ELECTRONIC METAL DETECTOR--MODEL 48-1

Operation

The detector is designed to locate individual reinforcing bars 1 inch in diameter and placed in concrete not closer than 3 inches of separation between bars. It will locate bars to depths of 18 inches below the exposed surface of the concrete at a somewhat increased spacing. The indications obtained are either visual on the face of the cathode ray tube or aural in the high impedance headphones.

To operate the detector, use the following technique with probe connected:

1. Plug power cord into 110-volt, 60-cycle outlet and turn instrument on. Allow to warm up at least 5 minutes.

2. Turn sensitivity control full counterclockwise to minimum sensitivity. Turn gain control full clockwise to maximum gain.

3. Adjust phase control until an approximately circular trace appears on face of cathode ray tube.

4. Adjust intensity control to desired brightness of trace on face of cathode ray tube.

5. With no metal in vicinity of the probe, turn sensitivity control until a small pip is raised on the circular trace on the cathode ray tube. With the headphones plugged in, a strong signal should be obtained in the headphones at this point. So long as the sensitivity control is not advanced beyond the point where the pip extends past the center of the circular trace, the detector will be quite stable in operation.

6. As the probe is now brought near a metal bar or target, the pip will increase in size as the probe comes nearer to the metal. Also a change in the timbre of the tone and an increase in amplitude of the headphone signal will be noticed as the probe comes nearer to the metal target.

In operating the detector when searching for reinforcing bars in concrete, it is possible not only to locate each bar but also to determine in what direction any bar is running. To do this, operate as follows:

1. Place the open ends of the probe legs on the concrete surface and move probe across the face of the concrete until the bar is located. Then, holding one leg of the probe over the bar, rotate the probe ninety degrees about this point. As the probe lines up over the bar, the indication signal will be at greatest amplitude. By use of this technique it is possible for a trained operator to locate and follow any bar in a reinforcing bar grid pattern in the concrete.

Due to the fact that the greatest signal is obtained from a bar which lies parallel to the probe so that both legs of the probe are over this bar, any bars or other metal objects lying under the probe but positioned at right angles to the probe axis will have minimum effect on the indicating signal amplitude. Thus, because of this fact, cross-over points of the bars in the reinforcing bar grid pattern such as is used in large reinforced concrete structures will have no effect on the accuracy with which any one reinforcing bar can be located.

In reinforced concrete structures in which the reinforcing bars are laid in two or more grid patterns and these grids are each at different distances below the exposed surface of the concrete, the individual bars in each grid can be located so long as the bars are not placed one behind the other with respect to the position of the probe and are sufficiently spaced.

It should be carefully noted that variations in the voltage amplitude of the line supplying power to the metal detector will have an effect on the output signals from the detector, both visual and aural indicating signals, that may be misinterpreted as indications of the presence of metal near the probe. For this reason, after the warm-up period, it is recommended that the operator keep the probe clear of possible metal targets while he studies the effects of the power line fluctuations on his output signals. If the power line is swinging over large amplitudes, some type of voltage stabilizer should be used with the metal detector.

When searching for metal targets embedded 12 inches or more below the exposed concrete surface, it is recommended that the aural indications be used. In this case the operator should reply on tonal variations in the headphone signal as the indication of the presence of metal.

The probe used with this metal detector is constructed in the following manner:

1. The core is made of laminated soft iron strips 3/4-inch wide and cut to a length sufficient to make the core U-shaped to the following dimensions:

a. Cross section 3/4 by 3/4 inches

b. Each leg 6 inches long

c. Length of center section between legs is 20 inches

2. Each of the iron strips is lacquered before the core is assembled.

3. When the laminations are assembled and bent to the required shape the core is then completely wrapped with electrical tape.

4. A single-layer coil of No. 14 enameled wire is wound around the center section of the center of the core and the two leads are brought out at one end of the coil. This is the driver coil.

5. Then a coil of 500 turns of No. 34 enameled wire is scramble wound on each of the legs 1/2 inch from the open end of the core leg.

6. Then a coil of 75 turns of No. 34 enameled wire is scramble wound at the exact center of the elongated portion of the core over the long coil already in place on the core.

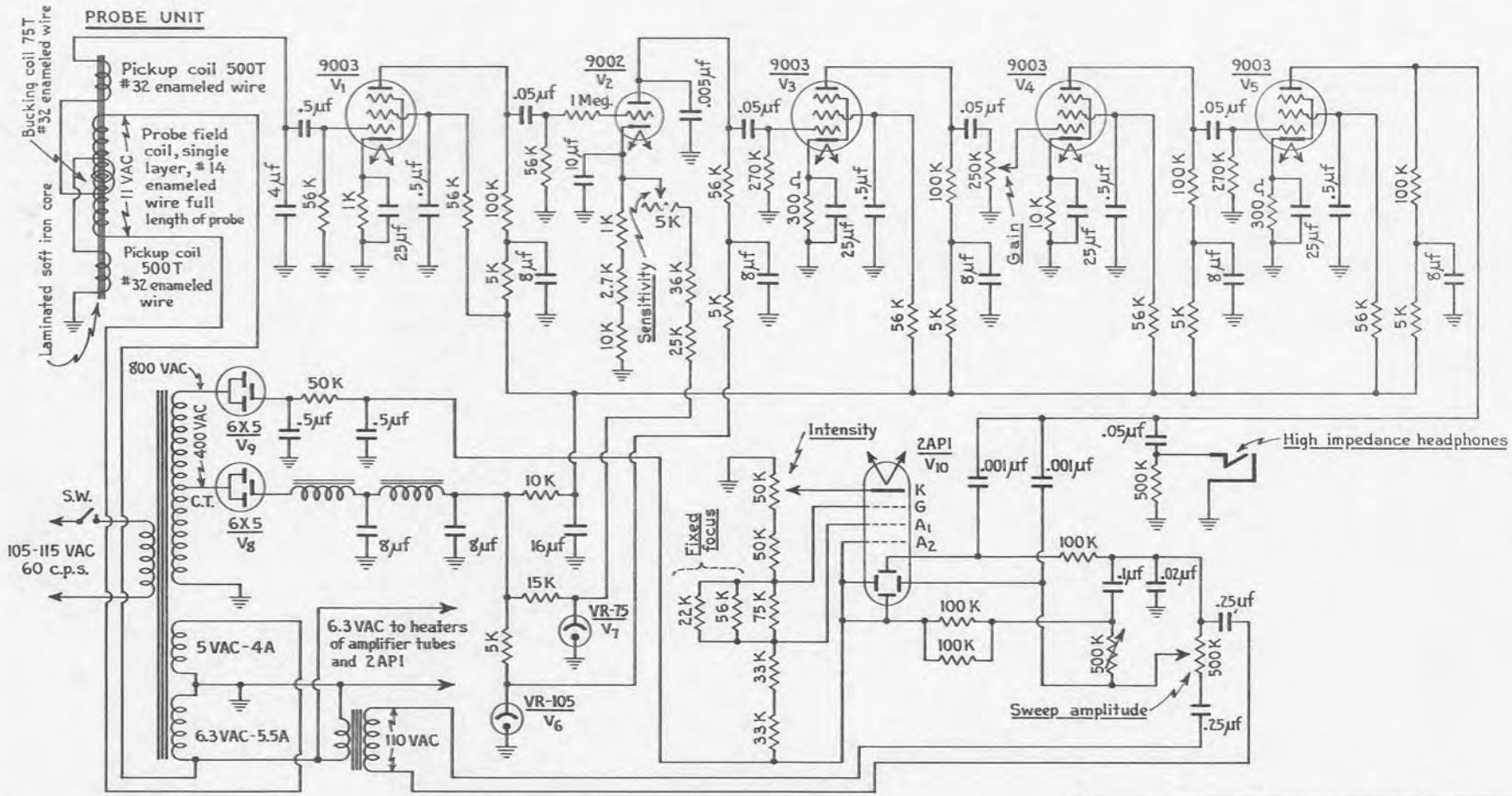
7. The pick-up coils on the ends of the legs and the bucking coil on the center of the driver coil are connected in series so that the pick-up coils are aiding and the bucking coil is opposing the pick-up coils. Leads from this assembly are brought out to the same end of the core as are the leads from the driver coil. The leads from the core are brought to a suitable plug to allow them to be connected from the probe through a four-wire cable to the circuits in the detector, as shown on the schematic diagram.

8. The completed probe is covered suitably to protect the coils from damage and hold the entire assembly rigid.

Assembly of the electronic circuits and the dimensions of the chassis depends on the size and types of component parts used. The only care required is to isolate the alternating-current power supply as much as possible to keep down stray fields in the chassis and protect the operator. The cathode ray tube should be shielded to cut down interference from the transformer fields present.

This electronic metal detector is covered by United States Patent Office Patent No. 2,503,247.

Interior - Reclamation - Denver, Colo.



Note – Power supply and probe unit shown for 105-115 volt, 50-60 c.p.s. operation only. For operation from other frequency and voltage source, suitable change in power supply and probe unit design must be made.

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UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
RESEARCH AND GEOLOGY DIVISION
HYDRAULIC LABORATORY

ELECTRONIC METAL DETECTOR MODEL 48-1

DRAWN L.T.C.	SUBMITTED
TRACED H.R.S.	RECOMMENDED
CHECKED C.R.D.	APPROVED
DENVER, COLORADO OCT. 3, 1950	

PROBE UNIT

Bucking coil 75T #32 enameled wire

Pickup coil 500T #32 enameled wire

Probe field coil, single layer, #14 enameled wire full length of probe

11 VAC

Pickup coil 500T #32 enameled wire

Laminated soft iron core

6.3 VAC to heaters of 6X5 tubes

SW

105-115 VAC 60 c.p.s.

3A fuse

800 VAC

400 VAC

C.T.

6X5 V_9

6X5 V_8

50 K

.5 µf

.5 µf

8 µf

8 µf

16 µf

10 K

15 K

5 K

VR-75 V_7

VR-105 V_6

5 VAC-4A

6.3 VAC-5.5A

6.3 VAC to heaters of amplifier tubes and 2 API

110 VAC

9003 V_1

.5 µf

4 µf

56 K

1 K

25 µf

.5 µf

56 K

100 K

5 K

8 µf

.05 µf

56 K

IN52A

IN52A

1.5 K

9002 V_2

1 Meg.

10 µf

1 K

5 K

Sensitivity

25 K

36 K

.005 µf

9003 V_3

.05 µf

56 K

270 K

300 Ω

25 µf

.5 µf

5 K

8 µf

56 K

.05 µf

100 K

250 K

.01 µf

Gain

9003 V_4

220 K

10 K

25 µf

.5 µf

56 K

5 K

8 µf

9003 V_5

.05 µf

100 K

270 K

300 Ω

25 uf

.5 µf

56 K

5 K

8 µf

100 K

Intensity

2 API V_{10}

K

G

A_1

A_2

Fixed focus

50 K

22 K

56 K

75 K

33 K

33 K

100 K

100 K

.001 µf

.001 µf

.005 µf

.015 µf

High impedance headphones

100 K

.1 uf

Phase control

.25 µf

500 K

500 K

.25 µf

Sweep amplitude

NOTES-

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REVISED & REDRAWN MARCH 7, 1961

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