



Metal Detecting Search Coils




Metal Detector Search Coil 101

by **Lee Wiese**
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<http://www.mdhtalk.org>

Metal Detecting Search Coils

Shape & Windings

A yellow sunburst logo with the text "Metal Detecting Search Coil Class" inside.

Metal Detecting
Search Coil Class

Search Coil

A circular (or other shaped) plastic housing containing single or multiple transmit and receive windings (wire coils) in a specific configuration.

Metal Detecting Search Coils

Names & Differences

A Search Coil Can be Called

- Antenna
- Coil
- Head
- Loop
- Spider Coil

Differences Between Search Coils

- Configuration (**Concentric, Widescan or Doubt “D”, Mono**)
- Shape (**Circular, Elliptical, Open Web or Spider**)
- Size (**4 to 18 + inches**)

Metal Detecting Search Coils

Coil Types

Search Coils Types



Concentric coil uses two separate coils of wire, a Transmit & a Receive coil, one inside the other.



Widescan coil or (DD) uses two Transmit & two Receive D-shaped coils of wire that are placed back to back.



Mono coil uses one coil of wire for both the Transmit and Receive function.

Note: Printed Spiral Search Coil is made only by Tesoro for use with pulse induction circuitry. It offers good sensitivity to a broader range of target sizes and improved sensitivity to less conductive targets such as fine gold chains.

Note: Big Foot Coil is becoming very popular with competition hunters; also called the "figure eight" loop. This coil is very efficient for fast searching. The search area of this narrow 18 inch rectangular coil is nearly the entire coil.

Note: Mono Coils are for MPS technology detectors (SD & GP Series), Eric Foster's High End PI Detectors



Metal Detecting Search Coils



Concentric Search Coils

Circular, Elliptical and Spider



4 inch

5.3 inch

7 inch

8 inch

9.5 inch

11 inch

9 x 12 inch

12 inch

Widescan (DD) - Double "D" Search Coils

Circular, Elliptical



4 x 6 inch

8 inch

6 x 10 inch

10.5 inch

12 inch

14 inch

18 inch

Metal Detecting Search Coils

Construction & Operation



Search Coil Construction

- **Transmitter Coil** - The outer coil acts as the transmit antenna
- **Receiver Coil** - This inner coil loop acts as the receiver antenna

Search Coil Operation

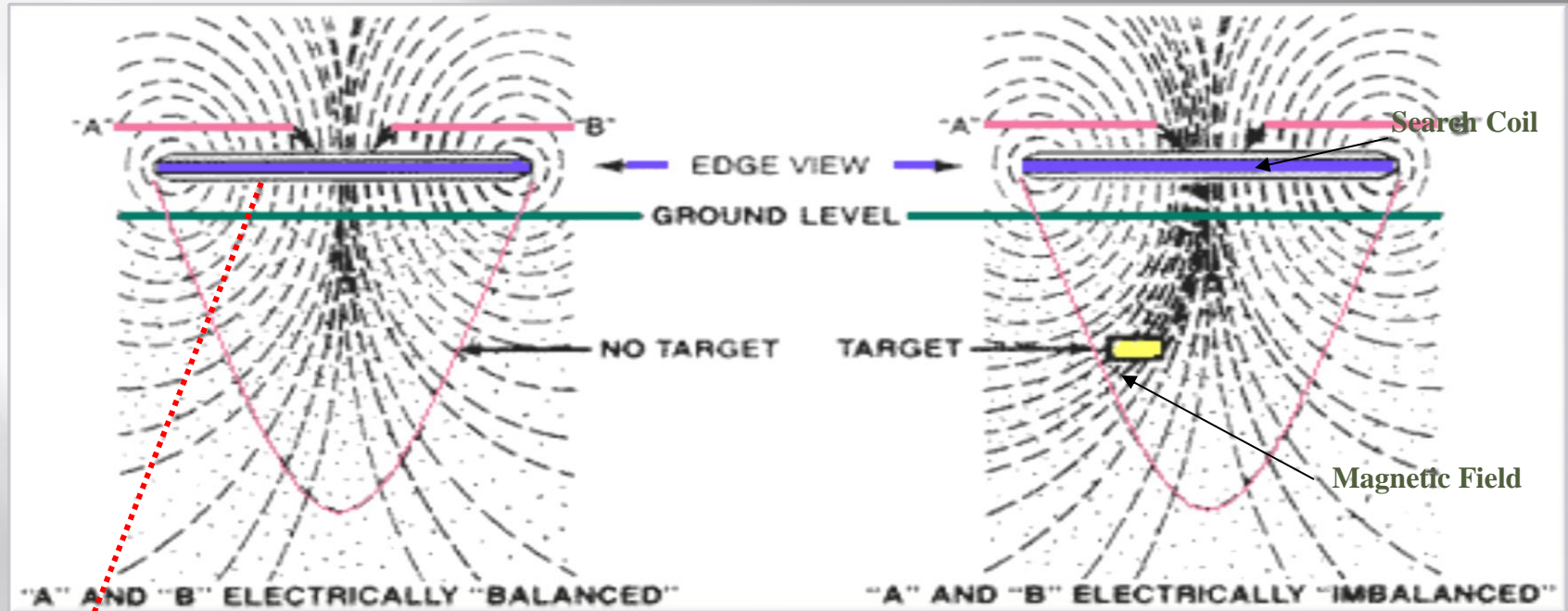
- The Detector's Electronics control an oscillator (an electric circuit capable of switching on and off very quickly determined by the Detectors Operating Frequency). This signal is directed to the search coil producing an electromagnetic field in the transmitter search coil.
- If the search coil is resting on the ground, the field it generates will extend outwards and downwards to a *depth roughly equal to the diameter of the coil for coin size targets.* When the coil's magnetic field detects an alteration in the magnetic field, the control electronics produce a corresponding change in the detectors speaker tone or on the detectors display.
- This change tells us that we have detected a buried metallic object.

Metal Detecting Search Coils

Field Patterns

Metal Detecting
Search Coil Class

Search Coil Magnetic Field Pattern



Balanced Fields

Unbalanced Fields

Note: *Coil Height Above the Ground*, The Higher the Coil the Less Ground Magnetic Penetration

Metal Detecting Search Coils

Scan Patterns

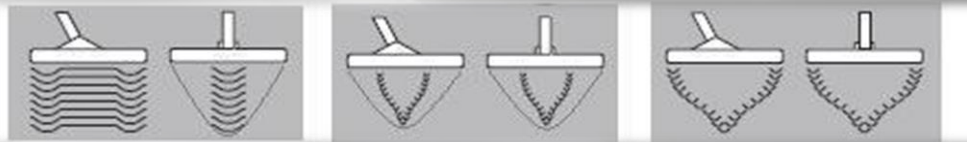


Search Coil Scan Pattern

Widescan (DD)

Concentric

Mono



Pattern View:

Side

Front

Side

Front

Side

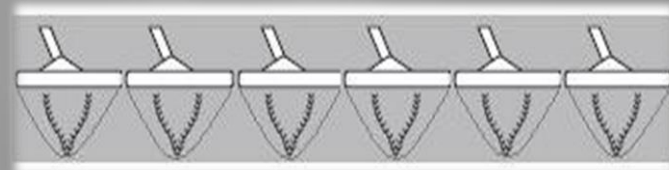
Front

Ground Covered While Sweeping



Widescan (DD)

Ground Covered While Sweeping



Concentric

Metal Detecting Search Coils

Coil Size



	Factory Add on Coil			Factory Installed Coil			Factory Add on Coil			
Coil Size	4 inch	5.3 inch	7 inch	8 inch	9.5 inch	10.5 inch	12 inch	14 inch	18 inch	++



Metal Detecting Search Coils Comparison



Search Coil Comparison

	Concentric Coil	DD Coil	++ Mono Coil
Noise Factor:	Noise in Mineralized soils	Less Less	Good
Ground Coverage:	Fair	Very GoodVery Good	Good
Sweep Profile:	Half Overlap	Little Overlap . Little Overlap	Half Overlap
Sensitivity:	Greater	Less Less	Greater
Operating Mode:**	All Modes	All Mode All Modes	All Metal
Pin Pointing:	Center	Toe / HeelToe / Heel	Center
Pin Point Difficulty:	Easiest	HardHard	Easiest
Coil Penetration Profile:	Cone Shape	Chisel Shape ...Chisel Shape	Cone
Number of Windings:	Two	FourFour	One
Ground Balancing:	Good	SuperiorSuperior	Difficult

** Operating Mode = Discrimination and All Metal

++ Mono Coils are for MPS technology detectors (SD & GP Series), Eric Foster's High End PI Detectors

Metal Detecting Search Coils

Coil Depth

Detector / Search Coil *Depth*:

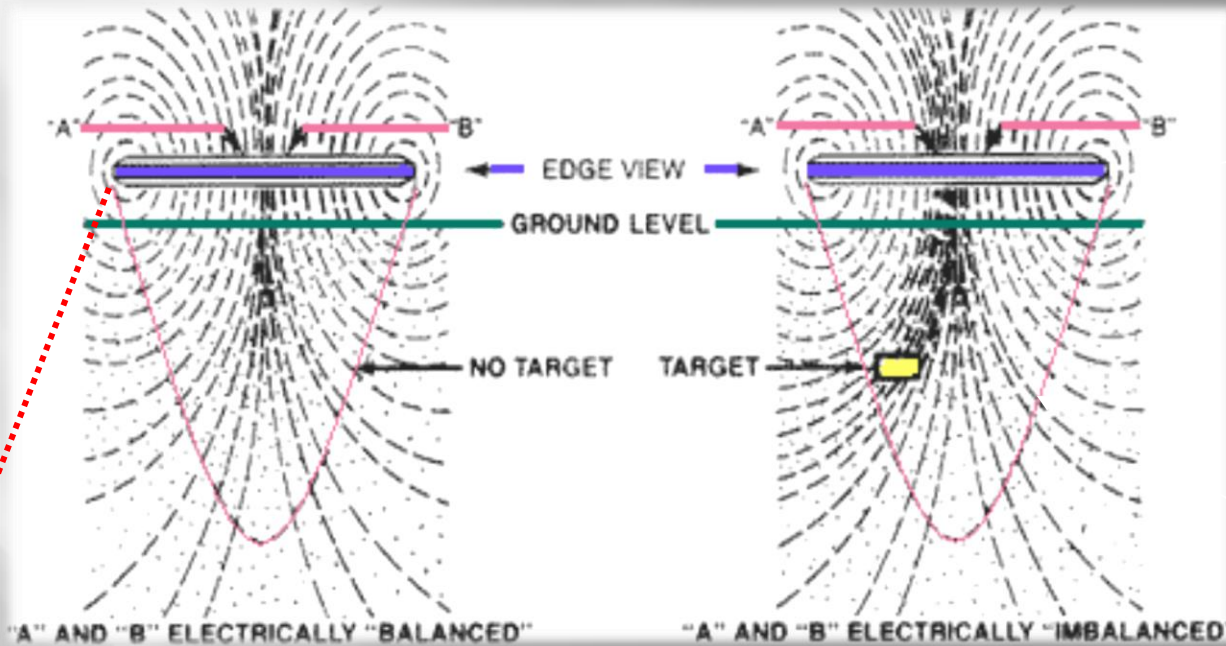
- ***Depth* is Dependant on Soil Conditions - Mineralization , Moisture, Trash**
- ***Depth* is Dependant on Target Material - Type, Position, Size, Shape**
- ***Depth* is Dependant on the Detector & Adjustments – ie: All Metal vs. Discrimination, etc**
- ***Depth* is Dependant on Operator Usage and Swing – Coil Level, Height, Speed**
- ***Depth* is Dependant on the Coil - Configuration, Shape, Size**
- ***Depth* is Dependant on the Magnetic Field Penetration into the Ground**

Metal Detecting Search Coils

Once Again



Search Coil Magnetic Field Pattern



Search Coil

Magnetic Field

Balanced Fields

Unbalanced Fields

Note: *Coil Height Above the Ground*, The Higher the Coil the Less Ground Magnetic Penetration

Metal Detecting Search Coils

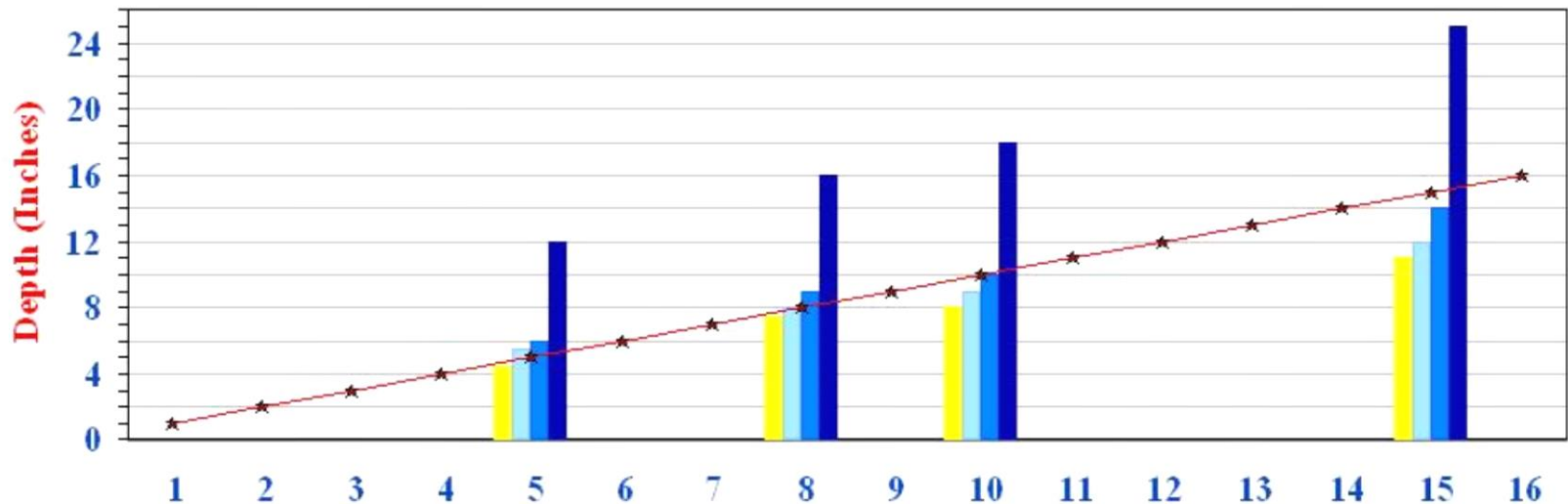
Air Test



DD Coils Used for Air Test are: 5", 8", 10.5", 15"

Detector Adjustments Held Constant for all Coils Sizes

Major Brand Detector Coil Depth Air Test



Coil Diameter (Inches)
Coil Sizes are: 5, 8, 10.5, 15 Inch

2 Gram Gold Ring
 Silver Quarter
 One Silver Dollar
 Sode Can
 ★ Coil Diameter = Coil Depth

Metal Detecting Search Coils

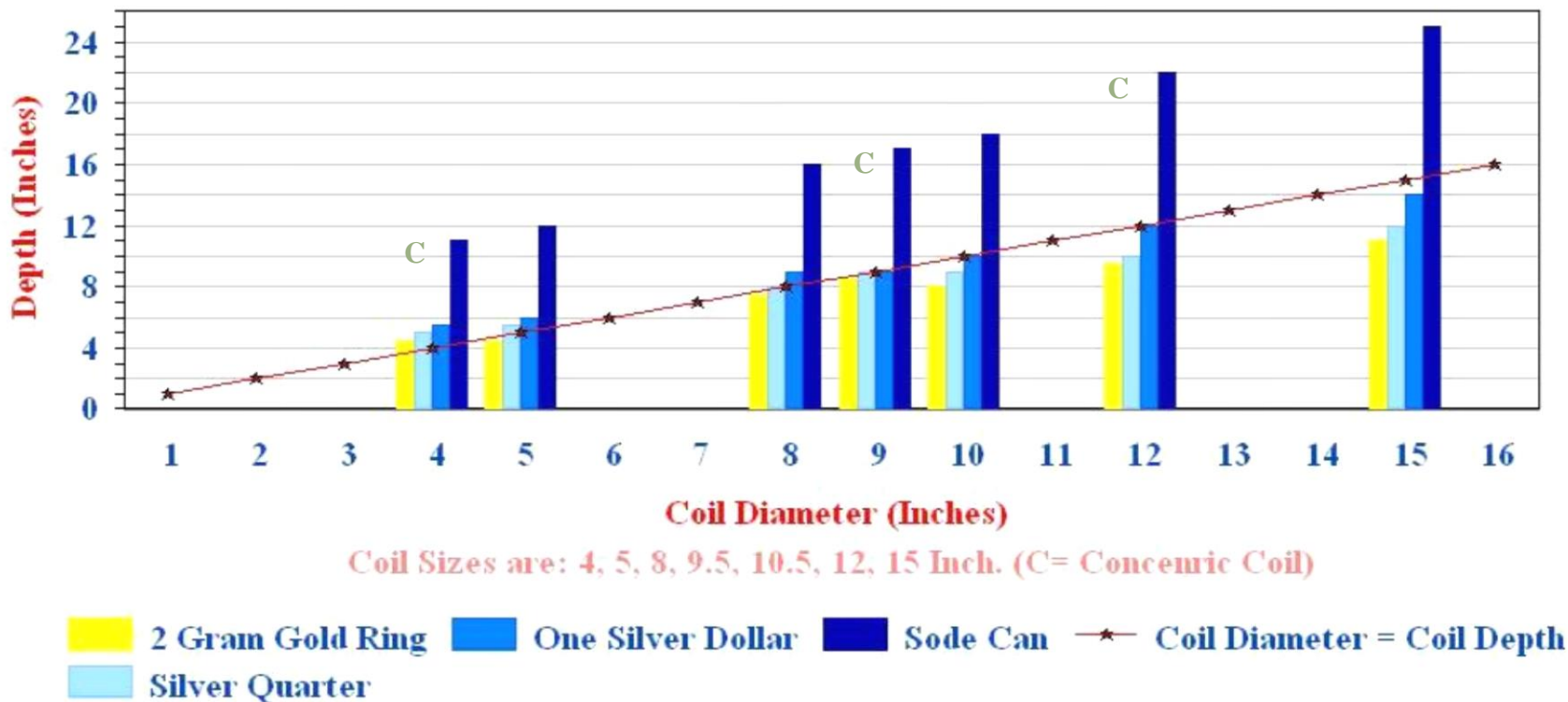
DD Coils Used for Air Test are: 5", 8", 10.5", 15"

Concentric Used for Air Test are: 4", 9.5", 12"

Detector Adjustments Held Constant for all Coils Sizes



Major Brand Detector Coil Depth Air Test



Metal Detecting Search Coils

To Recap



- **Depth** is Dependant on **Soil Conditions - Mineralization , Moisture, Trash**
- **Depth** is Dependant on **Target Material - Type, Position, Size, Shape**
- **Depth** is Dependant on the **Detector & Adjustments – ie: All Metal vs. Discrimination, etc**
- **Depth** is Dependant on **Operator Usage and Swing - Coil Level, Height, Speed**
- **Depth** is Dependant on the **Coil - Configuration, Shape, Size**
- **Depth** is Dependant on the **Magnetic Field Penetration into the Ground**

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End



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