EF Johnson KW Matchbox

Received With Shipping Damage
Purchased on E-Bay
Seller Would Not Make Good
The Story of a Repair

10-24-2015

EF Johnson KW Matchbox Repair

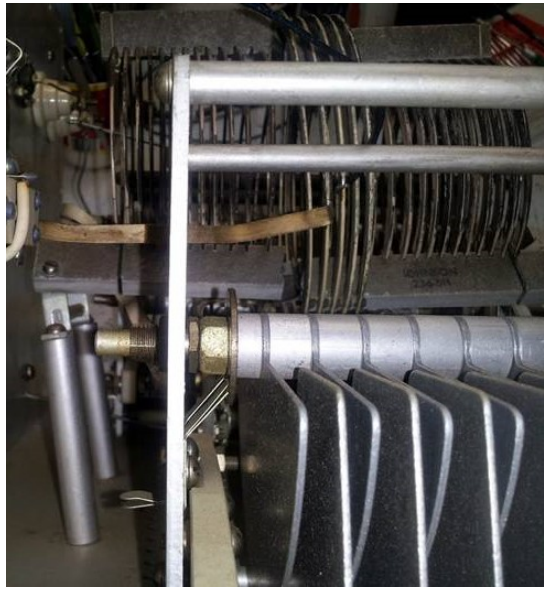
Shipped Without Any Packing

Box Had Been Punched Through

EF Johnson KW Matchbox Repair

The Damage Was Extensive

Coil Form Broken In Three Places



Switch Mount Pushed Back

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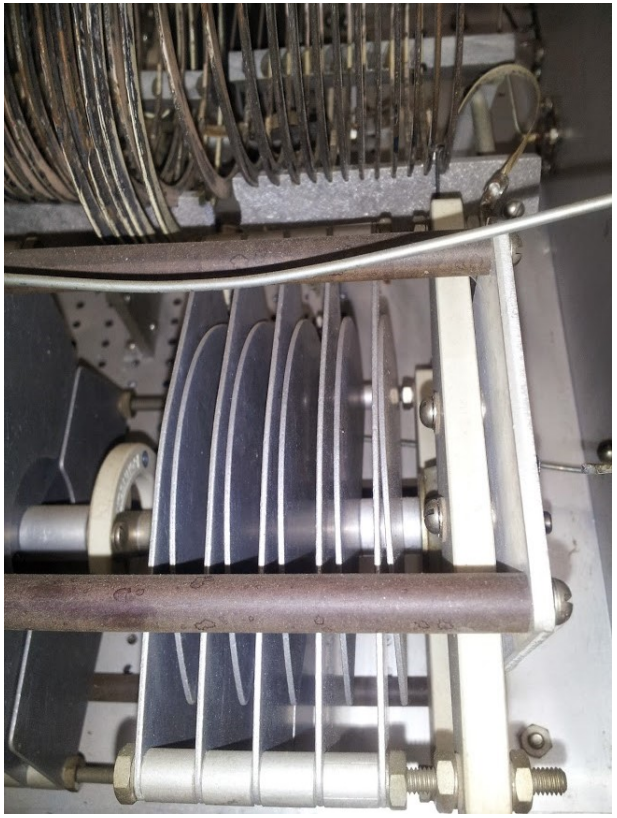
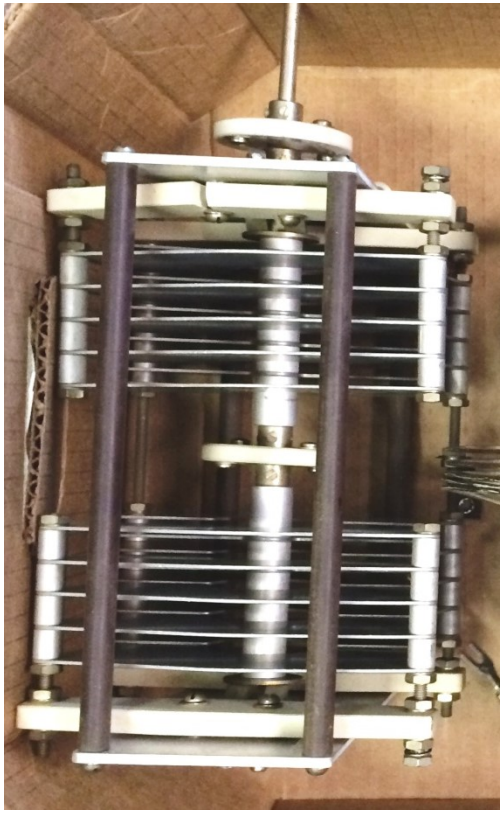
The Damage Continued



Capacitor
Plate Bent

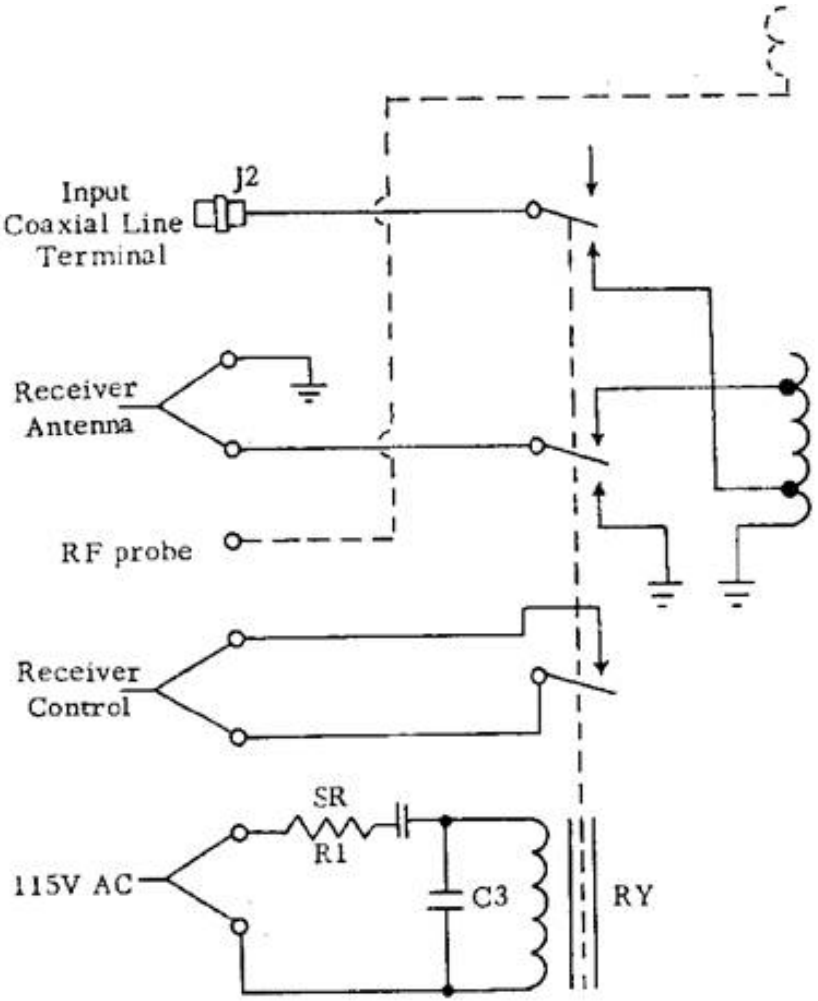


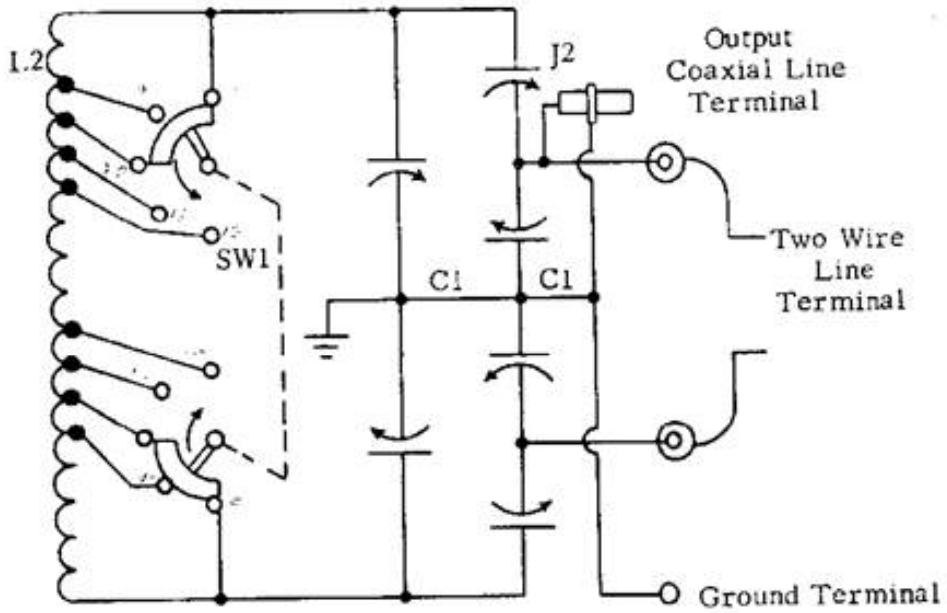
Ceramic Insulator
Broken

EF Johnson KW Matchbox Repair

- Repair Begins
  - Obtain Schematic
  - Disassemble
  - Straighten Bent Parts
  - Fix the RF Components
  - Reassemble
  - Test

KW Matchbox Schematic





Relay, RY, shown in transmit position

Band Switch, SW1, shown in 20 Meter position

RF Probe installed by operator according to coupling requirements

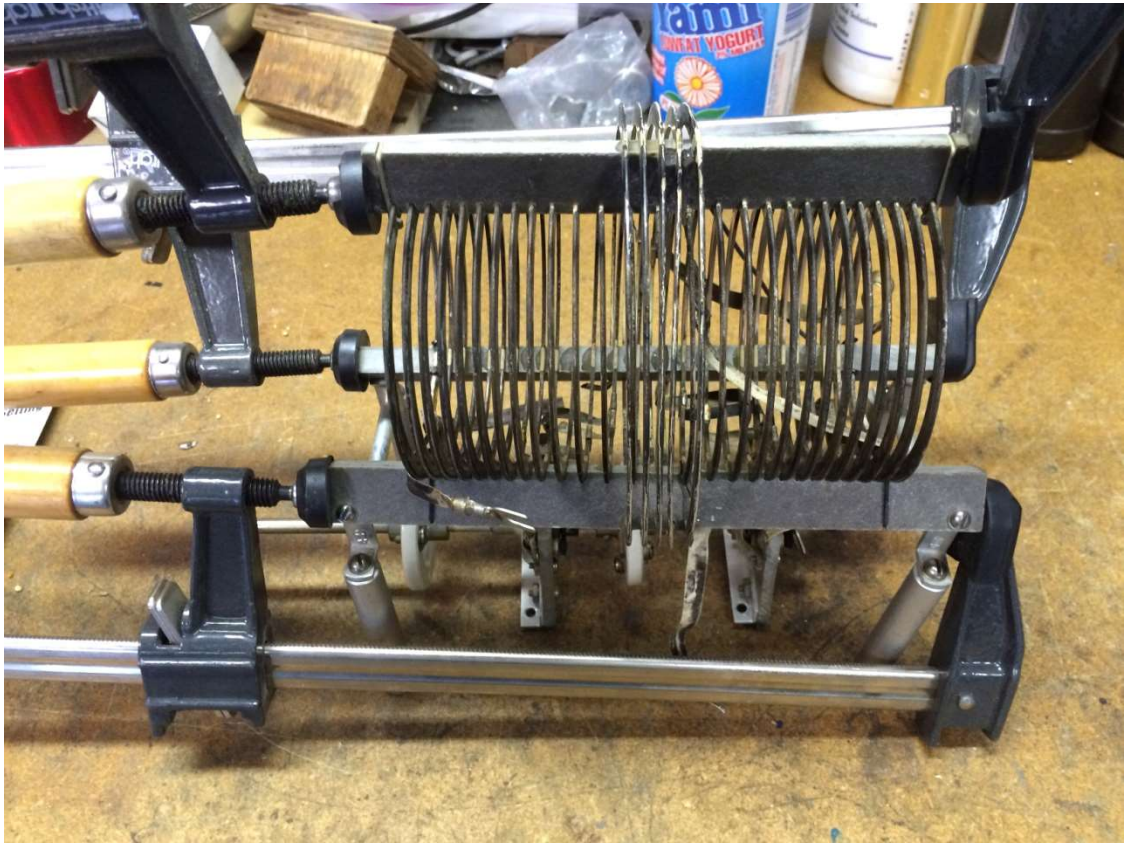
EF Johnson KW Matchbox Repair

I took it all apart, hammered out the dents in the chassis and took a good look at the damaged components

EF Johnson KW Matchbox Repair

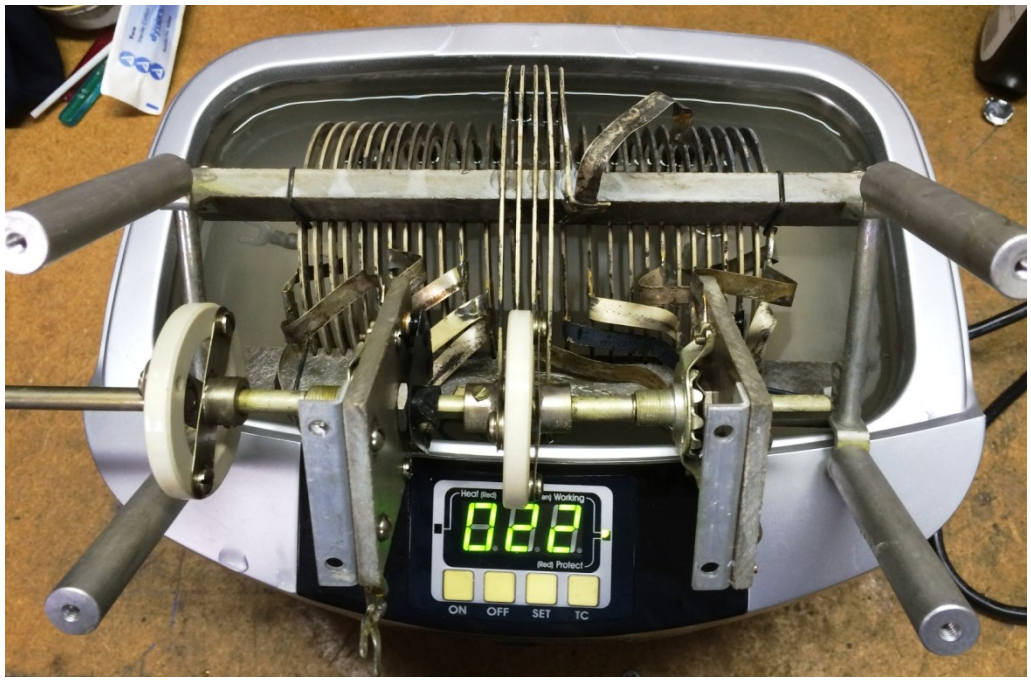
Next the capacitor plate was bent back into position and the ceramic insulator was glued with epoxy

EF Johnson KW Matchbox Repair



Clamping and gluing the coil back together
Fiberglass strand glued across the coil form 3 places

EF Johnson KW Matchbox Repair



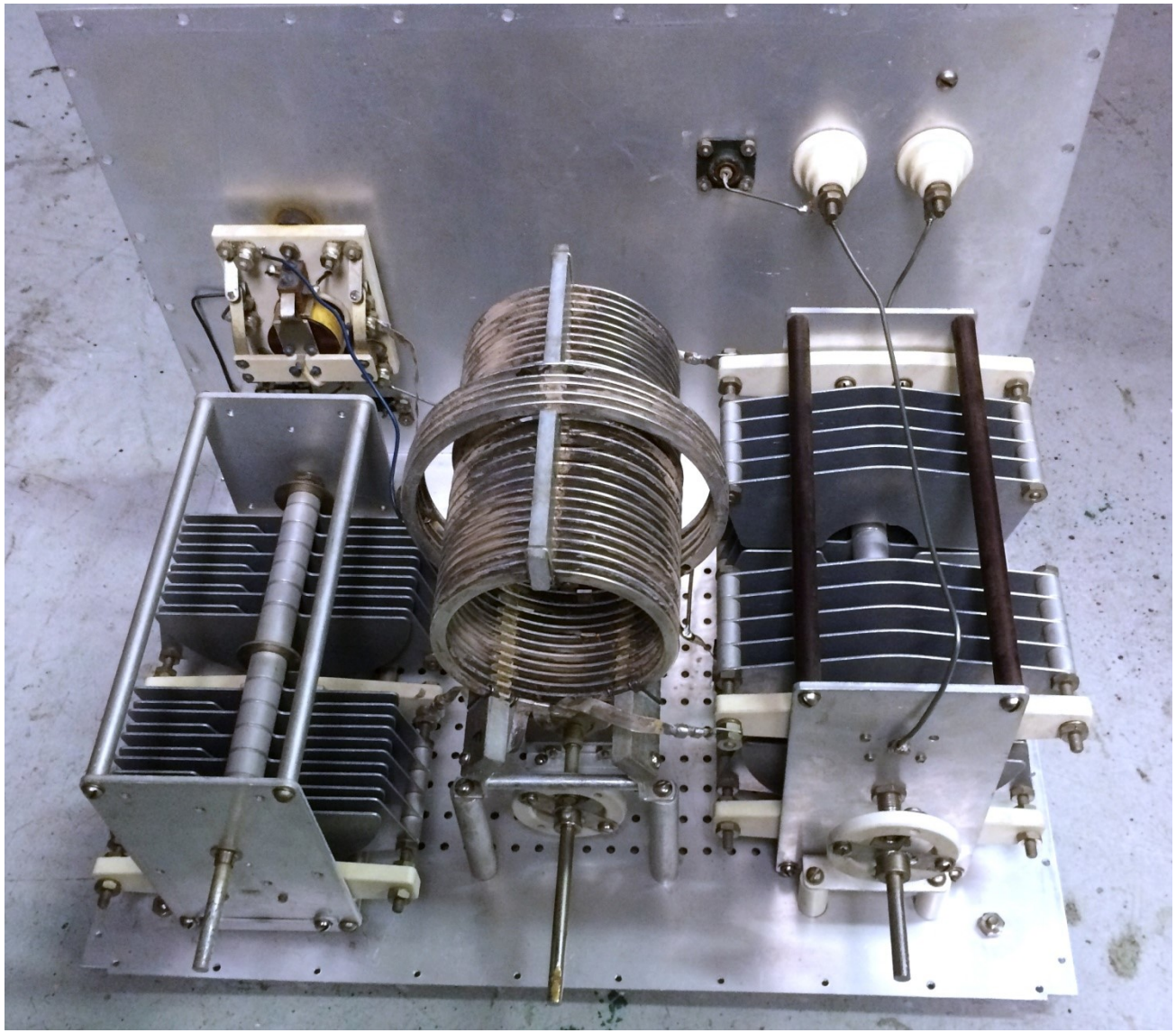
The coil was heavily corroded and needed a good cleaning
The ultrasonic cleaner got most but not all of the corrosion off

EF Johnson KW Matchbox Repair

After Tarn-X and Silver Cleaner it started to look a little better but not perfect.

Turned out that this is about the best I could do.

EF Johnson KW Matchbox Repair



Putting it Back Together

EF Johnson KW Matchbox Repair

Time to give it
a Test

EF Johnson KW Matchbox Repair

Some Day I Will Put The Cover Back On

My 300 Foot Loop Antenna

REPAIRED KW MATCHBOX RESULTS

28 May 2015

BAND	FREQUENCY MHz	SWITCH	SWR
160	1.85	80	No Match
80	3.545	80	1.0
80	3.7	80	1.0
80	3.9	80	1.0
60	5.38	80	1.0
40	7.034	40	1.0
30	10.12	80	No Match
30	10.12	40	2.0
30	10.12	20	No Match
20	14.05	20	1.0
17	18.1	20	1.1
15	21.01	15	1.0
12	24.9	10	1.2
12	24.9	15	1.1
10	28.3	10	1.0

Antenna is a triangular loop approximately 1 wavelength on 80 meters fed with about 50 feet of 450 ladder line. It is 85 feet at the apex and 25 feet at the base. It is fed from near a corner.

Table 14-19

E. F. Johnson kW Matchbox, Balanced Antenna Tuner

Note: These are resistive loads And complex Z may give different results

Manufacturer's Specifications
Input load range: 50 to 2000 Ω.
Output SWR range: not specified.
Frequency coverage: 80, 40, 20, 15 and 10 meters
Input power: 1000 W dc input.
Size: 12.5 × 17.25 × 11 inches (HWD).

Measured in ARRL Lab
See below.
See below.
See below.
Not tested.

SWR	*Load (Ω)*		*160 Meters*	*80 Meters*	*40 Meters*	*20 Meters*	*10 Meters*
		Power Loss %				15	<10
4:1	12.5	SWR BW %	No Match	No Match	No Match	1	3
		Imbalance				0	0
		Power Loss %			<10	13	<10
2:1	25	SWR BW %	No Match	No Match	2	2	4
		Imbalance			0	0	0
		Power Loss %		<10	<10	<10	<10
1:1	50	SWR BW %	No Match	2	2	2	4
		Imbalance		0	0	0	0
		Power Loss %	<10	<10	<10	<10	<10
2:1	100	SWR BW %	1	2	2	2	4
		Imbalance	0	0	0	0	0
		Power Loss %	<10	<10	11	<10	<10
4:1	200	SWR BW %	1	2	2	2	4
		Imbalance	0	0	0	0	0
		Power Loss %	<10	<10	<10	14	11
8:1	400	SWR BW %	1	2	2	2	4
		Imbalance	0	0	0	0	0
		Power Loss %	10	<10	<10	11	11
16:1	800	SWR BW %	1	3	2	2	4
		Imbalance	0	0	0	0	0
		Power Loss %	10	<10	<10		
32:1	1600	SWR BW %	1	2	2	No Match	No Match
		Imbalance	0	0	0		
		Power Loss %	10				
64:1	3200	SWR BW %	2	No Match	No Match	No Match	No Match
		Imbalance	0				

Notes

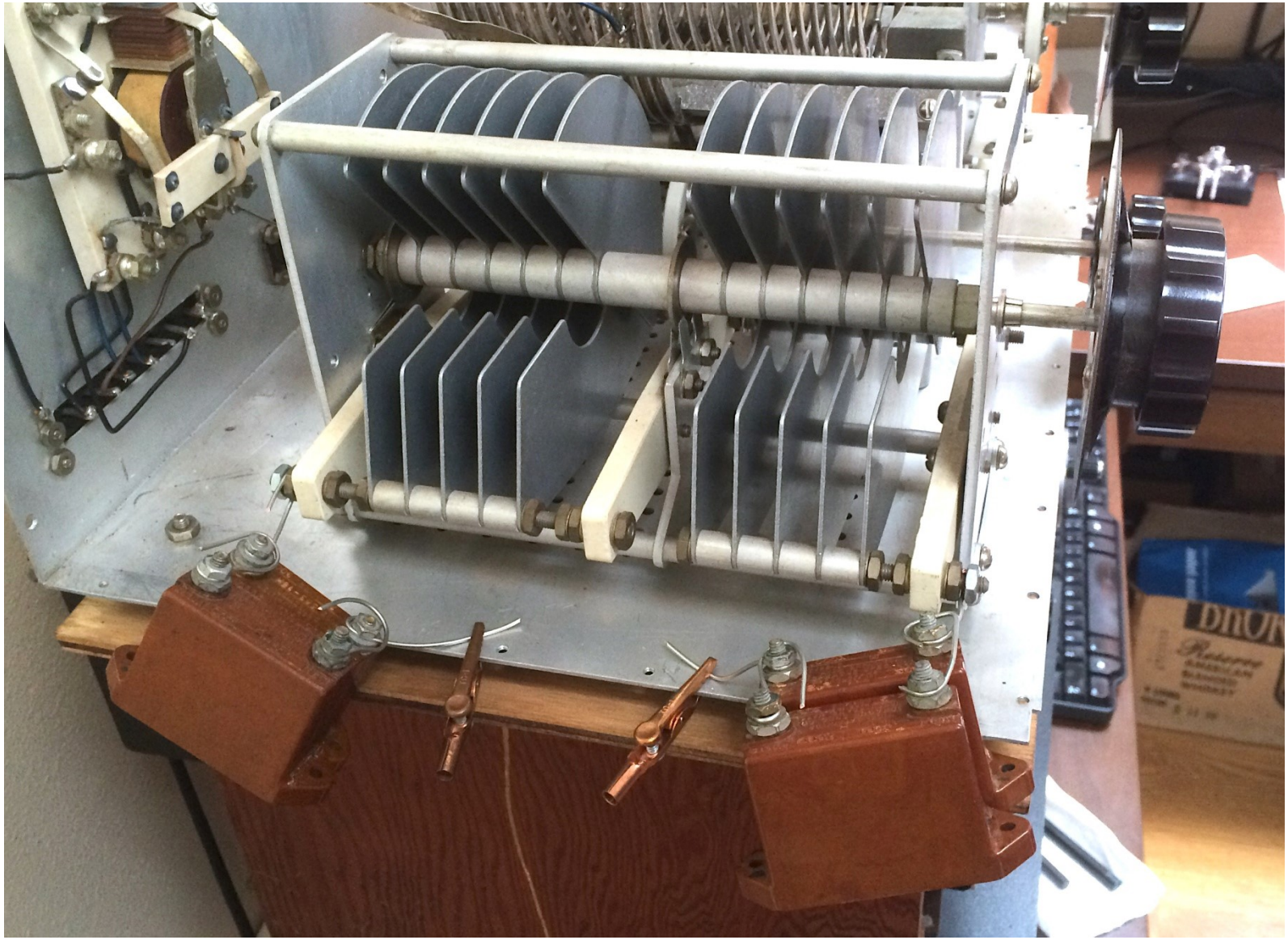
Power losses are expressed as a percentage. A 10% power loss represents less than half (0.46) a dB.
The SWR bandwidth is the percentage of the measurement frequency that can be changed with the SWR staying under 1.5:1.

EF Johnson KW Matchbox Repair

NOW WHAT ABOUT 160 METERS?

- Tryed increasing length of feed line did not work
- Adding Capacitance alone (did not tune)
- Place Ferrite Rod inside coil (tuned but lossy ferrite got very hot)
- Consider adding both capacitance and ferrite core inductance

EF Johnson KW Matchbox Repair
Add 160 Meters



EF Johnson KW Matchbox Repair
Add 160 Meters

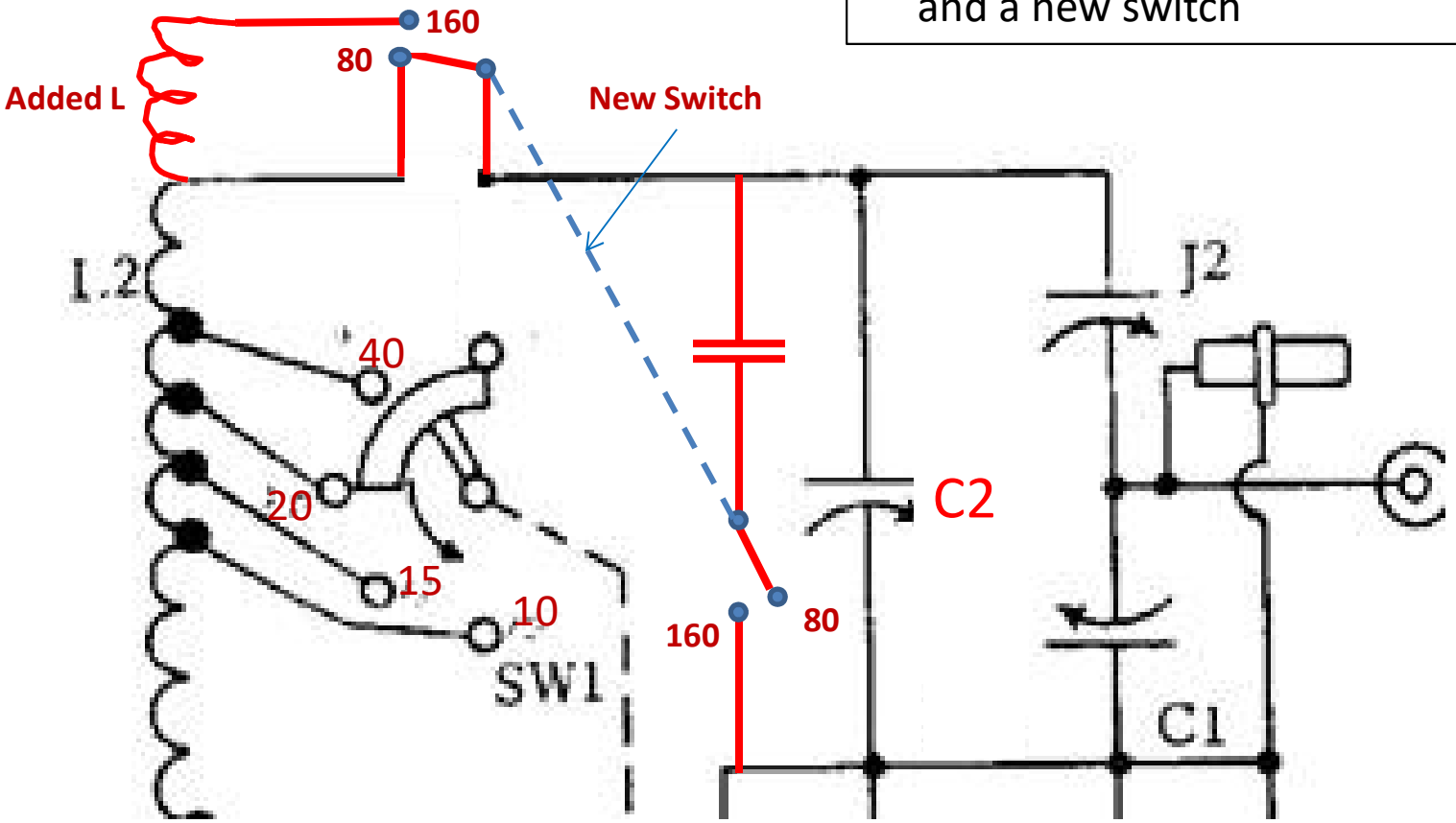
Left the added Capacitance in place

Added ferrite rods to increase inductance

Tuned 160 M but the lossy ferrite got very hot

A Possible 160 Meter Modification

- Try adding Ferrite core inductors and a new switch



One Half of Balanced Circuitry Shown

My Other Tuner an MFJ-986

Will Tune 160
But With Higher
Losses

Will Get By While
Experimenting
With Matchbox

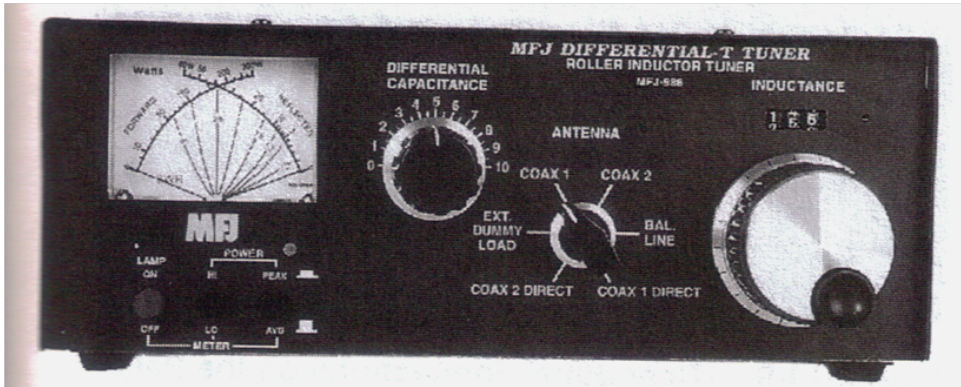


Figure 14-5 — Front panel of the MFJ-986.

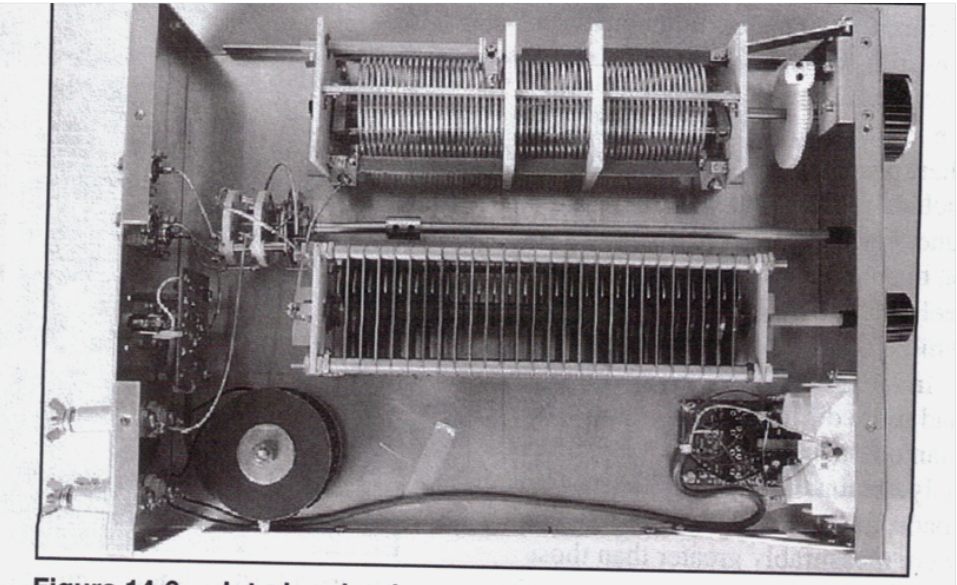


Figure 14-6 — Interior circuitry of the MFJ-986.

MFJ-986 Schematic

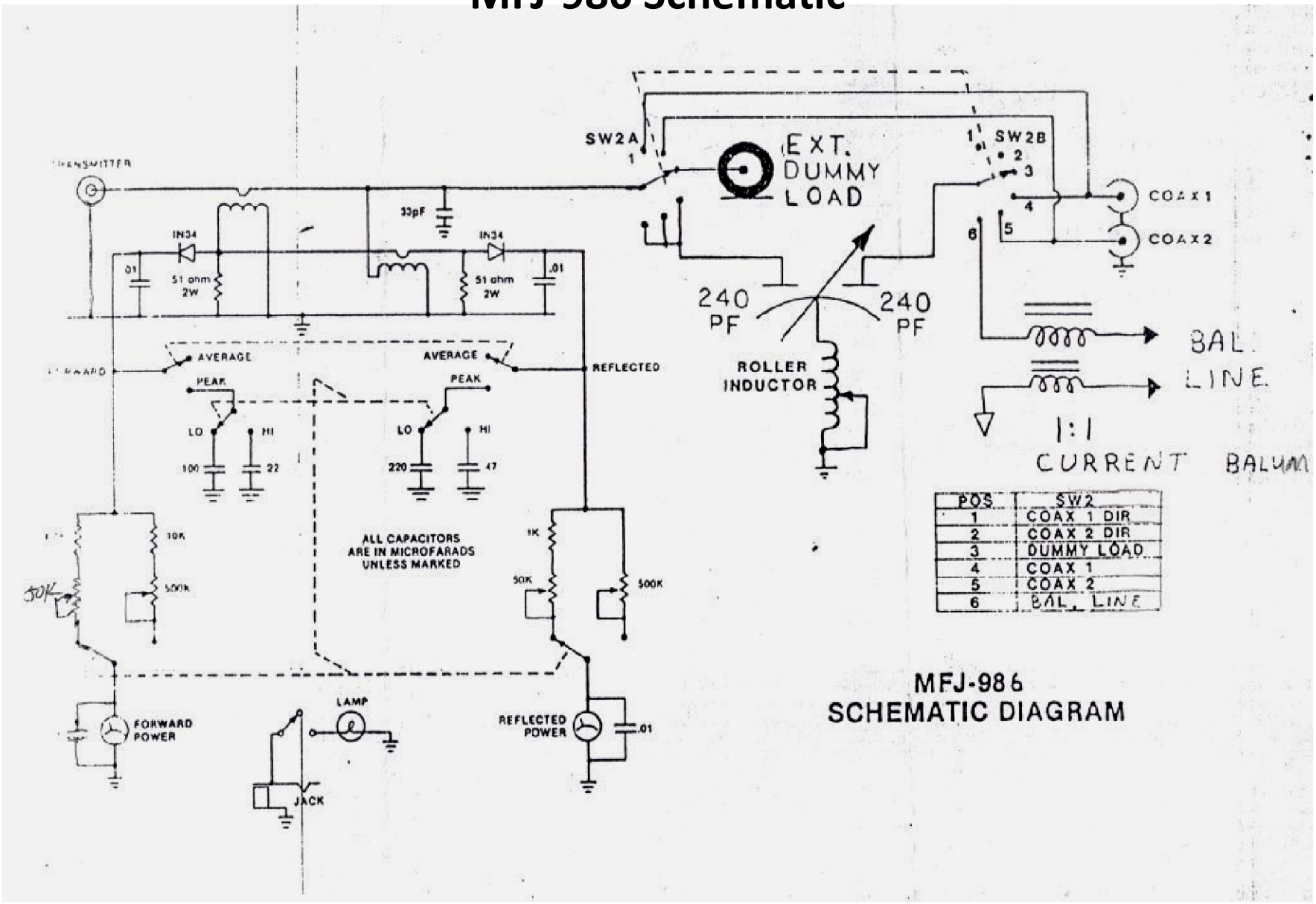


Table 14-3

MFJ-986 Loss and Bandwidth Test Results

SWR	Load (Ω)		160 m	80 m	40 m	20 m	10 m
8:1	6.25	Power Loss %	47	31	21	16	13
		1.5 SWR BW	1	1	2	4	>5
4.1	12.5	PowerLoss %	33	22	14	12	11
		1.5 SWR BW	1	1	4	5	>5
2:1	25	PowerLoss %	25	20	10	<10	10
		1.5 SWR BW	1	2	4	>5	>5
1:1	50	PowerLoss %	22	12	<10	<10	<10
		1.5 SWR BW	2	3	>5	>5	>5
2:1	100	PowerLoss %	15	10	<10	<10	19
		1.5 SWR BW	3	5	>5	>5	>5
4:1	200	PowerLoss %	11	<10	<10	<10	<10
		1.5 SWR BW	3	>5	>5	>5	>5
8:1	400	PowerLoss %	10	<10	<10	11	16
		1.5 SWR BW	3	>5	>5	>5	5

Notes

Power losses are expressed as a percentage. A 21% loss of power is 1 dB.

The 1.5-SWR Bandwidth (SWR BW) represents the bandwidth over which an SWR of 1.5:1 or less was maintained as a percentage of the measurement frequencies (1.8, 3.5, 7.2, 14.2 and 29.7 MHz).

Not only does the MFJ Tuner have greater losses it is also unbalanced and one must add the Balun losses and feed line radiation effects to these numbers.

160 Meter Results from 2010 Contest Using the MFJ-986 Tuner