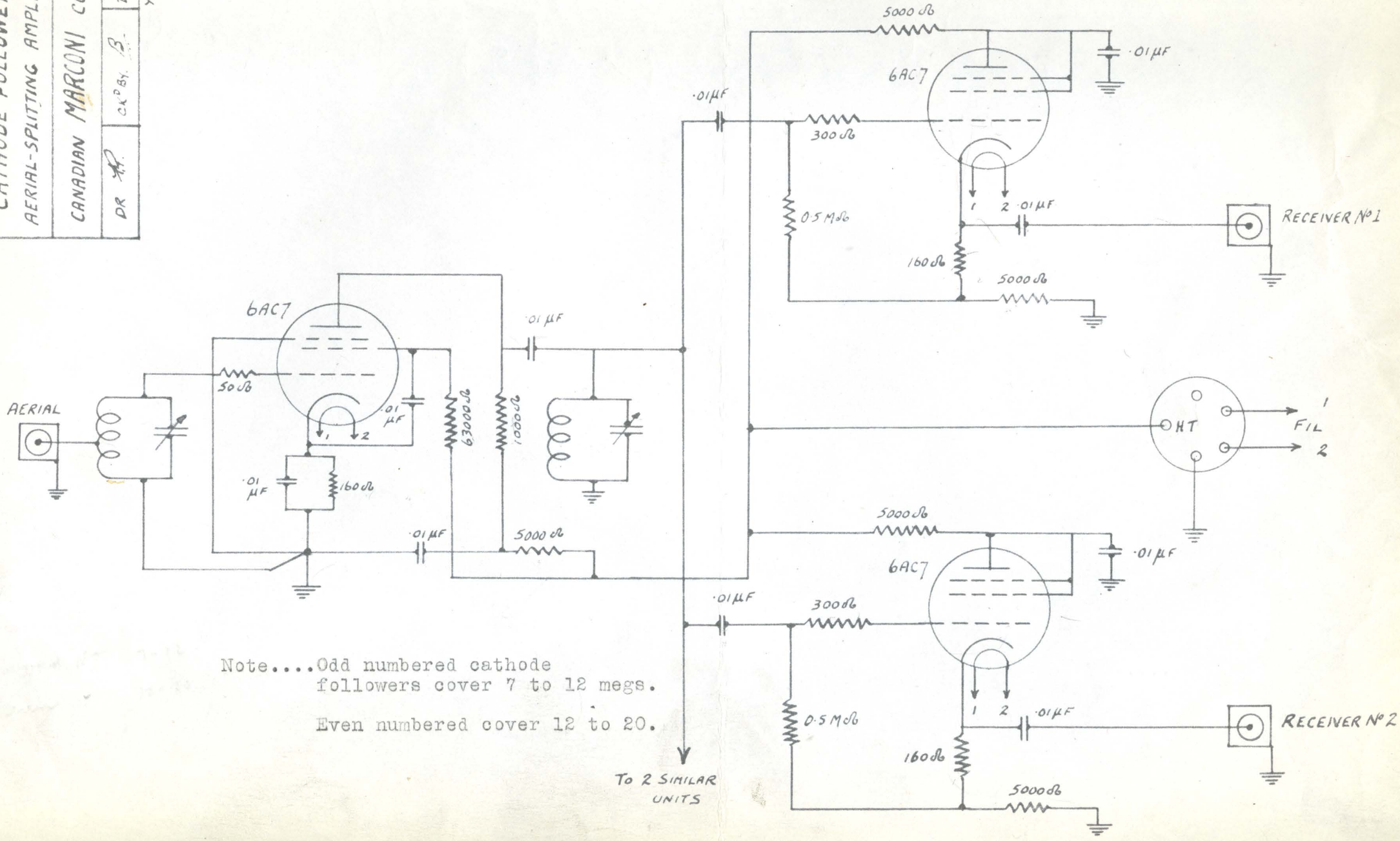
MAXIMUM DEPTH = 24".

5076

CATHODE FOLLOWER
AERIAL-SPLITTING AMPLIFIER

CANADIAN MARCONI COMPANY

DR	CK'D BY	DEC 14 1946	YAMAICHICKE



Note....Odd numbered cathode followers cover 7 to 12 megs.

Even numbered cover 12 to 20.

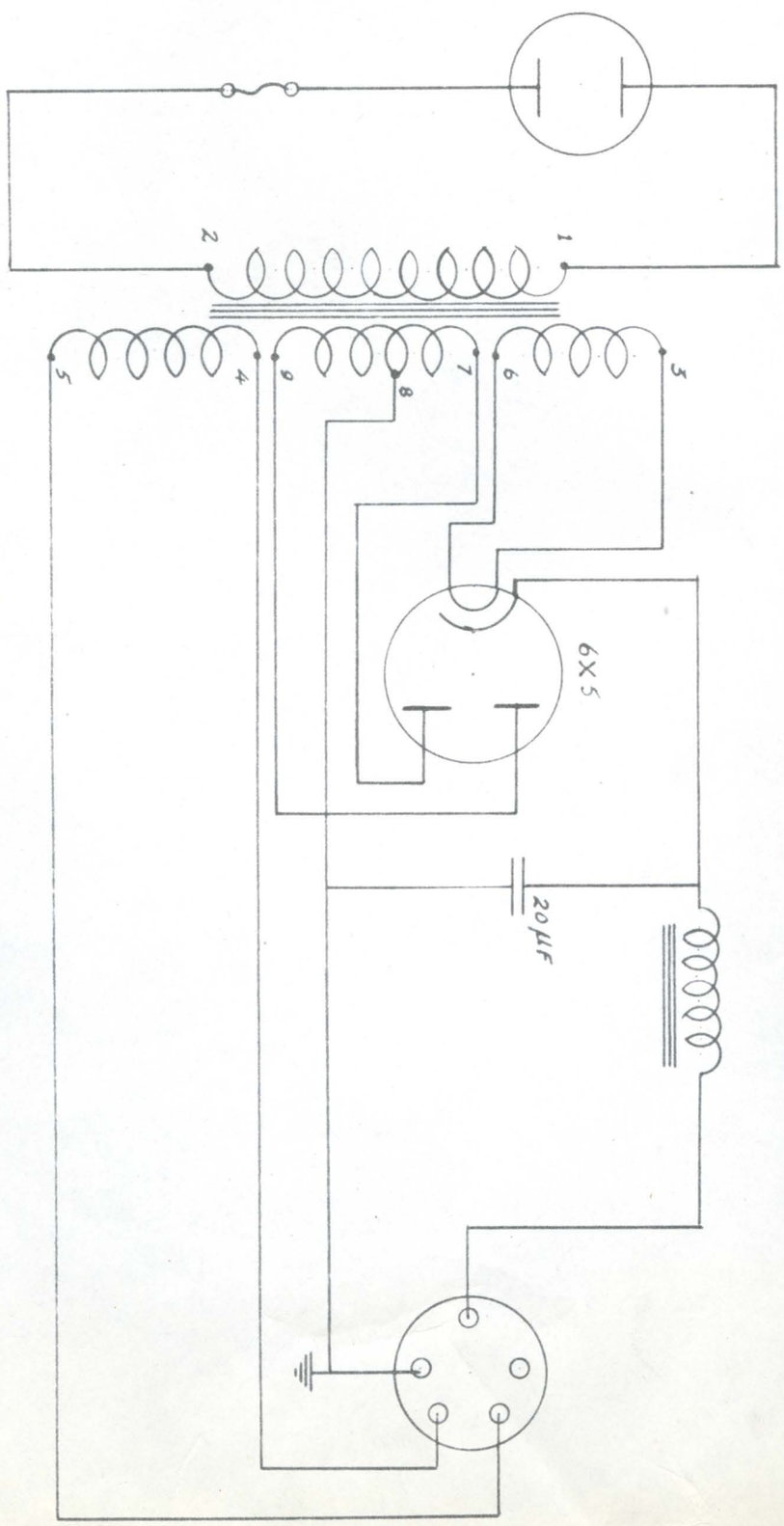
5077

CATHODE FOLLOWER
POWER UNIT

CANADIAN MARCONI COMPANY

Dr A.	Ck'd by B	DEC 17. 46

YAMACHICHE



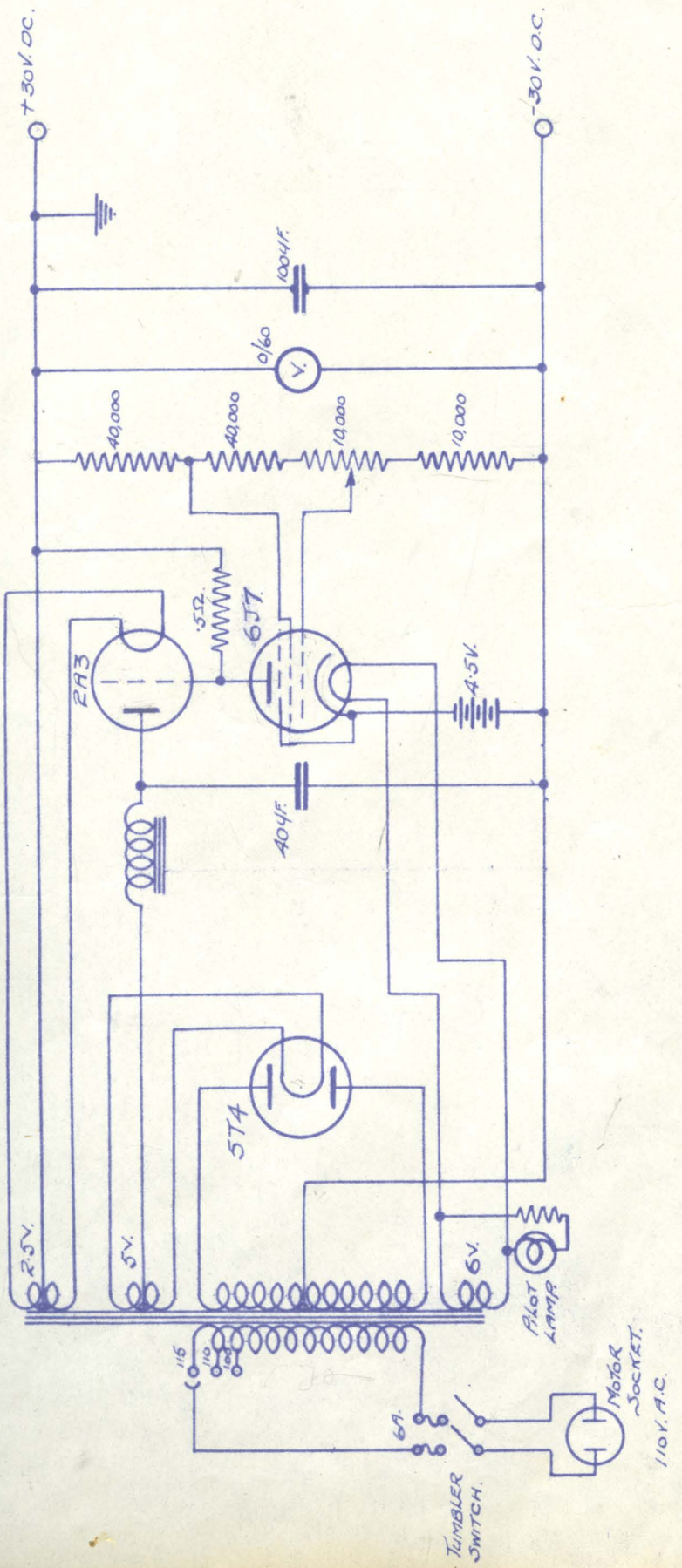
3819

BIAS UNIT. 30 V. D.C.

CANADIAN MARCONI COMPANY.

DR. W. CK. [illegible] MAR. 10. 1941

COMMON BIAS SUPPLY FOR DIVERSITY TELEGRAPH RECEIVERS YAMACHICHE.



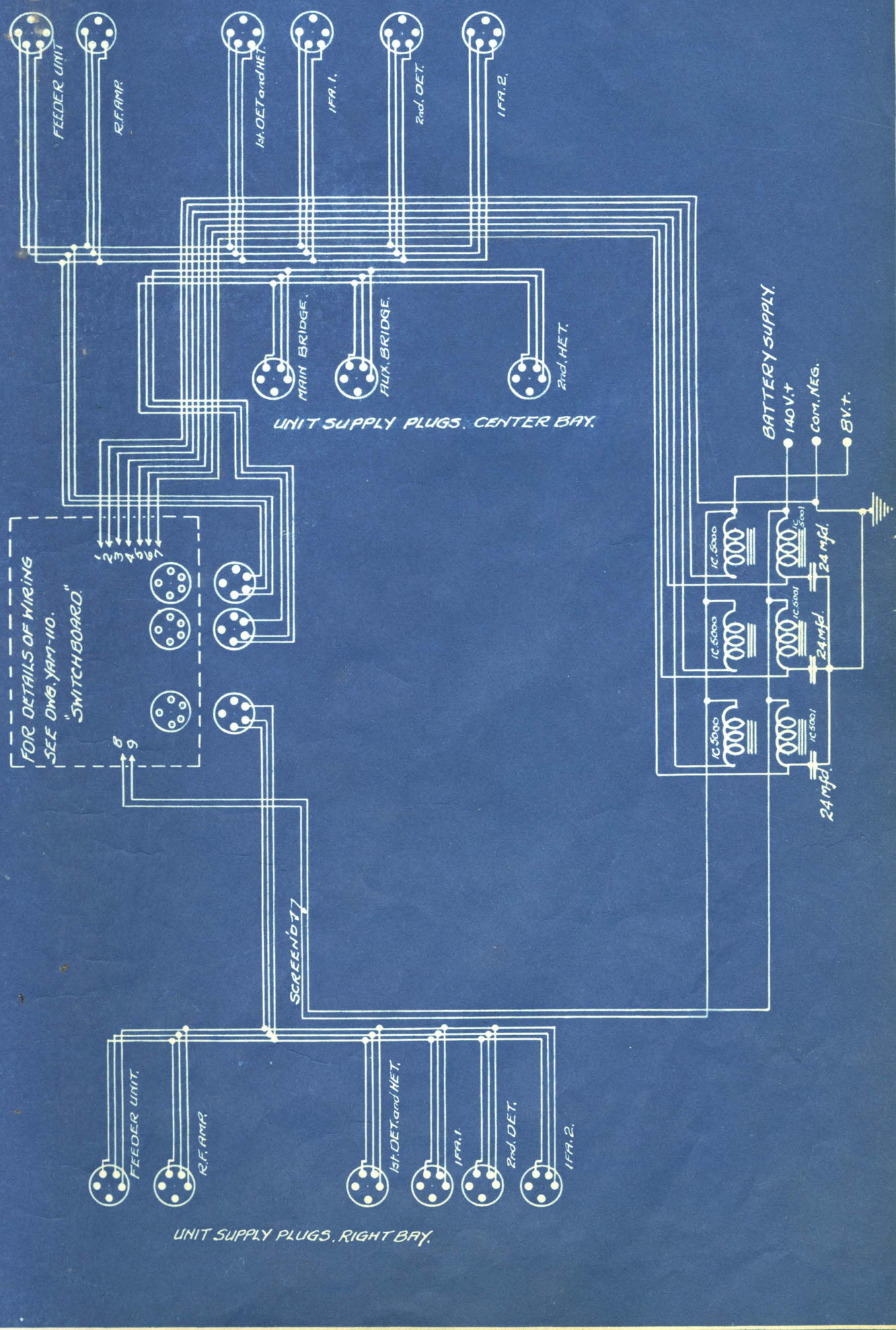
DRWG. No. 2464

CHANNEL WIRING. DOUBLE DIVERSITY TELEGRAPH RECEIVER.

CANADIAN MARCONI COMPANY.

DR. W.	CK.	YAM. No 109

6/8/34.



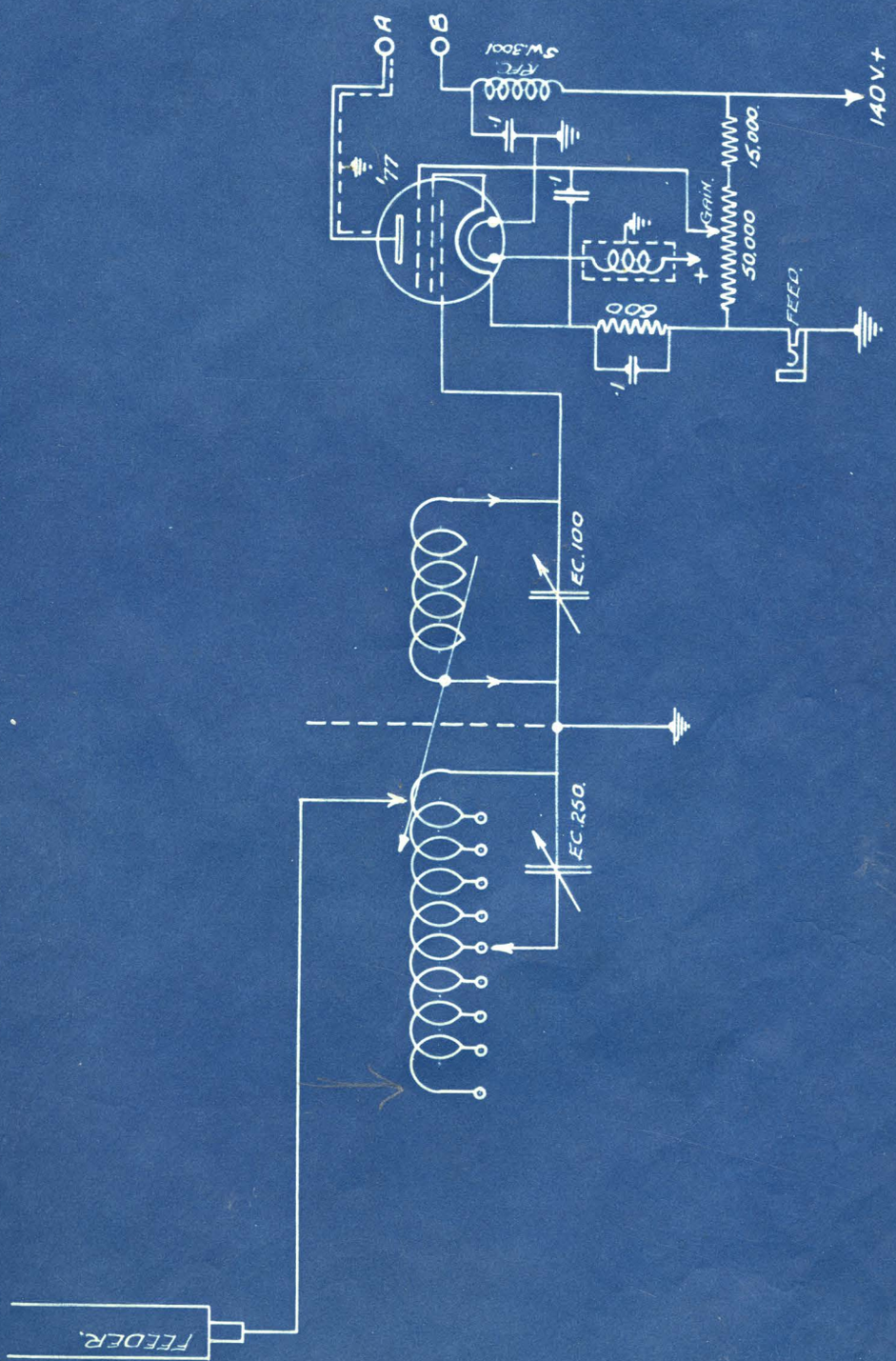
DRWG. No. 2466

FEEDER UNIT.
DOUBLE DIVERSITY TELEGRAPH RECEIVER.

CANADIAN MARCONI COMPANY

DR. WS	CK.	YAM. No 111

27-7-34.



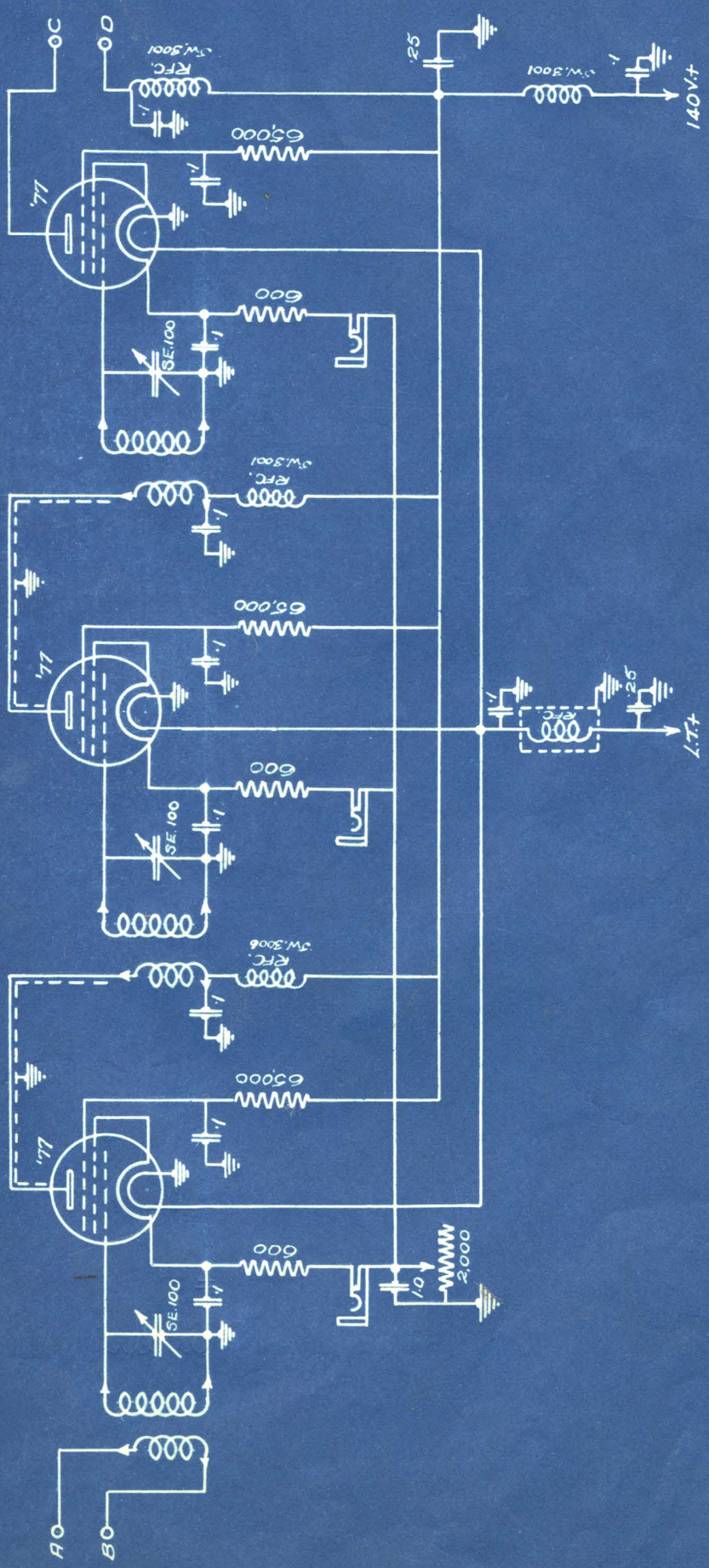
DRWG. No. 2467

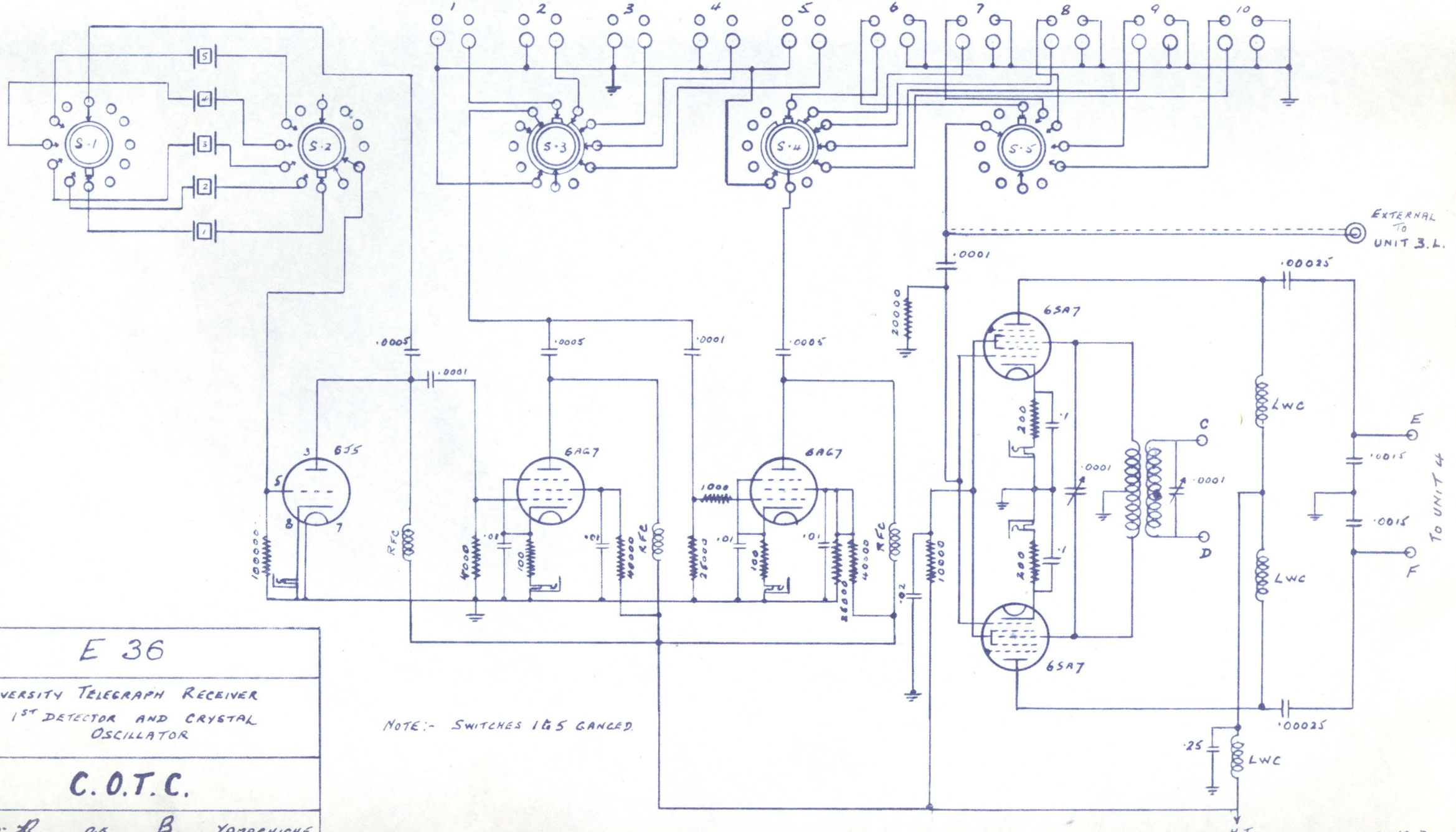
RF. AMPLIFIER.
DOUBLE DIVERSITY TELEGRAPH
RECEIVER.

CANADIAN MARCONI COMPANY.

DR. V.	CK.	YAM. No 112

30/7/34.



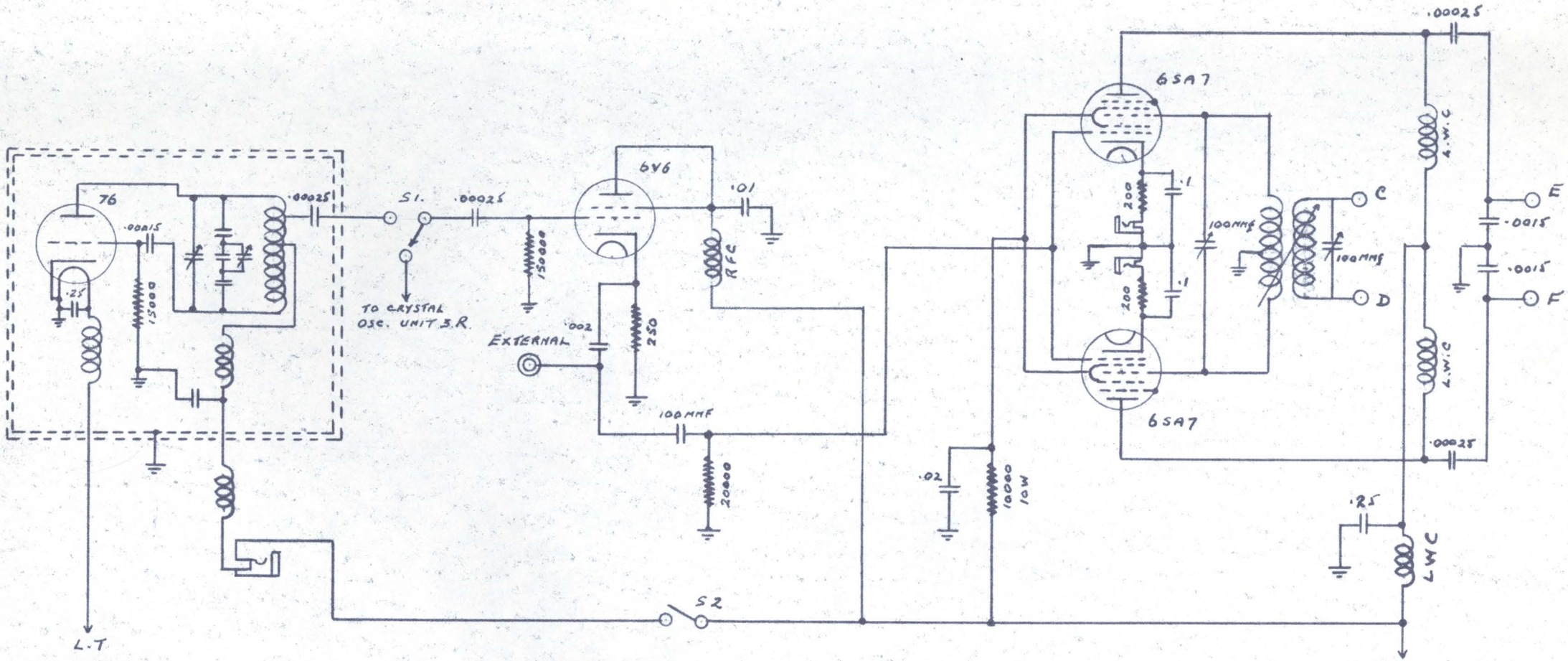


E 36

DIVERSITY TELEGRAPH RECEIVER
1ST DETECTOR AND CRYSTAL OSCILLATOR

C.O.T.C.

D.R. or B. YAMACHICHE JUNE 51

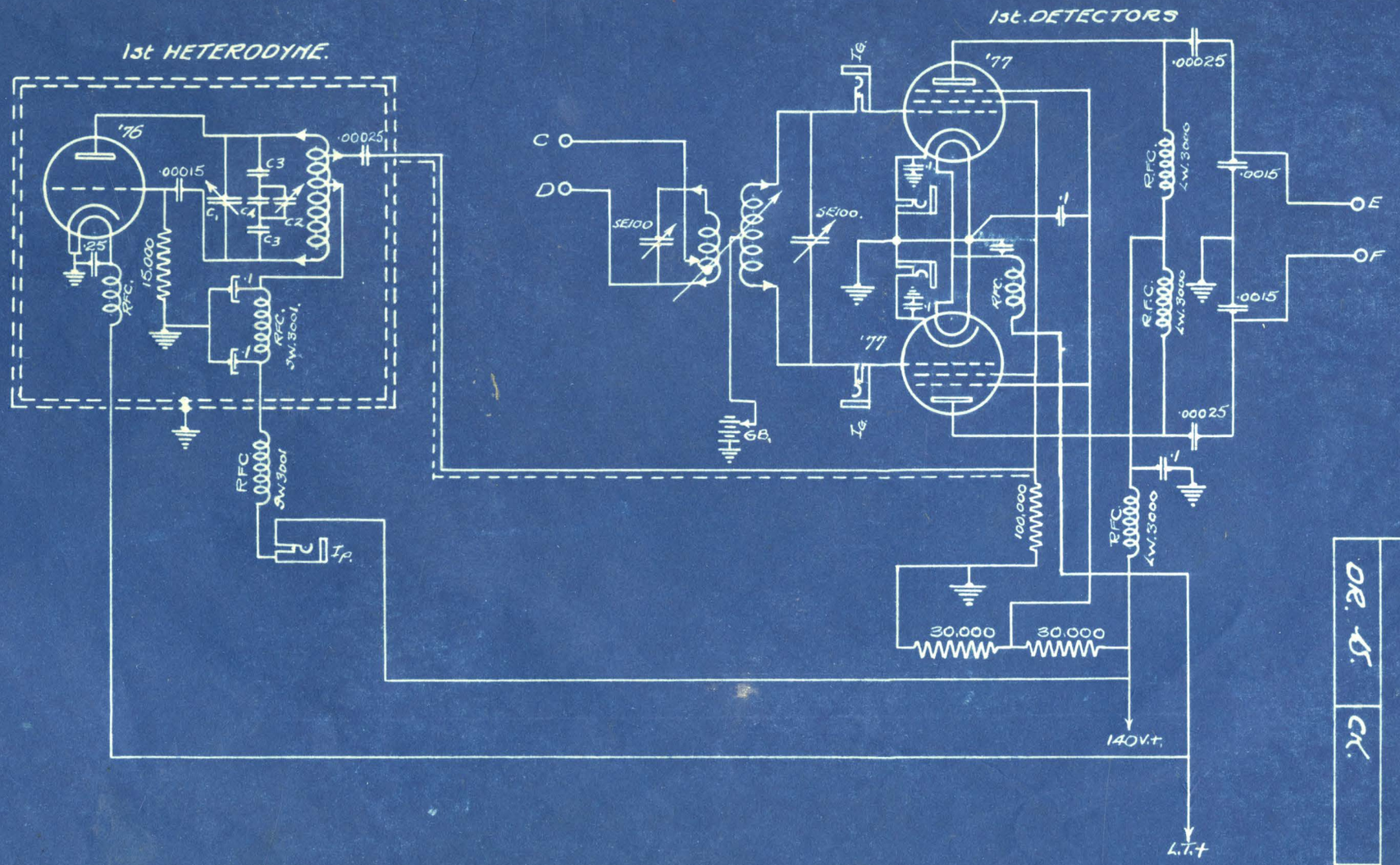


S1 AND S2 GANGED

DIVERSITY TELEGRAPH RECEIVER
FIRST OSCILLATOR AND DETECTOR

C. O. T. C. E61

D. Y.G. CK. D APRIL 19.52
YAMACHICHE



C1	SE. 100	·0001
C2	STH. 25	·000025.
C3	·00025	
C4	·00005.	

DRWG. No. 2468

FIRST DET. and HET.
DOUBLE DIVERSITY TELEGRAPH
RECEIVER.

CANADIAN MARCONI COMPANY.

DR. G.	CK.	
		YAM. No 113.

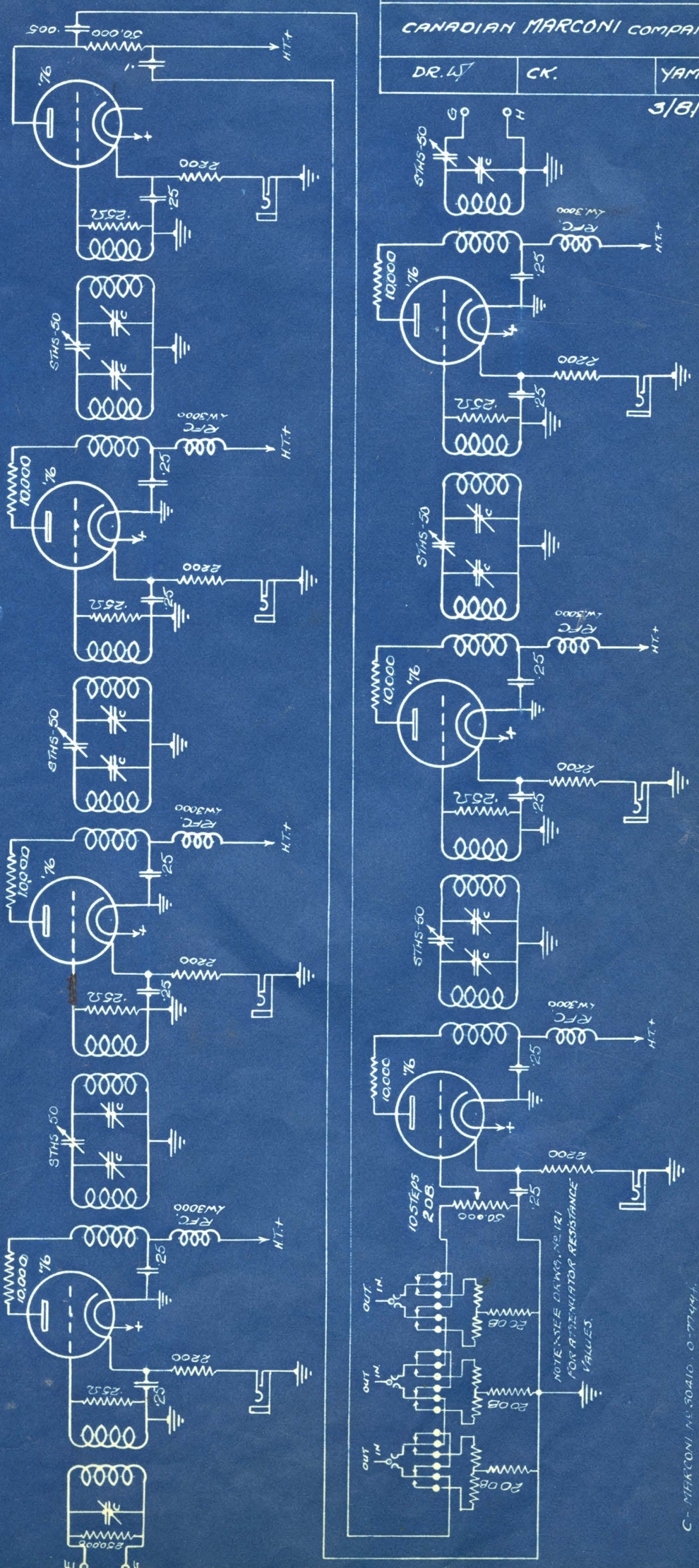
30/7/34.

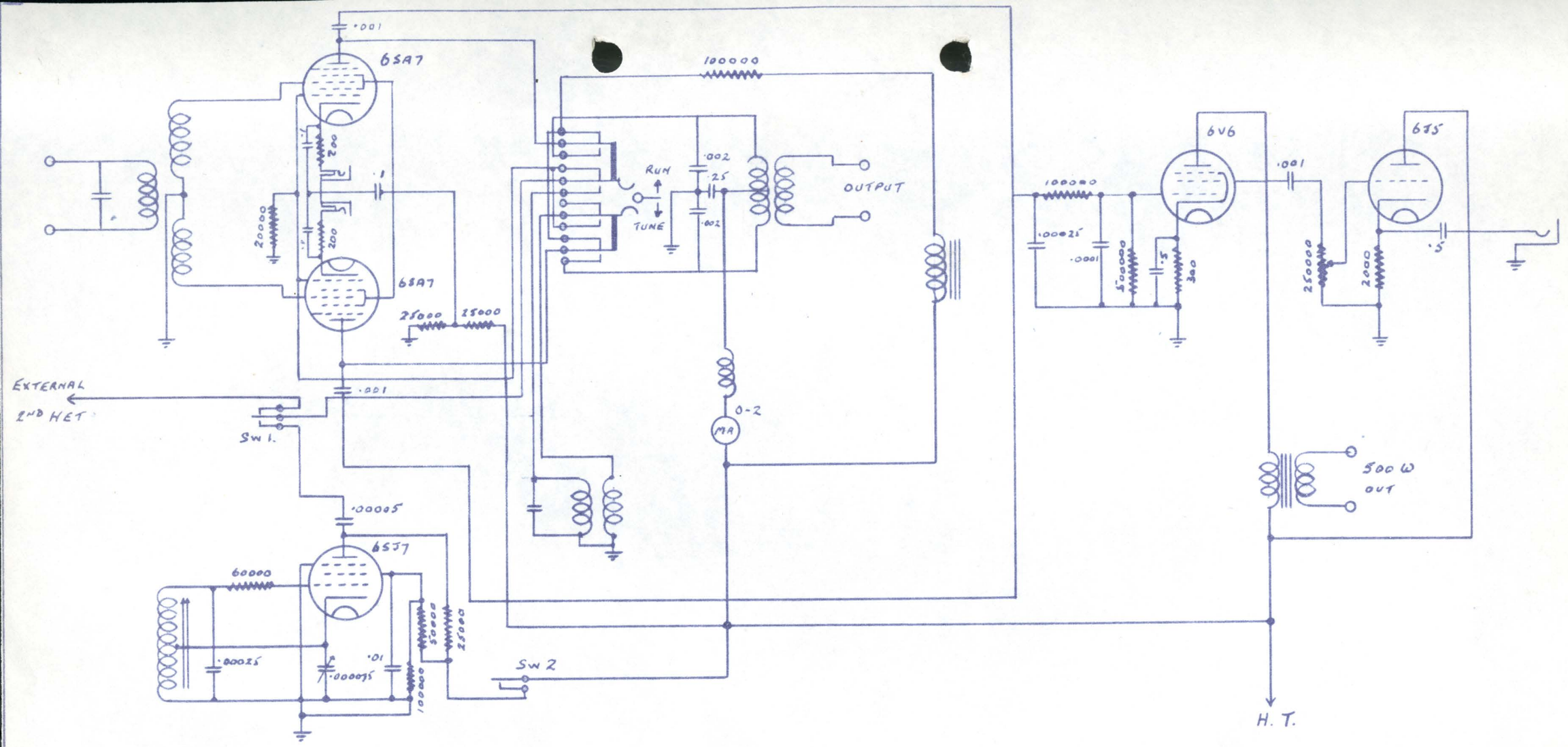
DRWG. Nº. 2469

250KC. I.F. AMPLIFIER.
DOUBLE DIVERSITY TELEGRAPH RECEIVER.

CANADIAN MARCONI COMPANY

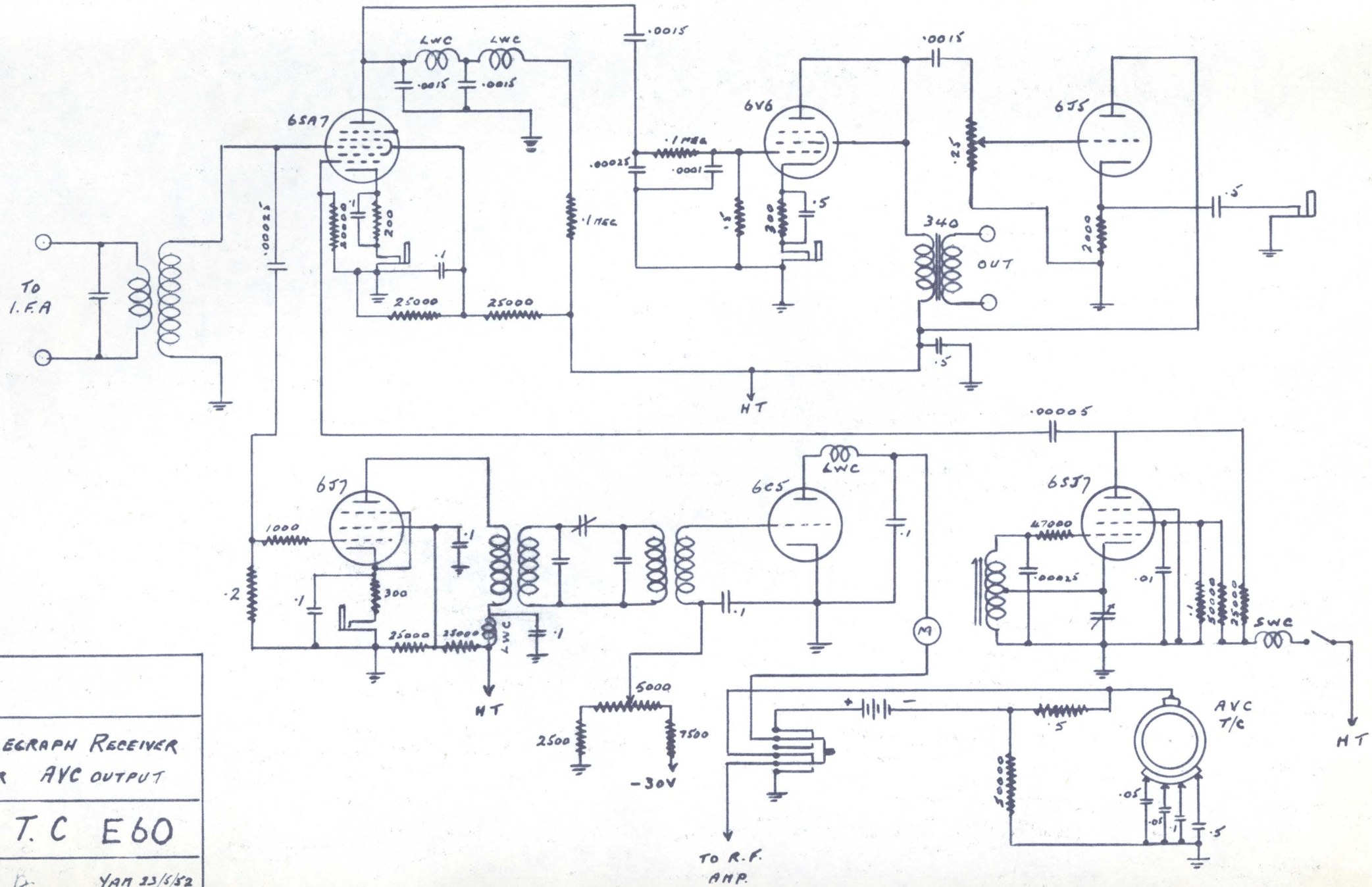
DR.	CK.	YAM. Nº 114
		3/8/34.





NOTE:- SWITCHES Nº 1 & 2 GANGED.

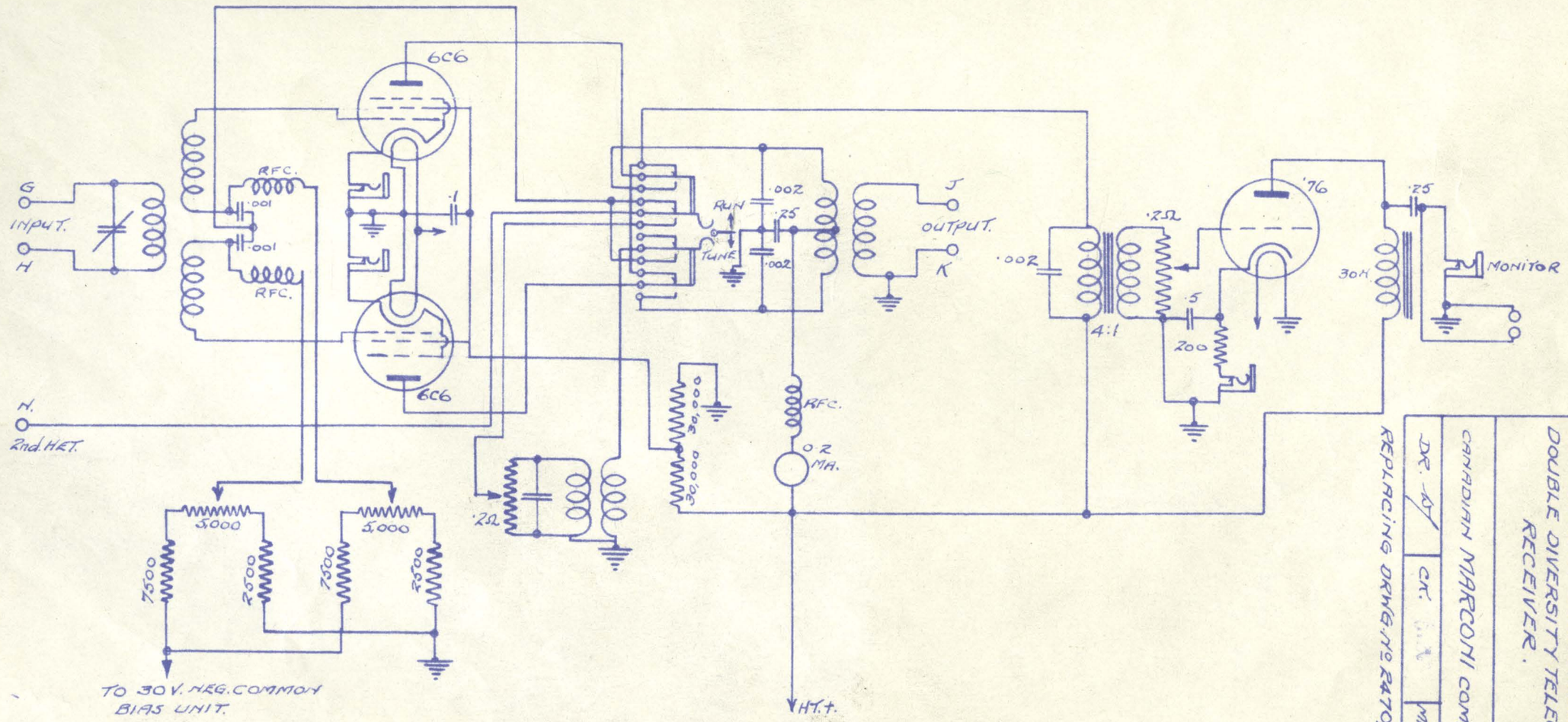
E 37
DOUBLE DIVERSITY TELEGRAPH 2ND DETECTOR, B.F.O. AND AUDIO AMPLIFIER.
C.O.T.C.
Dr. K.P. ex B YAMACHICHE JUNE 51.



DIVERSITY TELEGRAPH RECEIVER
2ND DETECTOR AVC OUTPUT

C. O. T. C E60

D" A ok P YAM 23/5/52



3818

SECOND DETECTOR.
DOUBLE DIVERSITY TELEGRAPH
RECEIVER.

CANADIAN MARCONI COMPANY.

DR.	CK.	MAR. 12. 1941

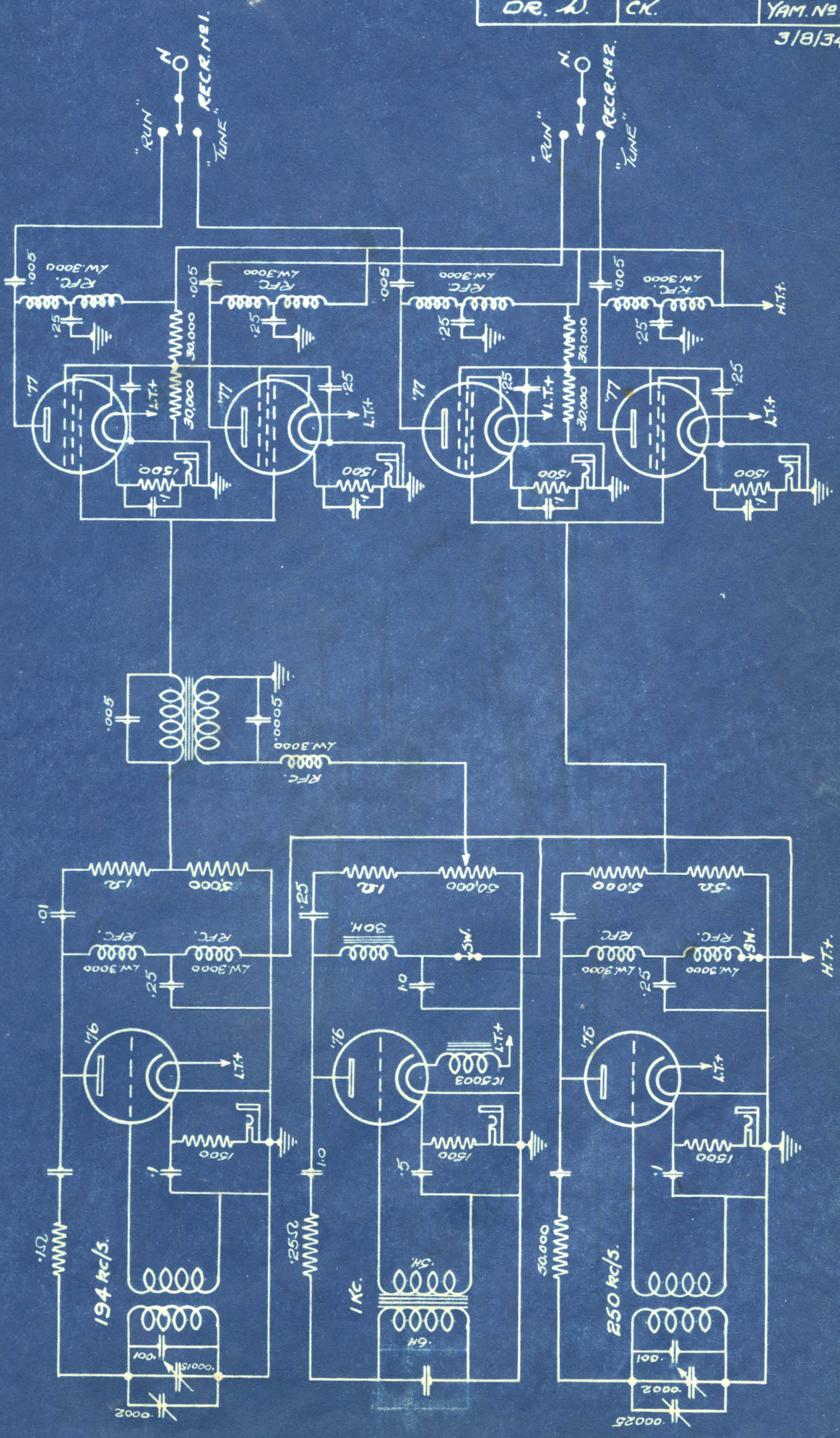
REPLACING DRWG. NO R4470, 1/8/34.

DRWG. No 2471

SECOND HETERODYNE DOUBLE DIVERSITY TELEGRAPH RECEIVER.

CANADIAN MARCONI COMPANY

DR. W.	CK.	YAM. No 116
		3/8/34.

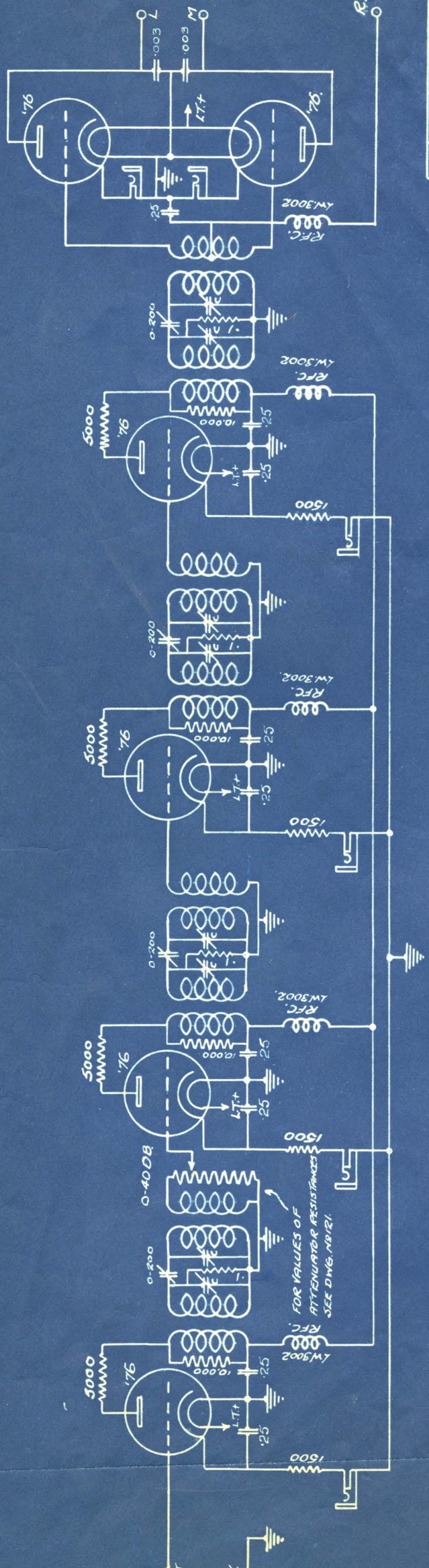


DRWG. Nº 2472

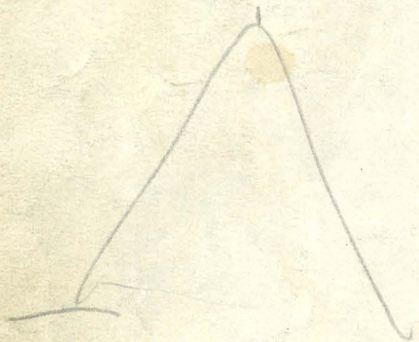
56 KC. I.F. AMPLIFIER. DOUBLE DIVERSITY TELEGRAPH RECEIVER.

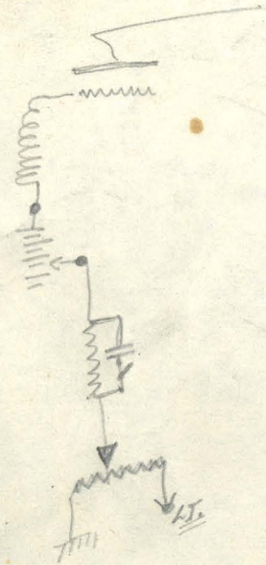
CANADIAN MARCONI COMPANY.

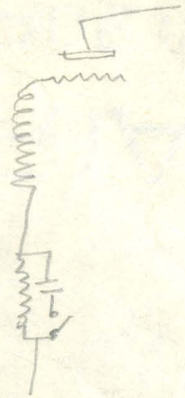
DR. W.	CK.	YAM. Nº 117
		4/8/34.



C—MARCONI Nº 3040 0-70 μμf.
AND .001 FIXED.

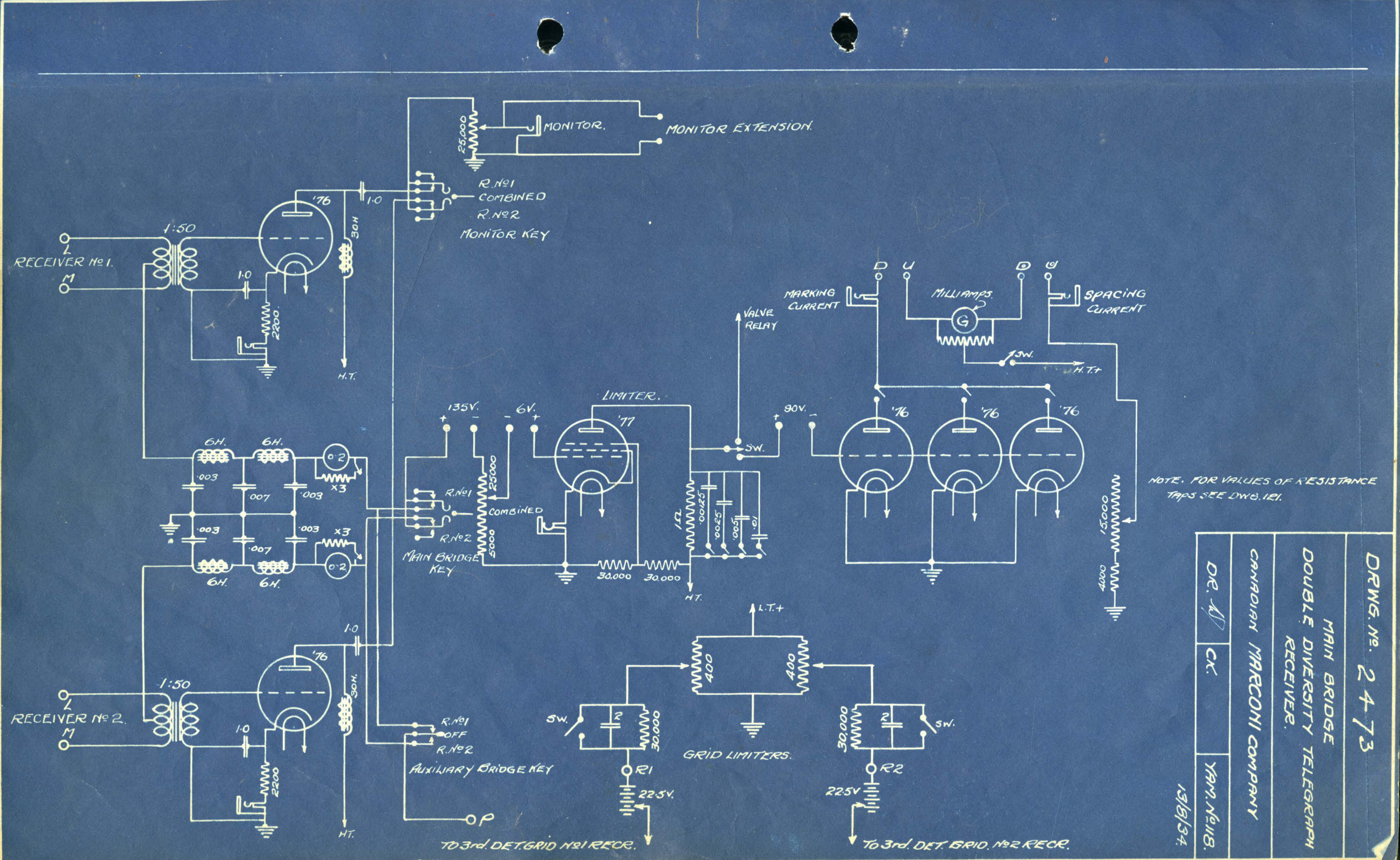






H & R

B & G


MONITOR.
MONITOR EXTENSION.
25,000
R.№1
COMBINED
R.№2
MONITOR KEY
RECEIVER №1.
L
M
1:50
'76
1·0
30H.
2200.
H.T.
MARKING CURRENT
MILLIAMPS.
SPACING CURRENT
D
U
G
SW.
H.T.+
VALVE RELAY
LIMITER.
'77
135V.
6V.
90V.
SW.
'76
'76
'76
6H.
6H.
·003
·007
·003
·003
·007
·003
0·2
X3
X3
0·2
6H.
6H.
R.№1
COMBINED
R.№2
MAIN BRIDGE KEY
25000
5000
L.T.
·00125
·00125
·005
·1
30,000
30,000
H.T.
15,000
4000
NOTE. FOR VALUES OF RESISTANCE TAPS SEE DWG. 121.
RECEIVER №2.
L
M
1:50
'76
1·0
30H.
2200
H.T.
R.№1
OFF
R.№2
AUXILIARY BRIDGE KEY
P
L.T.+
400
400
SW.
2
·0003
R1
22·5V.
GRID LIMITERS.
30000
2
SW.
R2
22·5V.
TO 3rd. DET. GRID №1 RECR.
TO 3rd. DET. GRID. №2 RECR.
DRWG. №. 2473
MAIN BRIDGE
DOUBLE DIVERSITY TELEGRAPH
RECEIVER.
CANADIAN MARCONI COMPANY
DR.
CK.
YARN. №118.
13/8/34.

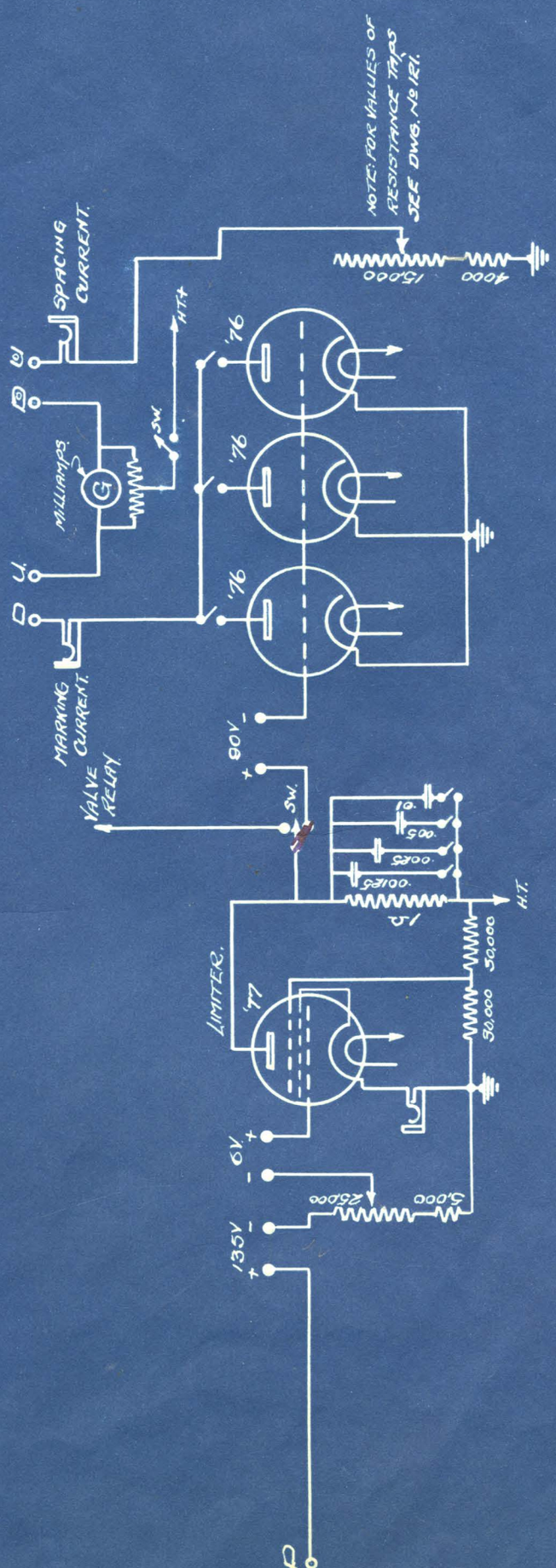
DRWG. No. 2474

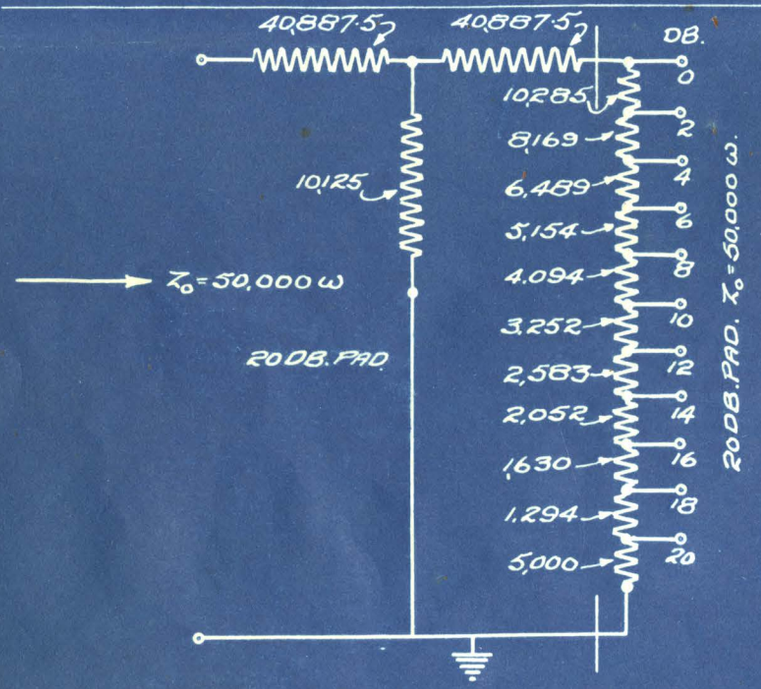
AUXILIARY BRIDGE
DOUBLE DIVERSITY TELEGRAPH
RECEIVER.

CANADIAN MARCONI COMPANY

DR. WJ	CK.	YAM. No 119

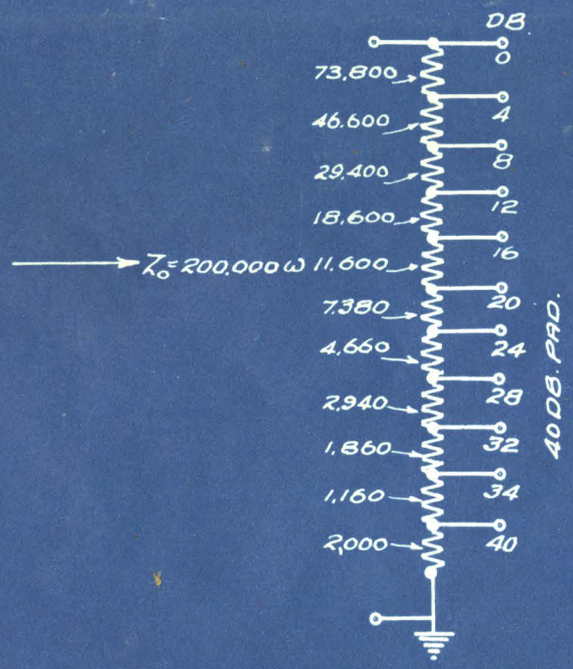
13/8/34.





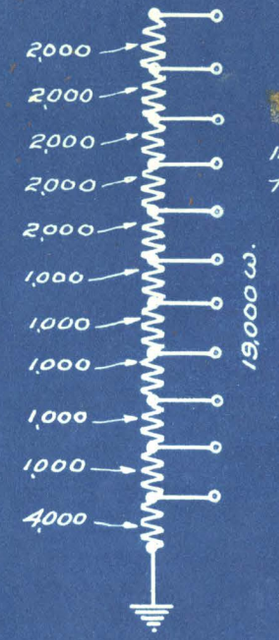
ATTENUATORS. 1st. I.F.A.

ERIE. CARBON. 1 WATT. INSULATED. PRECISION.



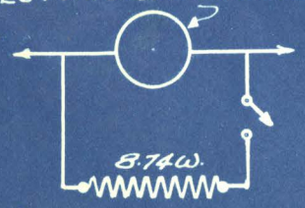
ATTENUATOR. 2nd. I.F.A.

ERIE. CARBON. 1 WATT. INSULATED. PRECISION.



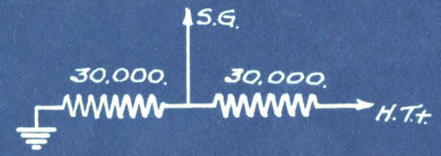
IRC. WIRE WOUND.
TYPE PB. 5 WATT.

SPACING CURRENT RESISTOR.



SHUNT. x3. 3rd. DET. PLATE METER.

10" - #32 E. NICHROME @ 10·39 Ω/FT.



VOLTAGE DIVIDERS FOR S.G. SUPPLY.

ERIE. CARBON. 1 WATT. INSULATED.

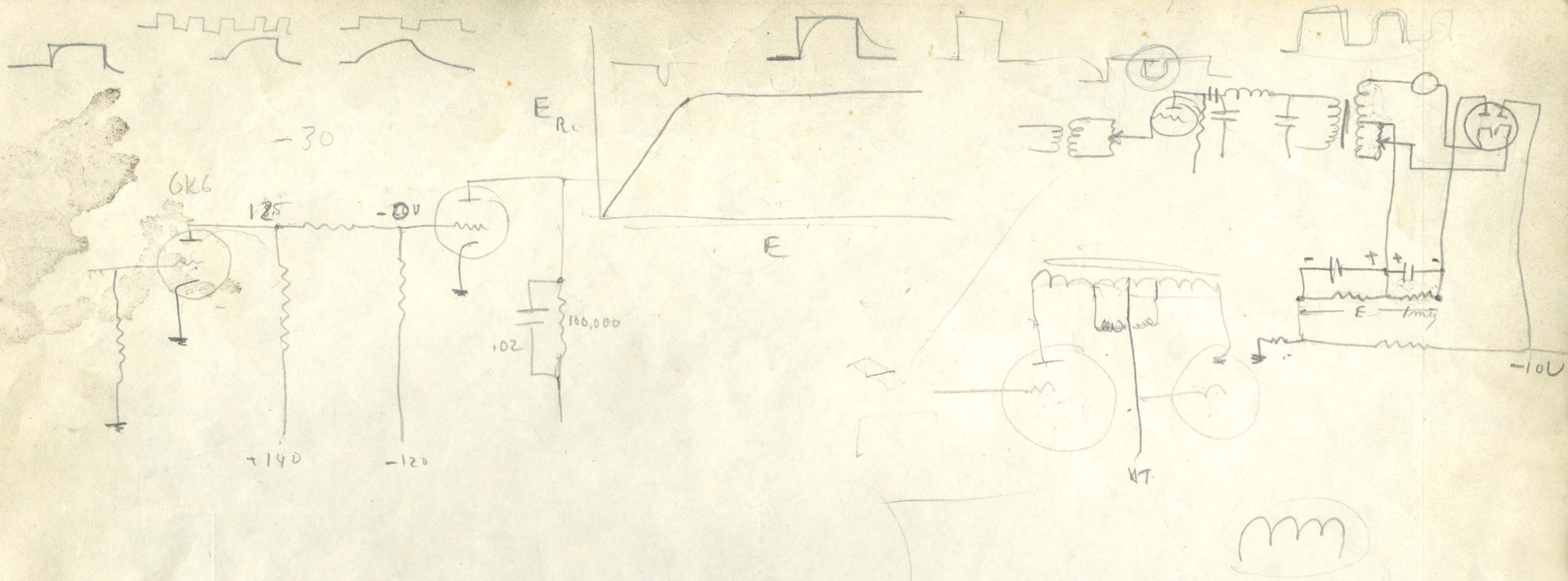
NOTE: ALL OTHER RESISTANCES ARE I.R.C. TYPE F-1. 1 WATT.

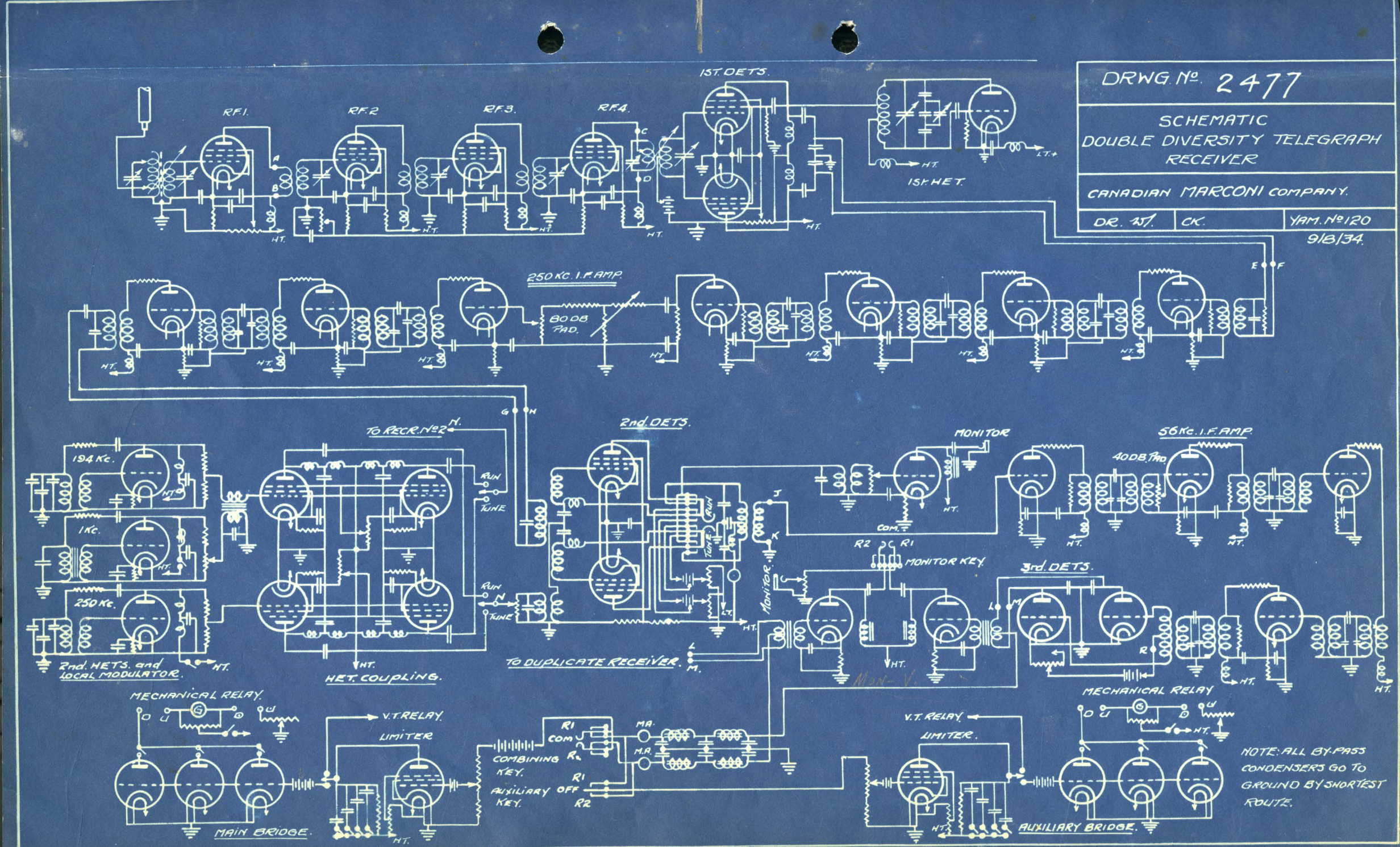
DRWG. Nº 2475

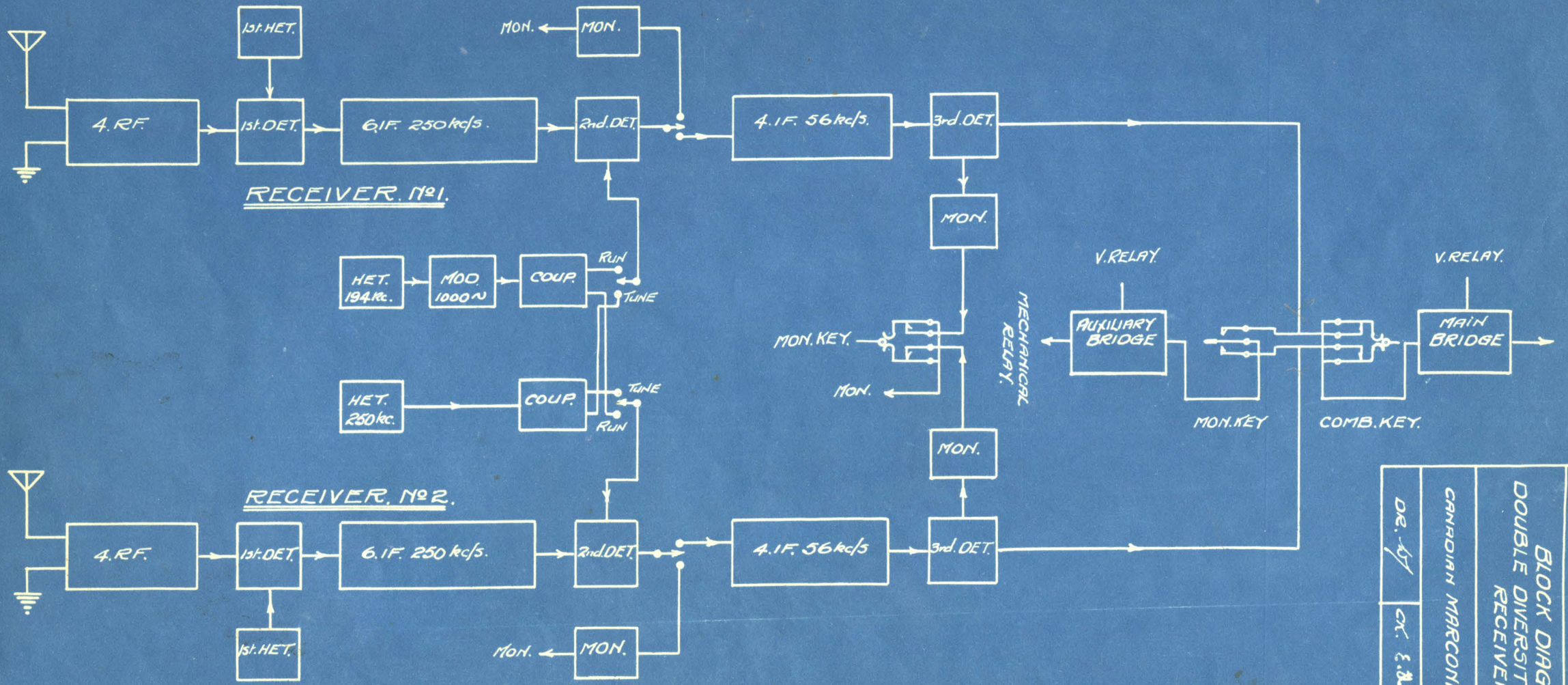
RESISTANCES
DOUBLE DIVERSITY TELEGRAPH RECEIVER.

CANADIAN MARCONI COMPANY

DR. W.	CK.	YAM. Nº 121
		13/10/34.


-30
6K6
125
-20V
100,000
.02
+140
-120
E
E
-10V
RT


DRWG. No. 2477
SCHEMATIC
DOUBLE DIVERSITY TELEGRAPH RECEIVER
CANADIAN MARCONI COMPANY.
DR. WJ.
CK.
YAM. No 120
9/8/34.
RF.1.
RF.2
RF.3.
RF.4.
1ST. DETS.
1ST. HET.
H.T.
L.T.+
250 Kc. I.F. AMP.
80 DB. PAD.
TO RECR. No 2
2nd. DETS.
MONITOR
56 Kc. I.F. AMP.
40 DB. PAD.
194 Kc.
1 Kc.
250 Kc.
2nd. HETS. and LOCAL MODULATOR.
HET. COUPLING.
RUN
TUNE
TO DUPLICATE RECEIVER.
COM.
R2
R1
MONITOR KEY.
3rd. DETS.
MECHANICAL RELAY.
V.T. RELAY.
LIMITER
MAIN BRIDGE.
COMBINING KEY.
AUXILIARY KEY.
MA.
M.A.
OFF
AUXILIARY BRIDGE.
NOTE: ALL BY-PASS CONDENSERS GO TO GROUND BY SHORTEST ROUTE.



DRWG. No 2478

BLOCK DIAGRAM. DOUBLE DIVERSITY TELEGRAPH. RECEIVER.

CANADIAN MARCONI COMPANY

DR. AT | CK. E.M. | YAM. No 122.

5/11/34.

becomes a matter of compromise. At the present stage of development a band width of two or three kilocycles gives satisfactory results.

As mentioned above, the receivers make use of two receivers. Each diversity receiver consists of two seperate receivers, which are identical in every respect, with suitable means provided for combining their outputs for operation of a common bridge unit.

The complete receiver is mounted in a steel relay rack divided into three bays. The dimensions are. length 66 inches, height 75.5 inches. The general arrangement of the various units in the rack is shown in drawing No. 2463. The right and left hand bays hold the two seperate receivers while the centre bay holds the Power Unit, Main Bridge unit and 2nd heterodyne unit.

The two receivers are made up as follows, four stages R.F. amplification, 1st detector, 1st het, six stages 1st intermediate amplifier, 2nd detector, 2nd het. four stages 2nd I.F. amplifier and 3rd detector.

The receiver is contained in nineteen aluminum boxes. The panels of the receivers have been finished in grey Duco while the

1st. I. F. AMPLIFIER UNITS

The schematic connectionsnof this unit are shown on drawing No. 2469. This unit consists of a six stage 250 KC amplifier having special filter circuits to give the desired selectivity. An attenuator having a range 0 to -80 DB has been incorporated in the unit. This calibrated attenuator, although primarily designed to enable the gain of the amplifier to be adjusted, is very useful for certain measurements on the receiver. The total gain of the amplifier is approximately 90 DB. The band width of the amplifier may be set to any desired width should it be found necessary to use another band width at some future date. For telegraph purposes the band width is normally set between two and two and one half kilocycles.

2nd. DETECTOR UNITS

The schematic connections of this unit are shown on drawing No. 2470. The unit contains the 2nd. detector and monitoring amplifier which is used for tuning purposes.

The 2nd. detector employs two type 6C6 valves in push-pull arrangement. Provision has been made to permit separate bias adjustment of each valve in order that the carrier from the 2nd. heterodyne may be balanced out.

A switch on the front panel enables the 2nd. detector output to be switched to the 2nd. I.F.A. or to the monitoring amplifier.

2nd. HETERODYNE UNIT

The schematic connections of this unit are shown on drawing No. 2471. The unit contains three oscillators ~~194~~ 180, 250 and 1 K.C. The ~~194~~ 180 KC oscillator is employed for heterodyning the signals from the 1st. I.F.A. to a frequency of ~~56~~ 70 KC for the 2nd. I.F.A. The 1 KC oscillator is for the

purpose of modulating the ~~194~~ 180 KC oscillator in order that stations using C.W. may be heard at the 3rd. detector. The 250 KC oscillator is provided for tuning purposes when a new station is being first picked up. It is used in conjunction with the monitoring amplifier of the 2nd. detector.

The oscillators are of the constant frequency type. The outputs from the ~~194~~ 180 and 250 KC oscillators are fed into coupling valves. A suitable switch enables the outputs of the coupling valves to be connected to the 2nd. detector circuit. The outputs to the 2nd. detector units are carried in concentric copper feeder.

2nd. I. F. AMPLIFIER UNITS

The schematic connections of these units are shown on drawing No. 2472. The unit contains a four stage ~~56~~ 70 KC amplifier having a gain of approximately 80 DB. The filter circuits are of a type similar to those employed in the 1st. I.F.A. An attenuator 0 to -40 DB, calibrated in 4 DB steps, has been incorporated for varying the gain of the amplifier. Like the 1st. I.F.A. it is possible to vary the band width should it be desirable to do so in the future.

MAIN BRIDGE UNIT

The schematic connections of this unit are shown on drawing No. 2473. The unit contains the 3rd. detectors of each receiver, combining and monitoring circuits, limiter and bridge circuit.

The monitoring circuits are included for checking the operation of each receiver aurally.

A resistor shunted by a condenser is incorporated in the ground return of the grid circuit of the 3rd. detector valves to act as a limiter when strong signals may be received that might possibly saturate the

3rd detedtor valve. A switch is mounted on the panel to cut this limiter arrangement in or out of citcuit.

The limiter employs a type 77 valve and operates from a voltage drop obtained across the resistor in the plate circuit of the 3rd Det.

Three marking valves have been supplied in the bridge circuit with means to employ one, two or three valves, this permits a larger marking current to be obtained when high speeds are to be received.

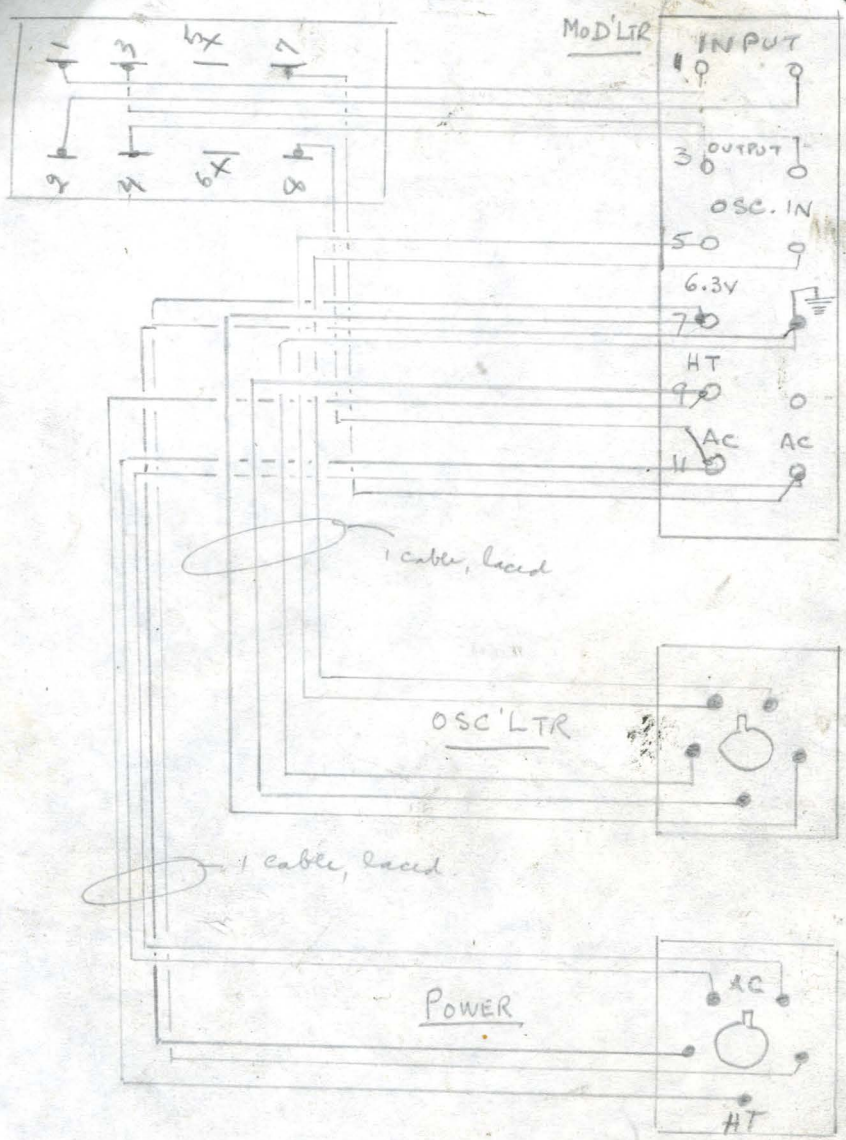
Provision has also been made to key a valve relay from the limiter circuit should it be desired to use a valve relay.

POWER SUPPLY UNIT.

The schematic connections of this unit are shown on drawing No. 3817. This unit controls the L.T. and H.T. supplies to the three bays. Should trouble develope on one receiver the power supplies of that receiver may be disconnected without disturbing the operation of the other receiver.

COIL BOXES.

These units are mounted at the bottom of the bays holding the receivers. Provision has been made for storing the coils away neatly when they are not in use.


MOD'LTR
INPUT
OUTPUT
OSC. IN
6.3V
HT
AC
AC
1 cable, laced
OSC'LTR
1 cable, laced
POWER
AC
HT