

# ELA306 Laboration 3 Report

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## Abstract

A metal detector using home-made components though possible, has results of which are lacking. The pursuit of each subsequent step is highly educational and grants a deeper understanding of the steps a more professional application and more compact circuit would apply.

## I. INTRODUCTION

A metal detector can be created using a direct current input that can be turned into an oscillating signal which can be ran through a coil inducing an electromagnetic field. This field will then induce a current in an adjacent coil, which will be affected by any ferrous materials that enter the field since that will alter the inductance of the coils. Measuring the changes in the current of the second coil then allows for the detection of metals within the electromagnetic field.

## II. METHOD

The metal detector is made up of three parts: the oscillator, the transformer and the rectifier. As for the oscillator a colpitts oscillator was chosen for its simplicity and since the required components were available. A 10 mH inductor and two 3.3  $\mu\text{F}$  capacitors were used for the LC circuit and the OP-amp increased the signal by 5 times.

The Transformer was made using two coils which were then zip tied together. The resistor between the coil connected to the oscillator and ground had a variable resistor to allow for the the signal to be tuned. A lowered resistance results in a stronger signal being induced in the second coil, but also in a less stable oscillation. The signal from the second coil was then amplified 10 times to make it stronger.

Finally the rectifier chosen was a half-wave rectifier using a single diode and a capacitor which would allow for the signal to more easily be detected either by eye or a separete system.

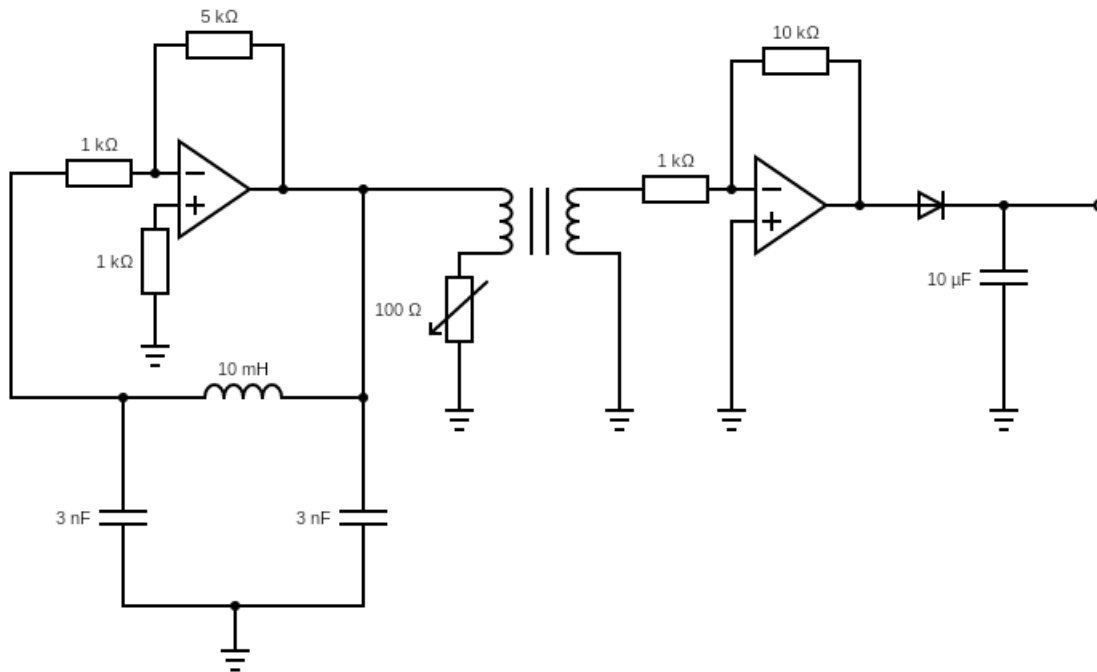


Figure 1. A diagram of the circuit of the metal detector discussed in this report

### III. RESULT

A weak signal could be seen intermittently. It was always visible in the shape of the signal out of the transformer but the quality of the signal out of the entire circuit would vary significantly.

### IV. DISCUSSION

While promising the results were weak and inconsistent. The main factors contributing to this is believed to be bad connections between the coils of the transformer and the rest of the circuit which would be solved by soldering the wires to the coils. The signal could also be strengthened by increasing the number of turns of the coils, resulting in stronger inductance between them.

A physical representation of the signal would be a beneficial addition once the circuit has been made more stable. For example some form of light or speaker could be attached to the output which could allow for the metal detector to be used even without an oscilloscope to view the data.