Large Antenna Generator

Mark IV revised 14/4/64

Reduced coils from 102 turns to 95 turns. Now tap is at 61 turns from low end. also reduced voltage divider capacity from 182 to 142 pf. The tuning range is now 1,77 to 3.24 mc. Performance as below, One half of voltage divider has $1/(\frac{1}{860}+\frac{1}{142}) = 123$ pf. Bottom is 7 times effective.

	$I_e = 1,0a$	$E_p = 405v$	
Freq. MC	I_p ma	I_p ma	I_e amps.
1,8	23,4	34,1	1.42
2,4	21,0	29,0	1,35
2,8	20,8	26,3	1,26
3,2	21,4	24,4	1,14

When $I_e = 1,0$ amps then E_p less than 405v probably about 270 to 380v

11,9 volt battery, $E_B = 405v$

Mark IV

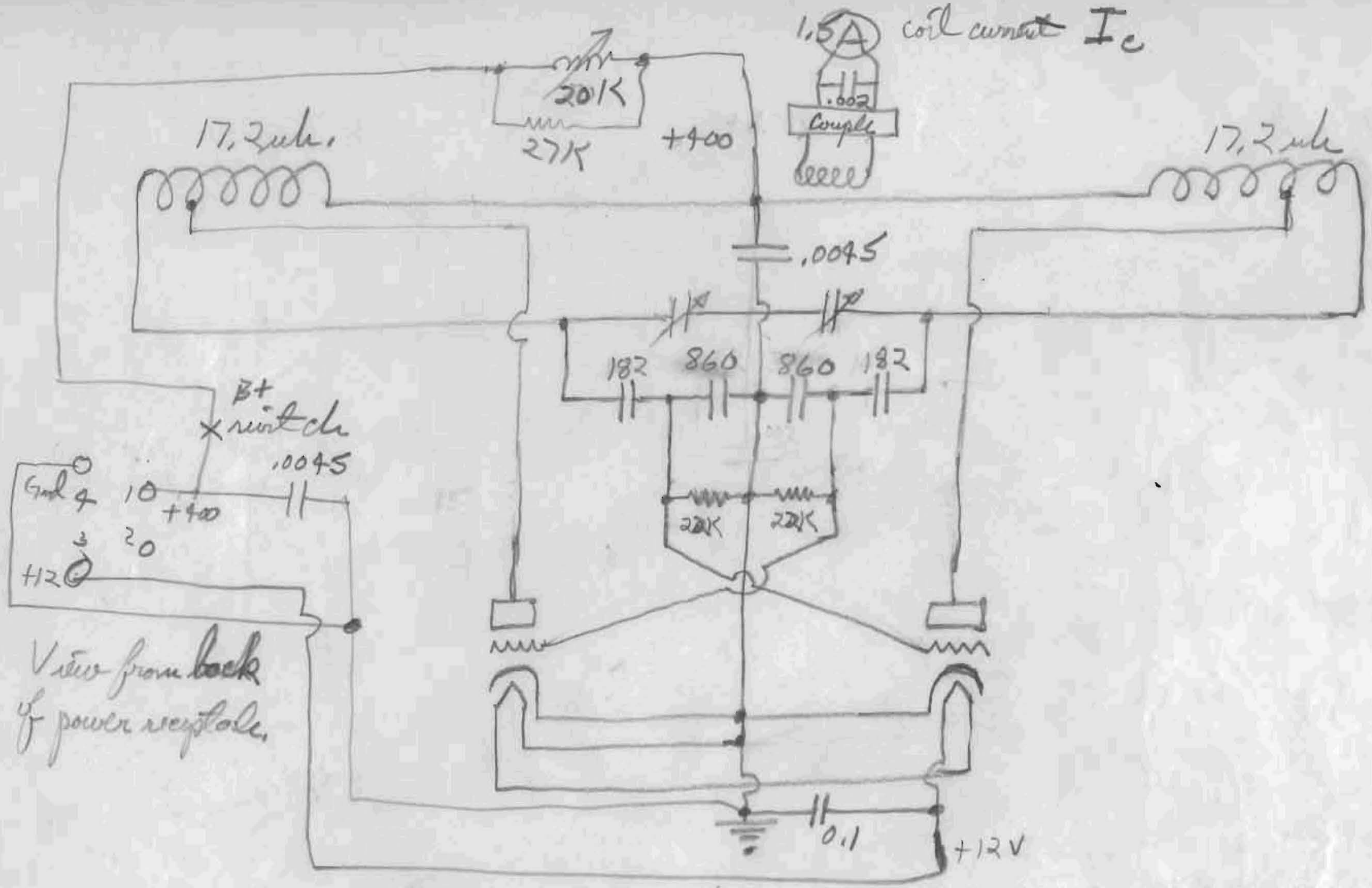
Antenna Field Generator Performance 27/2/64

An increase of excitation causes an increase of I_p without increase of I_e at high frequency end. A decrease of excitation causes I_e to decrease at low frequency end. Present voltage divider about optimum.

Frequency MC	1.6	2.2	2.8	B+
	Maximum I_e			
E_p volts	405	405	405	405
I_p ma.	35.0	27.2	23.2	
I_G ma.	5.6	6.8	7.0	
I_e amp.	1.52	1.29	1.06	
	Constant I_e			
E_p volts	275	302	385	405
I_p ma	23.5	20.9	22.5	
I_G ma	3.5	4.8	6.5	
I_e amps.	1.00	1.00	1.00	

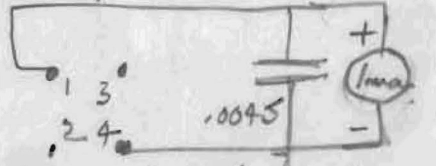
Maximum resistance in series with B+ = 6000 Ω
Absolute frequency range 1.61 to 2.79 mc in box.
Dynamotor rating 40 ma, Tubes rated each 11 ma.
I_p & I_G both tubes together.

22/12/63



Capacity voltage Divider $= 1/\left(\frac{1}{182}+\frac{1}{860}+\frac{1}{860}+\frac{1}{182}\right) = 75$ pf effective

Reactance of 860 pf at 2MC $= 1/6.28 \cdot 2 \cdot 10^6 \cdot 860 \cdot 10^{-12} = 10^6/10800 = 92.5$ ohms which is small compared to 22KΩ



View from back of meter receptacle.

plate tap on coil o

o— high end of coil

o— lower end of coil

View from front of coil receptacle

Toroid Coils

19/2/64

102 Turns. Plate tap at 68 turns from low end.

Coils alone

Coil A

MC	pf	Q	R
1.8	452	151	1.26
2.1	327	157	1.42
2.5	228	164	1.62
3.0	155	165	1.93
3.6	105	161	2.37

$C_0 = \frac{452 - 4\cdot105}{3} = \frac{32}{3} = 10.7\,pf$

$L_0 = 1/(6.28\cdot1.8)^2\,463 = 1/128\cdot463 = 16.9\,\mu h$

$R = \frac{6.28\,MC\cdot16.9}{Q} = 106\frac{MC}{Q}$ ohms

Coil B

MC	pf	Q	R
1.8	451	151	1.27
2.1	325	158	1.42
2.5	227	165	1.62
3.0	155	165	1.94
3.6	105	162	2.38

$C_0 = \frac{451 - 4\cdot105}{3} = \frac{31}{3} = 10.3\,pf$

$L_0 = 1/(6.28\cdot1.8)^2\,461 = 1/128\cdot461 = 17.0\,\mu h$

$R = \frac{6.28\,MC\,17.0}{Q} = 107\frac{MC}{Q}$ ohms

Coils with leads, plug & receptacle.

Coil A

MC	pf	Q	R	% increase
1.8	441	143	1.36	8.0
2.1	319	149	1.52	7.0
2.5	220	151	1.79	10.5
3.0	149	150	2.16	12.0
3.6	99	144	2.70	14.0

$C_0 = \frac{441 - 4\cdot99}{3} = \frac{45}{3} = 15.0\,pf$

$L_0 = 1/128\cdot456 = 17.1\,\mu h$

$R = 108\frac{MC}{Q}$

Coil B

MC	pf	Q	R	% increase
1.8	438	145	1.35	6.5
2.1	316	150	1.52	7.0
2.5	219	155	1.75	8.0
3.0	148	155	2.10	8.1
3.6	99	148	2.64	11.0

$C_0 = \frac{438 - 4\cdot99}{3} = \frac{42}{3} = 14.0\,pf$

$L_0 = 1/128\cdot452 = 17.3\,\mu h$

$R = 108.7\frac{MC}{Q}$

6/2/64

Toroidal Coil Inductance (Terman page 57+58)

Coil of circular crossection, diameter d and mean revolution D

$L = 0,01595 n^2 [D-(D^2-d^2)^{1/2}]$ μh.

d, D are inches.

Required inductance 17.2 μh

at d = 0.813, D = 3,063

$n^2 = L/0,01595[D-(D^2-d^2)^{1/2}] = \frac{17.2}{.01595}[3.063-(3.063^2-.813^2)^{1/2}]$

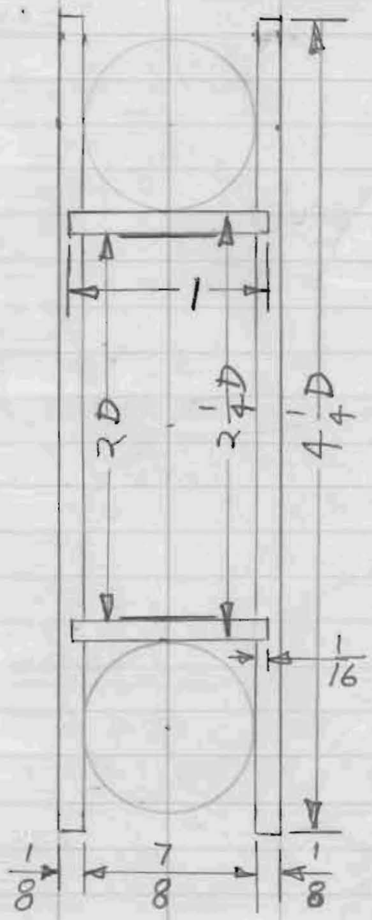
$= 1078/0.110 = 9800$

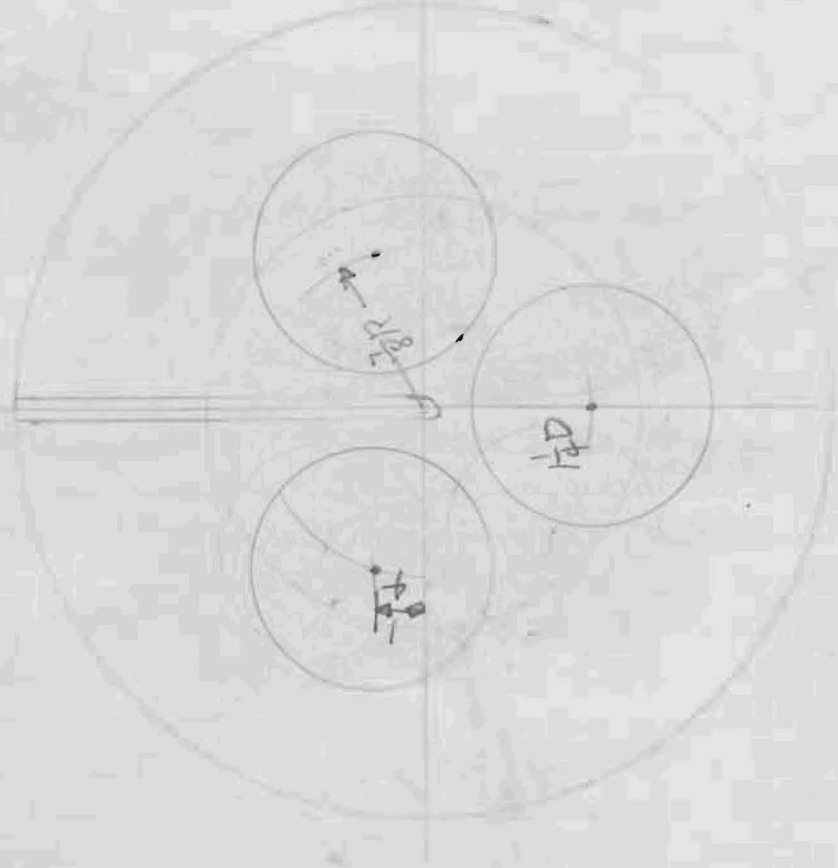
n = 99 turns, actual 102 turns because d slightly less.

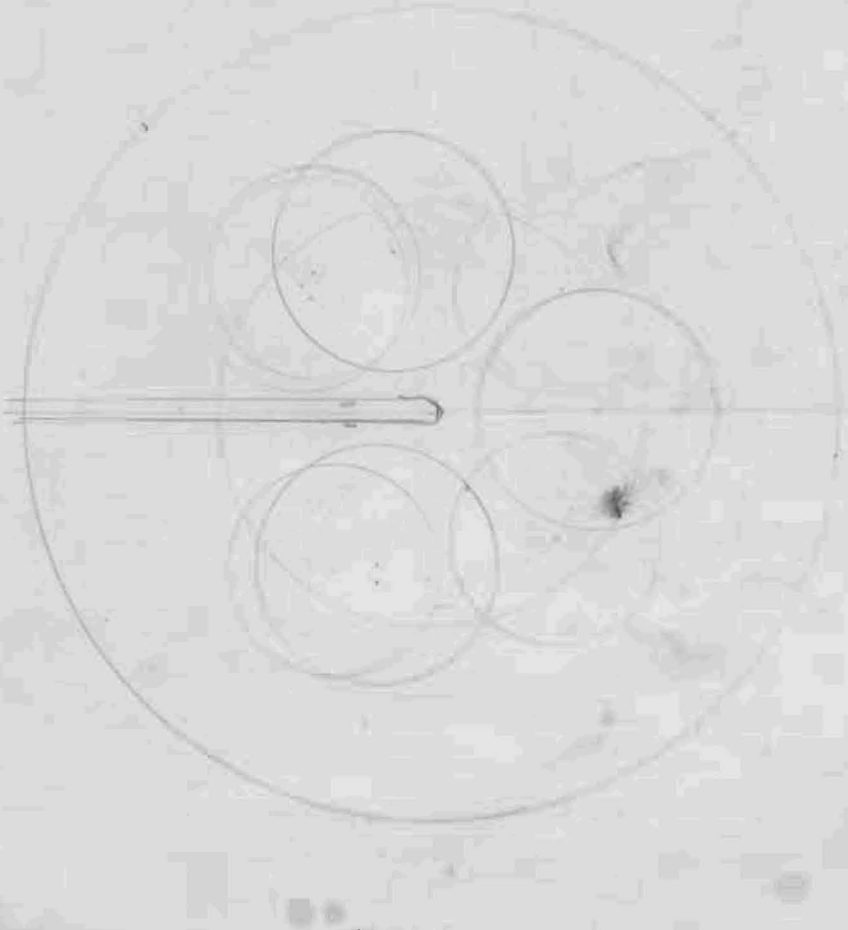
Wire length = $102\pi\, 0.813/12 = 21.7$ feet.

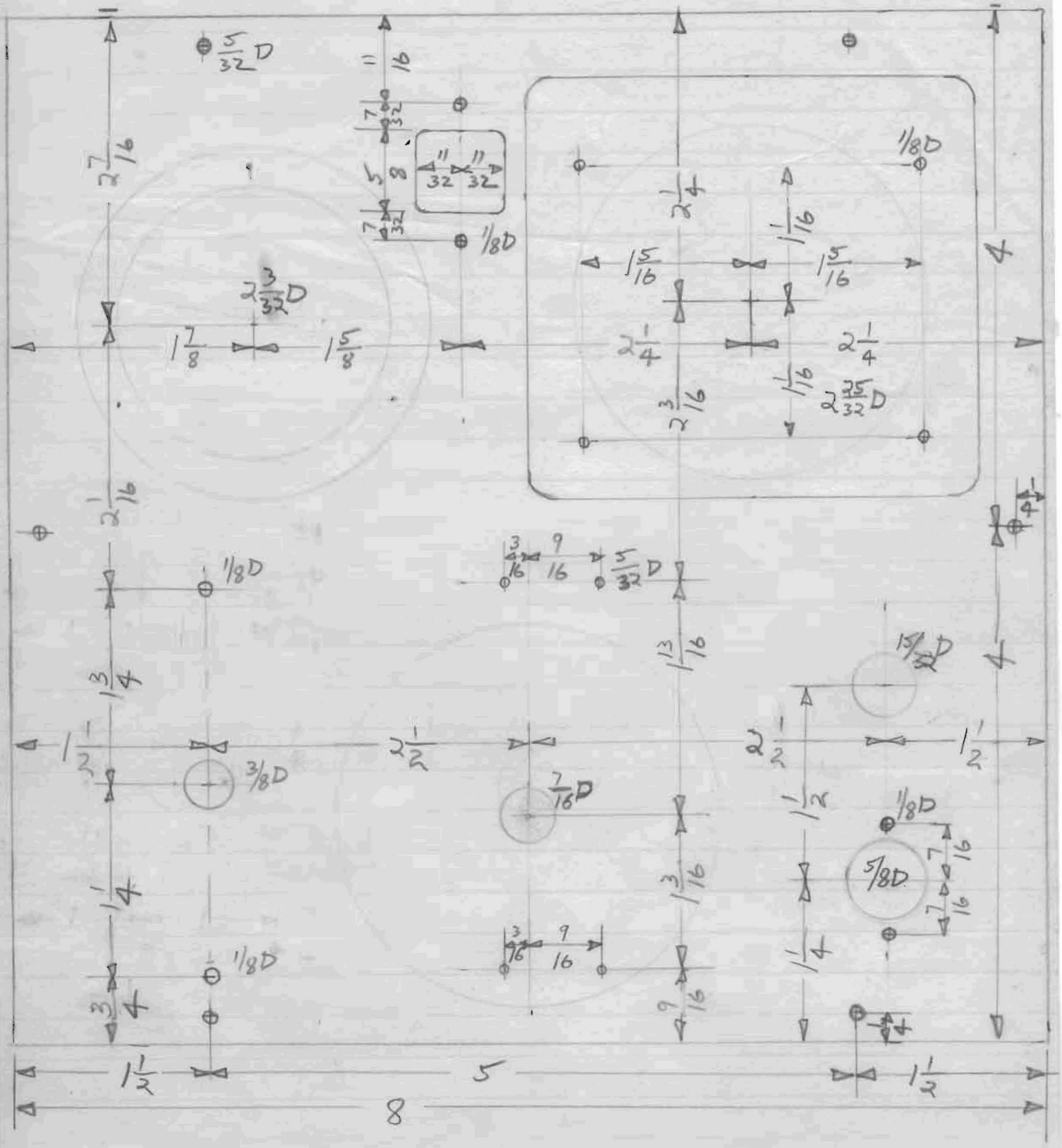
I.D = 2.25

d	Turns	Wire length feet
.750	110	
.813	99	21.1
1.000	81	21.2
1.125	73	
1.145	72	
1.165	71	
1.188	70	21.8









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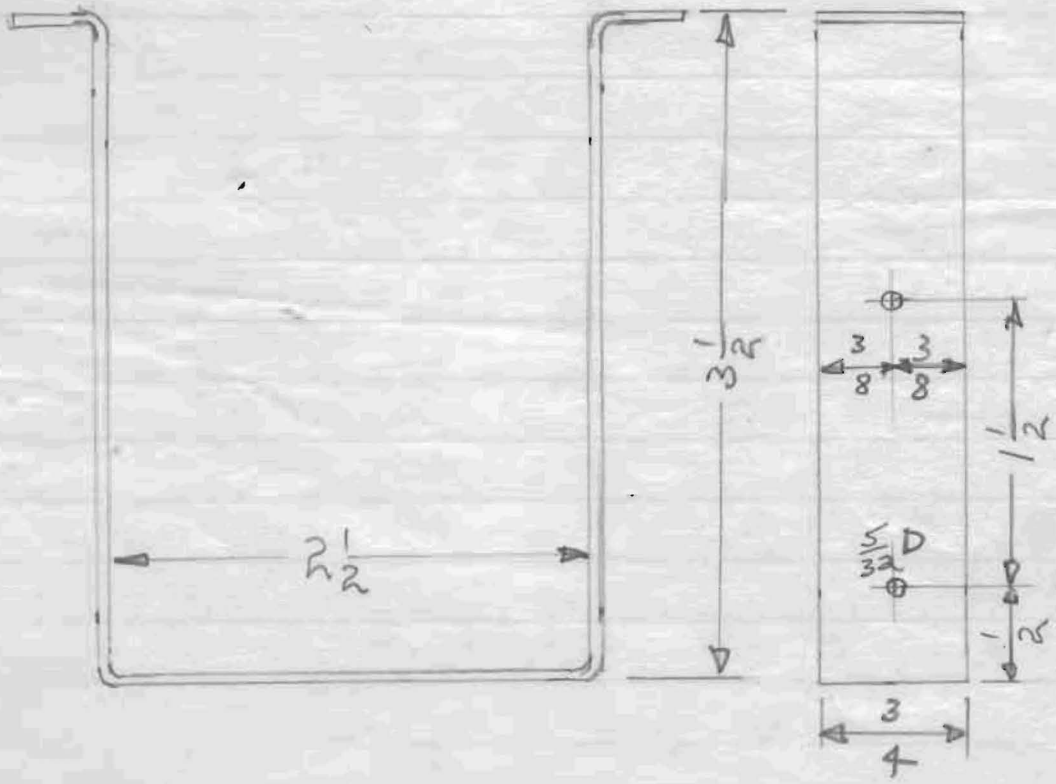
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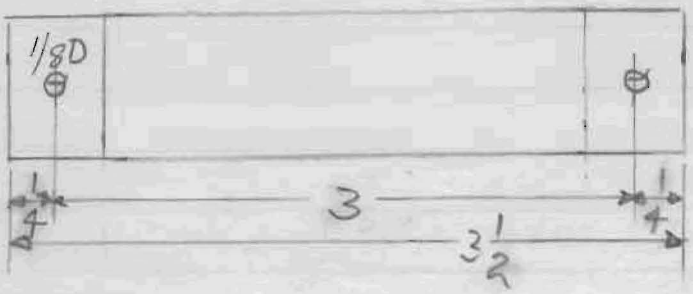
1/8 D
1/4
3
1/4
3 1/2

12 turn coils

4/2/64

Coil A

MC	Pf	Q	R
1,8	465	360	.52
2,1	338	389	.56
2,5	236	410	.63
3,0	162	424	.73
3,6	110	430	.87

$C_0 = \frac{465 - 4 \times 110}{3} = \frac{25}{3} = 8.3\,pf$

$L_0 = 1/(6.28 \cdot 1.8 \cdot 10^6)^2 \cdot 473 \cdot 10^{-12} = 1/128 \cdot 473$

$= 16.5\,\mu h$

$R = \omega L/Q = 6.28 \cdot 16.5\,MC/Q = 103.6\,MC/Q$

Coil B

MC	Pf	Q	R
1,8	454	372	.51
2,1	330	390	.57
2,5	230	415	.64
3.0	158	429	.74
3.6	107	432	.89

$C_0 = \frac{454 - 4 \times 107}{3} = \frac{26}{3} = 8.7\,pf$

$L_0 = 1/(6.28 \cdot 1.8 \cdot 10^6)^2 \cdot 463 \cdot 10^{-12} = 1/128 \cdot 463$

$= 16.9\,\mu h$

$R = \omega L/Q = 6.28 \cdot 16.9\,MC/Q = 106.1\,MC/Q$

Both coils are slightly under the computed 17.2 μh.

Wire length = $\frac{4.06\pi}{12}\,12 = 12.8$ ft.

These were short solenoids ($4\frac{1}{8}$" D, $1\frac{5}{8}$" long) used for initial circuit test. They are much better coils than final toroids.