

# BUILDING YOUR OWN METAL DETECTOR HEADPHONES

By Sven Stau---Oct. 2009  
Originally built for my Minelab  
Musketeer.

## Parts used:

1---Howard Leight Thunder 29  
Headphones

2---Apha 12mm 1K Audio Taper  
Potentiometer, Mouser # 313-1200F-1K  
(volume control)

1---1/4" Phone jack, Mouser #550-  
20311, nut Mouser #550-1005

## Soft Limiter:

Not needed if using 600 ohm speakers

1---Green LED

1---Metal film resistor, 1.5k (1500 ohm),  
one watt

1---Misc. wire

2---Kobitone 600 ohm 1.5" speakers,  
Mouser #25CE500-RO

2---Speaker grills, made from tool box  
drawer liner material.

1---Nexxtech Evolution Shielded Coiled  
Guitar cable, 15' Part #4202473N (not  
stereo)

1---PFM Glue or similar.

## OPTIONAL PARTS

2---Bourns cerment 8.4 volt  
1k potentiometer, Mouser  
#652-3310C-111-102L

2---Alps RK097 1K audio  
potentiometer (without on/off  
switch)

2---Panasonic EVJ, 1k audio  
potentiometer

2---Koss UR-30 speakers

2---Volume control knobs



**Step 1:**

Remove earmuffs from headband.

Pull earmuff covers off, very easy.

Remove foam.

**Step 2:**

Mark holes for phone jack, volume control pots, crossover wire.

Drill holes, I used special drill bits for plastic. They drill perfect holes without melting the plastic.

Fit parts.

The crossover wire is a set of two wires that will go over the headband and connect speakers; pots together in both earcups.





### Step 3:

Wiring phone jack.

If using 600 ohm speakers, limiter circuit is not needed.

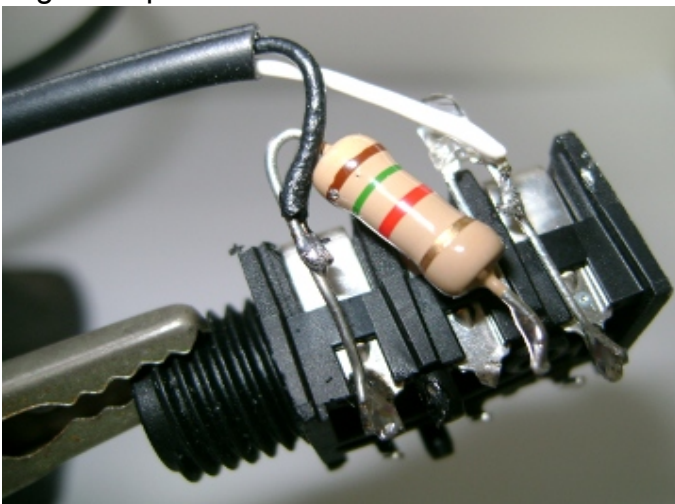
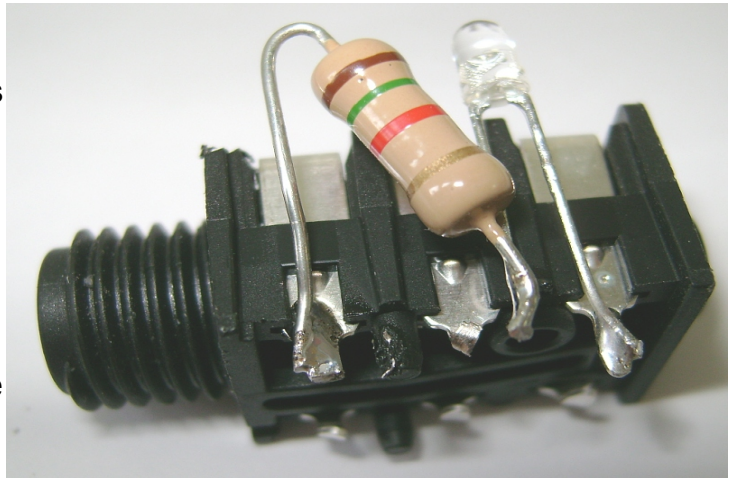
Unless you plan on adding an external amplifier. Which is my next project with tone control.

So I wired a limiter in place:

One end of the Green LED soldered to rear tang on jack, other end is soldered to one lead of a resistor. The other end of the resistor is wired to the front tab. Resistor value could vary depending upon speaker ohm.

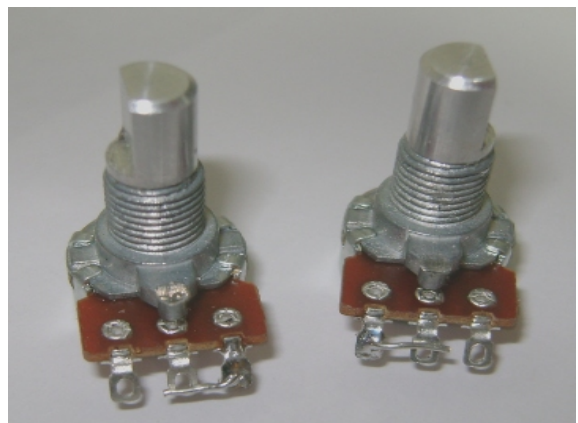
Solder two white wires to the LED leg that goes to the rear tab, one goes to the one end of potentiometer. The other white wire will be from the crossover wire that goes to the other pot in the other ear cup.

Solder two black wires to the resistor leg of the front tab. One wire will go to the negative side of the speaker. The other black wire will be from the crossover wire that will go to the other ear cups negative speaker side.



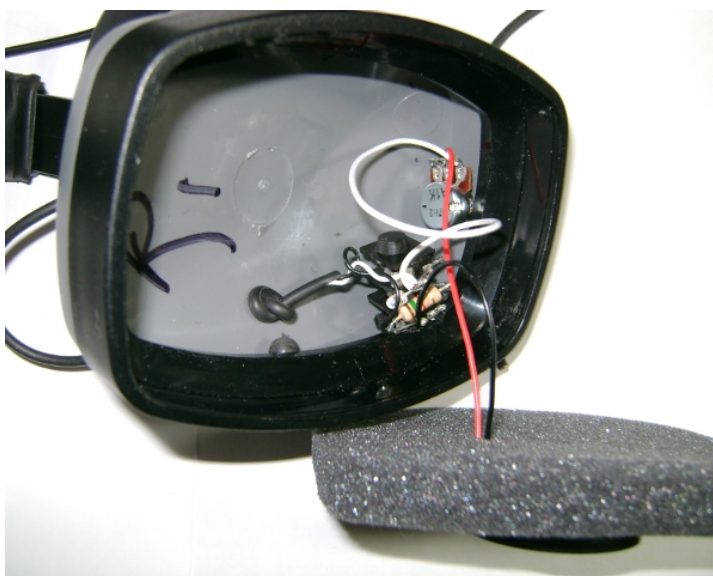
If not using the limiter, just wire white wires to rear jack tabs. And the black wires to the front jack tabs.

Solder red (+) speaker wire to middle and outside tab of of each potentiometer.



Run your crossover wire through the hole in the earcup. Adjust your cross over wire, so it's not too loose or too tight. I ran the crossover wire through some shrink tubing on the earcup frame to keep them tucked in neatly. Take a crosswire and feed it through the headband sleeve. It may take some time.

An overhand knot was made of the crossover wires inside each earcup, to prevent the wires from pulling out. A dab of PFM glue was added to the knot and earcup, as well as a dab on the outside to to act as a simple strain releaf.



#### **Step 4:**

Take one of the foam sound deadening material and make a small slit in. The speaker wires will be fed through it. Dab a dot of glue to the speaker magnet and center speaker on to foam. Let it dry.

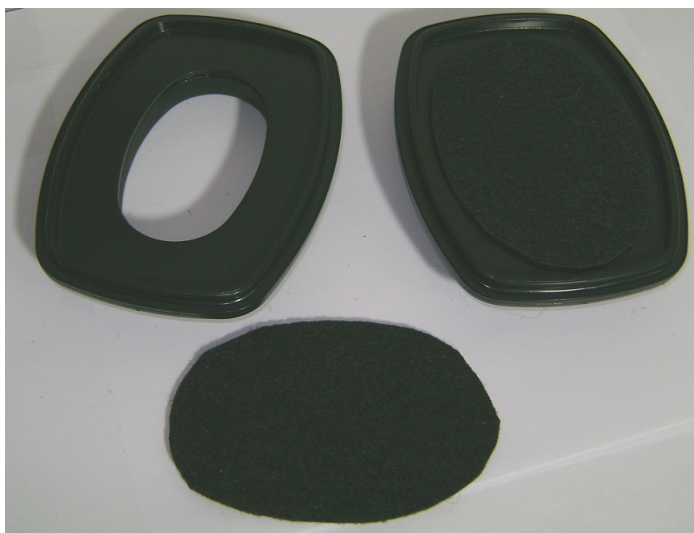
Insert first layer of foam into each earcup. You may want to trim some foam away to make it fit better. Now place the foam piece with glued on speaker into earcup.



#### **Step 5:**

Take your earmuff covers and cut 2 grills from the toolbox drawer liner material. The material is practically acoustically transparent. They should be cut oversize. Then glue them in place.

Once dry you can snap them back onto the earcups.





## Your done.

Now just plug in your guitar cord into the headset and detector.

Mine sounded similar to the Ratphones I once owned.

You have now built yourself a high end set of headphones at a big savings. The money saved can now be put it towards your other treasure hunting needs.

### Notes:

Switching to other brands of speakers such speakers found in Koss UR-30, Sony MDR-V6 or V200's headphones or those used for Ipods, CD players etc. will give you a different sound than the ones I used. You can experiment with different headphones and speakers. When you find a set that sounds good to you and your detectors you can always put them inside Thunder 29, ProEar etc. shells.

Lots of audiophiles take their cheap headphones and put them into ProEars etc. headphone shells...they sound 100% better. Check out Utube on-line, lots of videos---tutorials.

You could spend a little more and go for the optional Alps or Panasonic Audio potentiometers. You may or may not notice much difference. They do make a difference, if you build a audio amp. The Bourns Cerment potentiometer used in the RatPhones, they are environmentally sealed from the elements. They are hard to find and need to be custom ordered in large quantities.

You do not have to put the volume control pots on the bottom of the earcups. You can put them on the earcup sides if that suits your needs better. I put them under the earcups, they seem to be less likely to get bumped out of adjustment.

Using the mono guitar cord will also work with other Minelab, Garrett and Fisher, etc. metal detectors. For those that it will not, just get yourself a mono jack to stereo plug adapter from Radio Shack etc. then plug that end into the metal detector.



Headphone shells, are basically industrial hearing protectors used in factories, construction sites, gun shooting ranges, etc. Metal detector headphone manufacturers such as Detectorpro, Killer Bees, Ratphones, Chef-phones.....will use these hearing protectors to build their headphones.

The most popular hearing protectors used are the ProEars. There are three main comfortable varieties to choose from. Retail \$20-\$35.00

The other similar shells to ProEars are manufactured by Howard Leight, made in Switzerland. Sold worldwide and priced cheaper than the ProEars, claimed to be better; more comfortable than ProEars. I used the Howard Leight Thunder 29's. Howard Leight also produces another fantastic shell called the Leightning L2F folding ear muff. These are used in building the UK's popular Chef-phones. Retail \$15-30.00



The latest Ratphones MSA headphones are made using shells made by MSA Sordin, model is the "Left/Right Low" which come in 3 colors yellow, white and blue. Retail \$25.00



All the above hearing protectors can be found on the web by doing a Google "shopping" Search or by checking out Ebay. Priced new and used from \$4.00 to \$30.00 per set.

#### Speaker Tip:

Check garage sales, thrift shops, etc. for high end audio headphones at crazy low prices. You want them for the speakers to experiment with. Chances are the speakers are in great shape. Cosmetically they may not be too appealing, with only cracked, torn, deteriorating foam ear pads.



## Do your headphones fit too tight on your head??

ProEars and Thunder 29's that are made of plastic with plastic headbands can be adjusted to to a comfortable fit. Carefully grab the headband at each end and slowly bend upwards a little at a time. Try them on, bend a little more if needed until they fit just right.

## What they cost me to build my headphones:

Thunder 29 new from Ebay.....	\$4.00
2 potentiometers.....	2 x \$2.16 = \$4.32
Phone jack and nut.....	\$0.65
2 Speakers.....	\$5.14
Resistor and LED.....	\$0.50
Wire, shrink tubing, knobs, left over from other projects...	\$0.00
Guitar Cord.....	\$14.99

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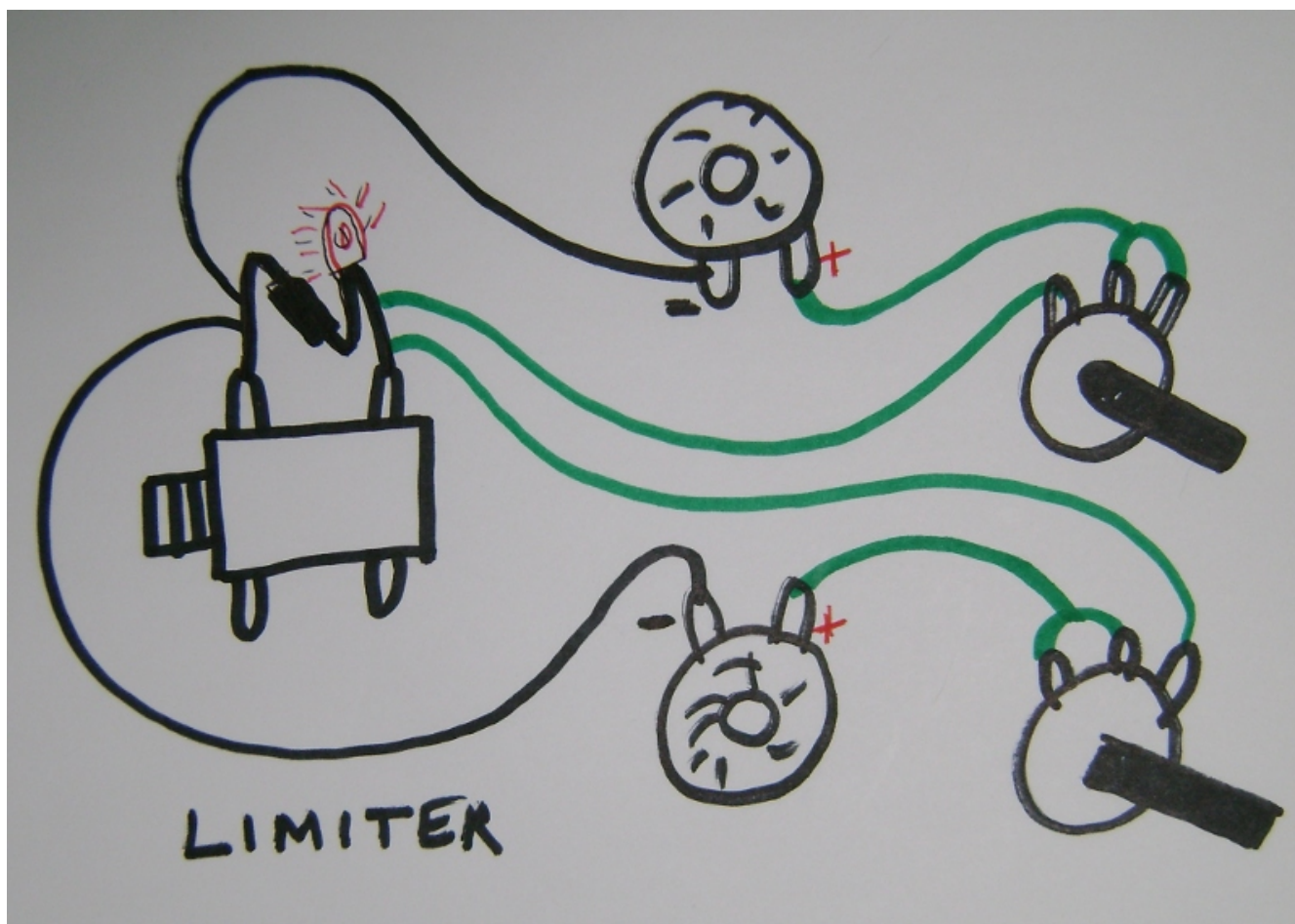
**Total Cost** (does not include any shipping charges).....**\$29.10**



## WIRING DIAGRAMS

For those that will find a wiring diagram helpful, I have added two. One with the limiter and one without the limiter. If your using 600 ohm speakers, limiter is not needed.

### With Limiter



### REVISION May 29, 2010

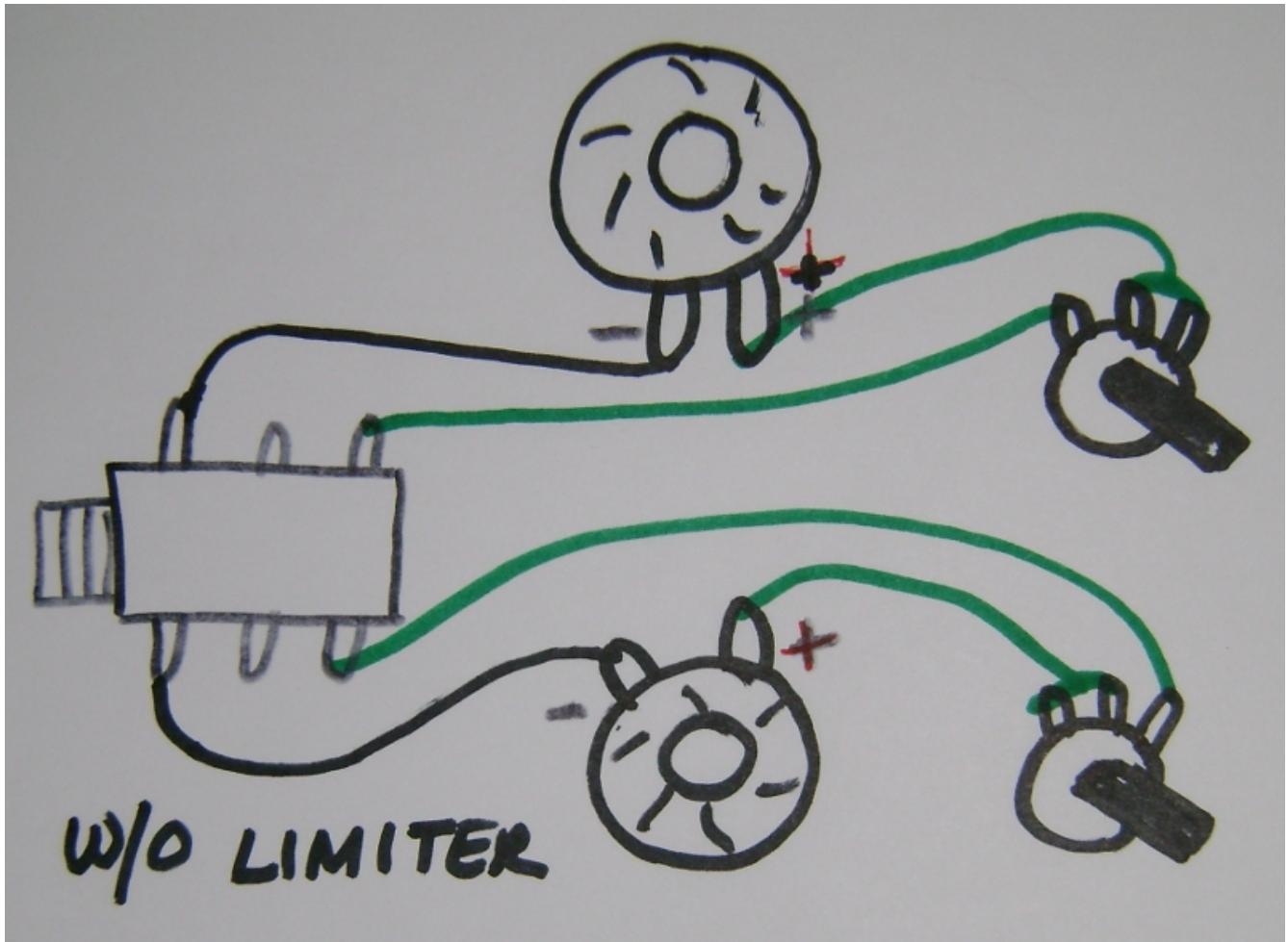
The limiter used may not work with some detectors that already have sound enhancers built into them. They increase the volume of surface objects beyond what the limiters will handle because of the ohms of the speakers. 600 ohm speakers tend to amplify all signals naturally by themselves. It is suggested by another hobbyist that 50-100 ohm speakers may be a better option to use with the limiters.

Or build the headphones without the limiter and build a limiter per schematics below. The schematics below work with 50 ohm speakers and will control surface target signals from being too loud.

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# Without Limiter



## Volume Too Loud??

When volume controls are turned down to min. using the Kotone 600 ohm speakers and 5k potentiometers, is the volume too loud ? This can happen if your detector puts out a high volume amount.

You can tame the volume by replacing the two 1K volume control potentiometers with two 5K pots. They must be  $\frac{1}{4}$  watt. Or the volume power coming from the detector will wear out the wiper inside the pot. Then add a  $\frac{1}{4}$  resistor in line to reduce volume at low and high potentiometer settings. You can tailor this to your hearing by choosing either a 2k2, 3k3, 5k6 and so on resistor. I found that 2k2 resistor value is perfect for my hearing. See wiring diagram below.

Warning, using any headphones with too loud of a volume can contribute to hearing loss.

If you don't have Audio pots on hand, you can also use Linear pots. I was told no real advantage in detector headphones if you use Audio.

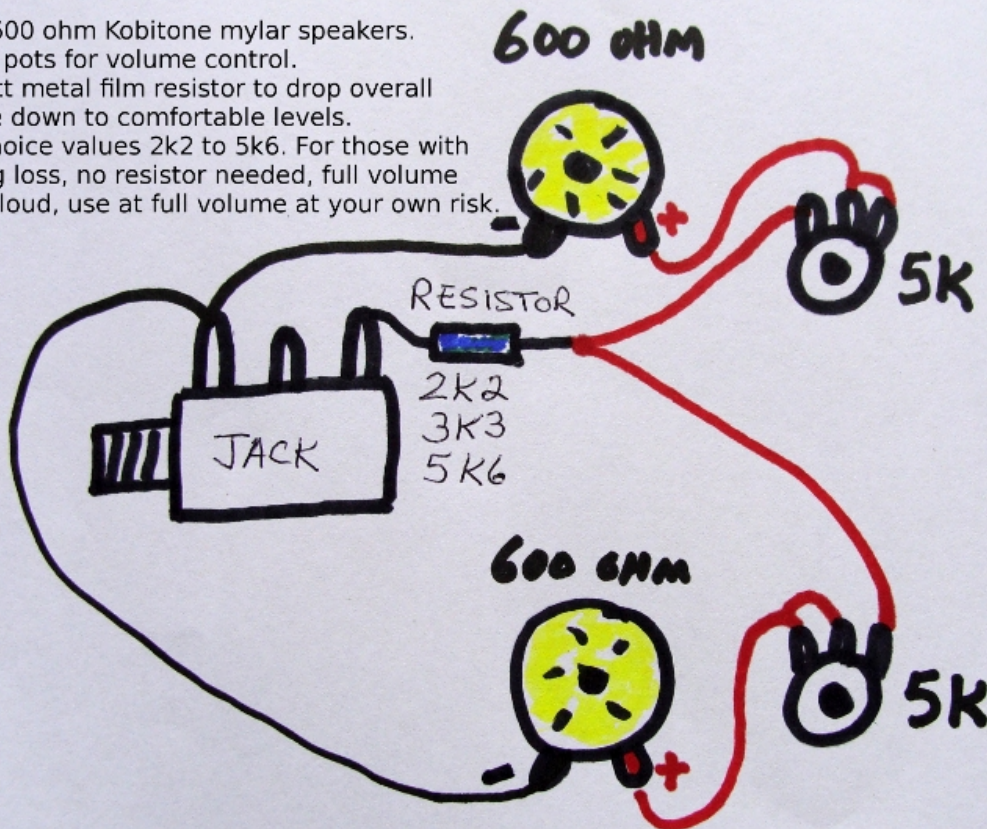
### Headphone Wiring Diagram

Using 600 ohm Kobitone mylar speakers.

Two 5k pots for volume control.

$\frac{1}{4}$  watt metal film resistor to drop overall volume down to comfortable levels.

Best choice values 2k2 to 5k6. For those with hearing loss, no resistor needed, full volume will be loud, use at full volume at your own risk.

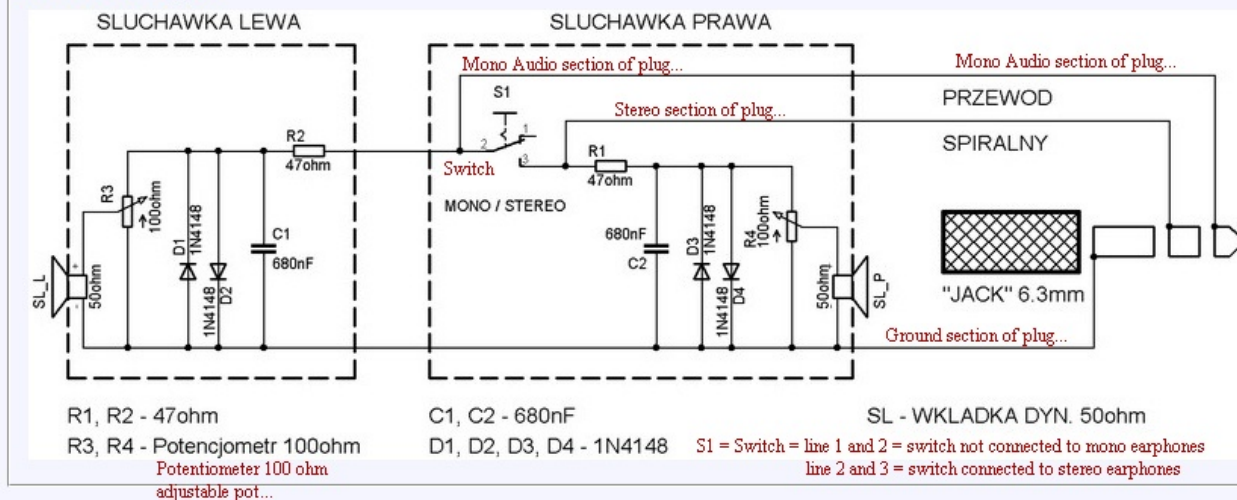






As simply, make earphones with limiter. This work very well.  
Mrand

#### Attached Images

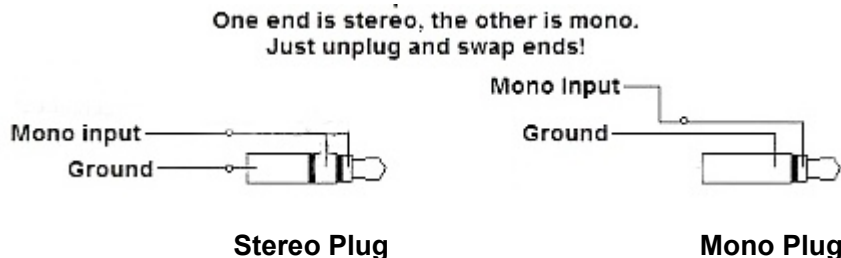


## MONO TO STEREO PLUG

If using the mono guitar patch cord to connect your headphone from the earcup to the detector. Bare in mind that it is set up for mono. If your detector is set up for stereo headphones you'll need an mono to stereo adapter plug.

Now you can also take that mono guitar cord and make it work with either mono or stereo metal detectors. Remove one of the mono plugs from the cord and resolder to a stereo plug.

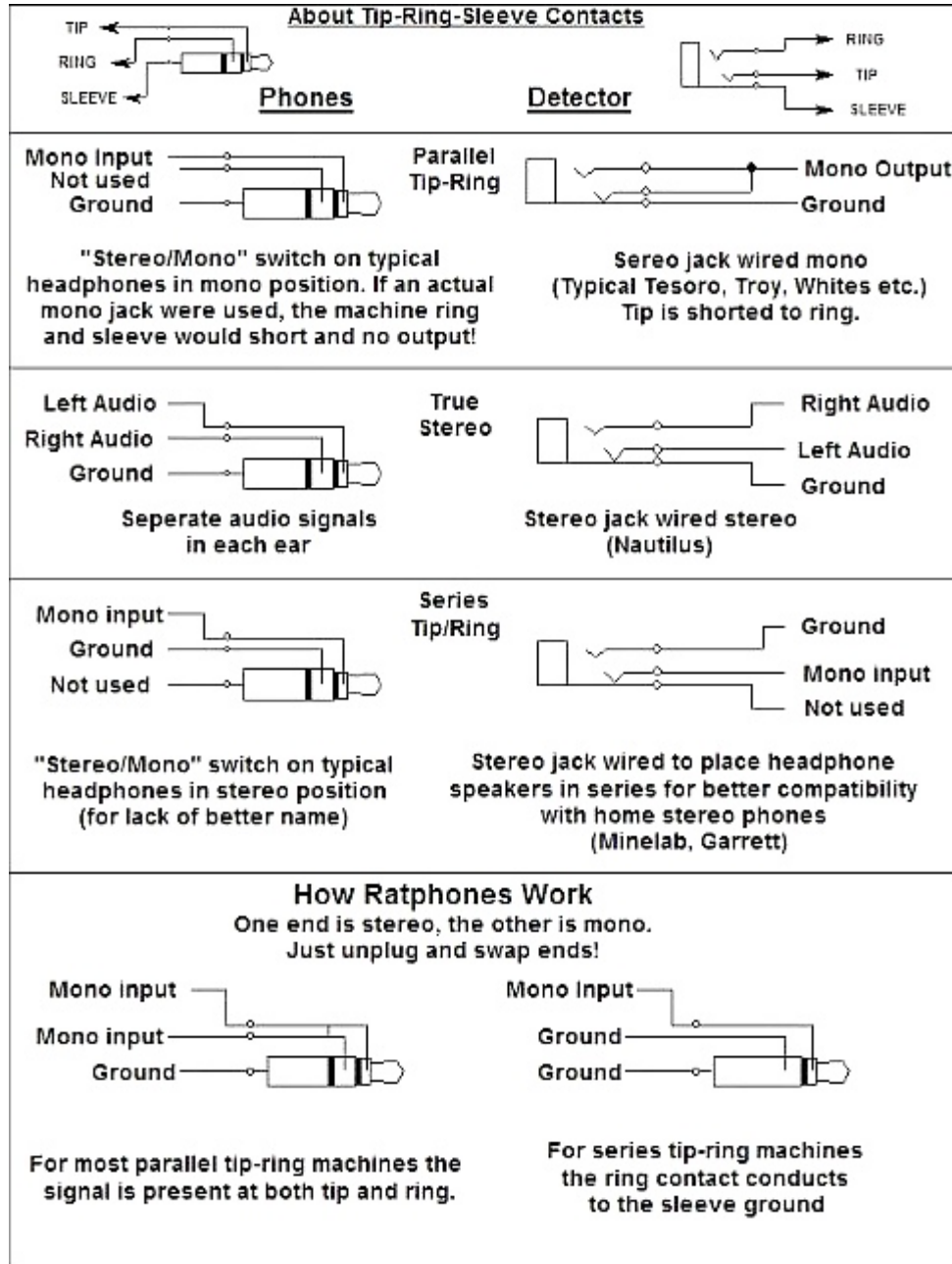
White wire is ground and soldered to the sleeve and the red wire gets soldered to the tip and ring contacts.



You can now use your headset with either a mono detector or stereo detector by just reversing the plug ends that go into the detector and headset. No need for a stereo/mono switch.

## Detector Plug Set-ups

Useful illustration by Ratphones





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## **For those that want to experiment.**

**You can build a separate amplifier to boost weak signals and limit loud surface target sounds with the gadgets on the next several pages.**

**United States Patent** [19]  
**Bernzweig**

[11] **Patent Number:** **4,594,559**  
[45] **Date of Patent:** **Jun. 10, 1986**

[54] **METAL DETECTOR AUDIO AMPLIFIER**

[56]

**References Cited**

**U.S. PATENT DOCUMENTS**

[76] **Inventor:** **David S. Bernzweig**, 24 Raleigh Rd.,  
Framingham, Mass. 01701

4,376,267 3/1963 Chu et al. .... 330/284  
4,486,712 12/1984 Weber ..... 324/329

[21] **Appl. No.:** **531,295**

*Primary Examiner*—James B. Mullins  
*Assistant Examiner*—G. Wan  
*Attorney, Agent, or Firm*—William Nitkin

[22] **Filed:** **Sep. 12, 1983**

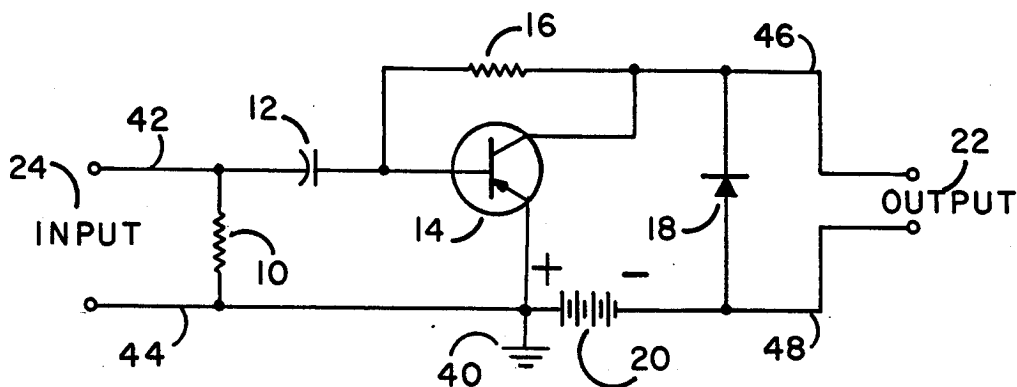
[57]

**ABSTRACT**

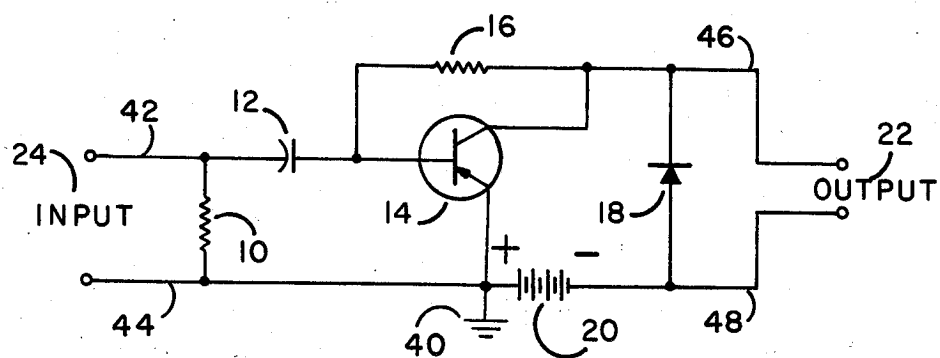
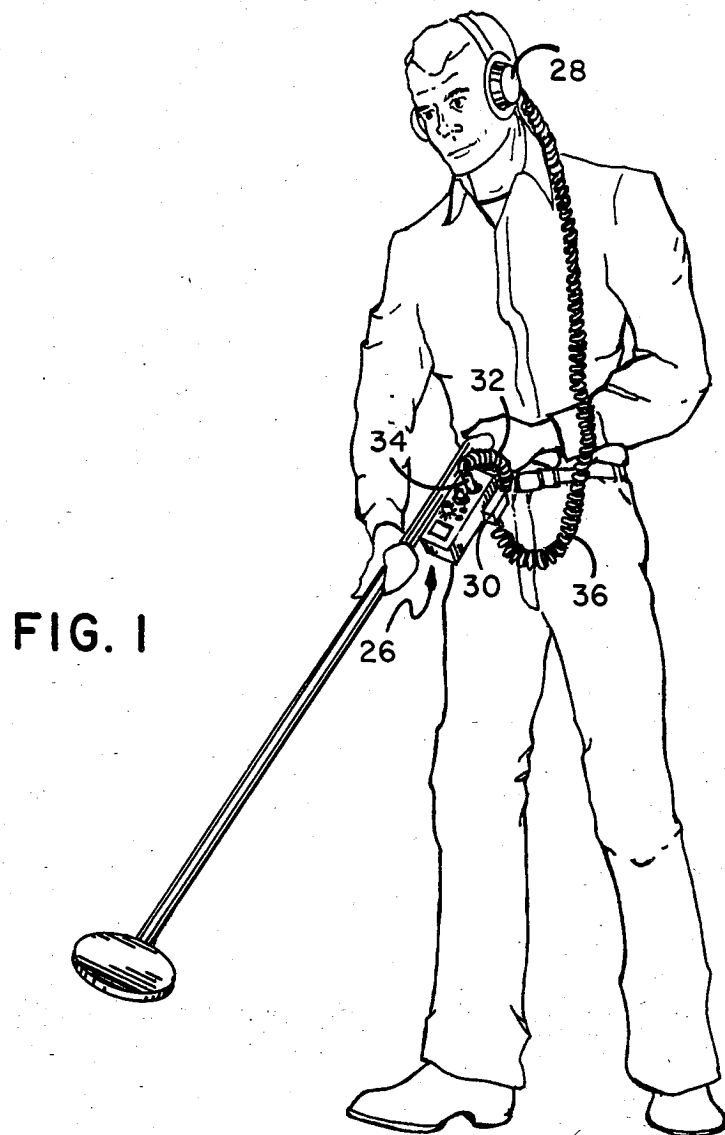
An accessory device for use with a metal detector with means to amplify the low, barely audible audio output of the metal detector so that it can be easily heard with further means to dampen louder audio output signals causing those signals to be softer.

[51] **Int. Cl.<sup>4</sup>** ..... **H03F 1/26; G01V 3/11**  
[52] **U.S. Cl.** ..... **330/149; 324/329**  
[58] **Field of Search** ..... **324/326, 327, 328, 329;**  
**307/559; 328/171; 330/278, 284, 149**

**2 Claims, 2 Drawing Figures**







**FIG. 2**

## METAL DETECTOR AUDIO AMPLIFIER

### BACKGROUND OF THE INVENTION

#### 1. Field of the Invention

The device of this invention is in the area of metal detectors and more particularly relates to an accessory device for amplifying the low volume audible signals while dampening signals of above predetermined volume.

#### 2. History of the Prior Art

Metal detectors used by individuals can emit an audible signal when their search coil passes over buried metal objects. When objects are near the surface, the metal detector produces a loud audible signal while objects that are more deeply buried will cause the detector to emit a softer, less audible signal. These less audible signals often represent more valuable objects such as older coins and artifacts. To hear these less audible signals better, the metal detector user will often use earphones connected to the metal detector which brings the audible signal close to the ear and blocks out other distracting sounds from the environment making it easier for the user to hear the softer signals. Unfortunately when detecting buried metal objects located close to the surface, the loud signal generated can then hurt the user's ears. Further, many times deeply buried objects cause the metal detector to produce an audible signal so soft that even with the aid of earphones, the signals are inaudible.

### SUMMARY OF THE INVENTION

It is an object of this invention to provide an accessory amplifier for metal detectors which amplifies barely audible signals so that they can be easily heard and which also dampens loud signals so that they do not hurt the user's ears. The device is contained within a small casing which is attached to the metal detector. One method of attachment can be by the use of Velcro strips so that the amplifier is removable and reattachable. A coiled electric cable extends from the device and is plugged into the audio output jack of the detector. A second coil extends from the device to the earphones of the user. The device of this invention also acts effectively to increase the sensitivity of the metal detector because it increases the user's ability to tune the detector. Typical metal detectors have two wound coils in their search heads, each tuned to the other. A control knob allows the user to adjust the tuning by turning the audible sound created by the two coils down to just where it is no longer audible. If the sound is soft then it may be difficult to fine tune the detector as the tuning may not be perfect. With the signal amplified from the device of this invention, the coils can be perfectly balanced and the detector will operate with a higher sensitivity than if it were not perfectly tuned.

### BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 illustrates a metal detector in use with the device of this invention attached thereto.

FIG. 2 is a schematic of the circuit of the device of this invention.

### DESCRIPTION OF THE PREFERRED EMBODIMENT(S)

FIG. 1 illustrates an individual utilizing a metal detector 26 having the device 30 of this invention attached thereto. The device is interconnected to the metal de-

tor by cable 32 with jack 34 inserted into the audio output of the detector. A second cable 36 extends from the device of this invention up to earphones 28. The device of this invention is small and lightweight, does not interfere at all with the use of the metal detector and, as mentioned above, can be attached to the detector by any removable and reattachable means such as by Velcro strips, snaps, slide clips or any equivalent method of fastening.

FIG. 2 illustrates the circuitry of the device with cable 32 not shown to be attached to input 24 carrying the signals of metal detector 26 to input 24. First input line 42 extends from the input 24 to the base of transistor 14. Between input 24 and transistor 14 on line 42 is capacitor 12 which can be a 1NF electrolytic capacitor or equivalent. Before electrolytic capacitor 12 on line 42 and before the emitter of transistor 14, the first and second input lines are interconnected by resistor 10 which can be a 1K resistor or equivalent. Transistor 14 can be a 2N3906 transistor or equivalent. The collector of transistor 14 is interconnected by a feedback loop through resistor 16 which can be a 3.3K resistor or equivalent to first input line 42 between capacitor 12 and the base of transistor 14. On second input line 44 after resistor 10 is battery 20 which can be a 1.5 volt AA penlight batter. The emitter of transistor 14 is interconnected on the second input line 44 between resistor 10 and battery 20 which interconnection point 40 is grounded. First output line 46 extends from the collector of transistor 14 and second output line 48 extends from the negative pole of battery 20 between which output lines are interconnected diode 18 which can be a 1N34A germanium point contact diode or equivalent. After diode 18, output 22 is interconnected by a jack direct connection or equivalent means to cable 36 to carry the signal to earphones 28. The transistor and its related circuitry amplify the input signal while diode 18 acts as a sound dampener cutting off the amplitude of louder signals making their sound softer at the output while not effecting the amplified lower volume signals. When the device is not in use there is no power drain on the battery as the circuit only becomes operative when the earphone is plugged into the output jack or if the earphones have a direct connection, then when the input cable 32 is plugged into the metal detector.

Although the present invention has been described with reference to particular embodiments, it will be apparent to those skilled in the art that variations and modifications can be substituted therefor without departing from the principles and spirit of the invention.

#### I claim:

1. An accessory device for use with a metal detector of the type using earphones, said device being connected to the audio output of said metal detector comprising:

means to amplify low audio signals from said audio output to easily audible levels;

means to dampen loud signals causing those signals to be softer, said device including:

a casing;

means to releasably attach said casing to said metal detector;

a first cable means to attach to said audio output and carry said signal to said casing;

an electronic circuit within said casing including: an input having a first input line and second input line extending therefrom, said input lines being



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interconnected by said first cable means to said audio output;

a transistor having a base, emitter and collector; said first input line extending to the base of said transistor; 5

said second input line extending to the emitter of said transistor;

a capacitor on said first input line between said input and the base of said transistor; 10

a first resistor, one end of which is attached to said first input line between said capacitor and said input and the second end of which is attached to said second input line between said transistor's emitter and said input; 15

a feedback loop with a second resistor thereon extending from said transistor's collector and said first input line between said capacitor and the base of said transistor; 20

a power source such as a 1.5 volt battery on said second input line;

a ground between said power source and said first resistor on said second input line;

a line interconnecting said transistor's emitter to said ground; 25

a first output line extending from said transistor's collector;

a second output line extending from said power source; 30

said means for dampening loud signals including:

a diode having its first end connected to said first output line and its second end connected to said second output line; and 35

a second cable means attaching said first and second output lines to said earphones.

2. An accessory device for use with a metal detector of the type using earphones to improve the sensitivity tuning of said detector's coils, said device being connected to the audio output of said metal detector comprising: 40

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means to amplify low audio tuning signals from said audio output to an easily audible level to balance the coils in the search head including:

a casing;

means to releasably attach said casing to said metal detector;

a first cable means to attach to said audio output and carry said signal to said casing;

an electronic circuit within said casing including:

an input having a first input line and second input line extending therefrom, said input lines being interconnected by said first cable means to said audio output;

a transistor having a base, emitter and collector; said first input line extending to the base of said transistor;

said second input line extending to the emitter of said transistor;

a capacitor on said first input line between said input and the base of said transistor;

a first resistor, one end of which is attached to said first input line between said capacitor and said input and the second side of which is attached to said second input line between said transistor's emitter and said input;

a feedback loop with a second resistor thereon extending from said transistor's collector and said first input line between said capacitor and the base of said transistor;

a power source such as a 1.5 volt battery on said second input line;

a ground between said power source and said first resistor on said second input line;

a line interconnecting said transistor's emitter to said ground;

a first output line extending from said transistor's collector;

a second output line extending from said power source; and

a second cable means attaching said first and second output lines to said earphones.

\* \* \* \* \*

**United States Patent** [19]  
**Bernzweig**

[11] **Patent Number:** **4,644,290**  
[45] **Date of Patent:** \* **Feb. 17, 1987**

[54] **METAL DETECTOR AUDIO AMPLIFIER**

[76] **Inventor:** **David S. Bernzweig**, 24 Raleigh Rd., Framingham, Mass. 01701

[\*] **Notice:** The portion of the term of this patent subsequent to Jun. 10, 2003 has been disclaimed.

[21] **Appl. No.:** **829,237**

[22] **Filed:** **Feb. 14, 1986**

**Related U.S. Application Data**

[63] Continuation-in-part of Ser. No. 531,295, Sep. 12, 1983, Pat. No. 4,594,559.

[51] **Int. Cl.<sup>4</sup>** ..... **H03F 1/26; G01V 3/11**

[52] **U.S. Cl.** ..... **330/149; 324/329**

[58] **Field of Search** ..... 330/278, 279, 149; 328/171; 307/559; 324/326-329

[56] **References Cited**

**U.S. PATENT DOCUMENTS**

4,376,267 3/1983 Chu et al. .... 330/284

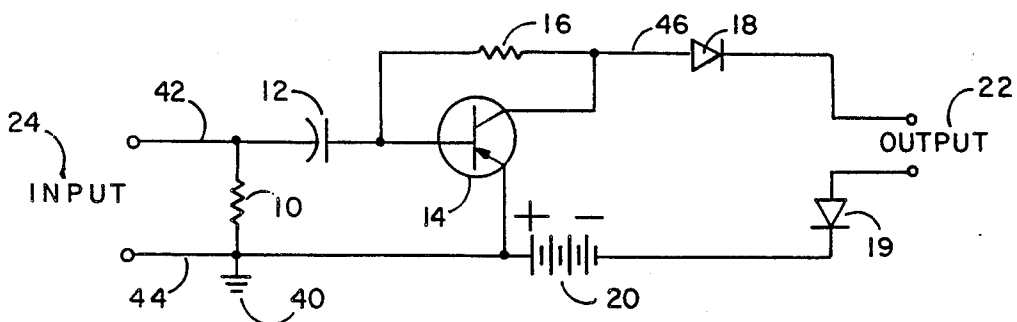
*Primary Examiner*—Gene Wan

*Attorney, Agent, or Firm*—William Nitkin

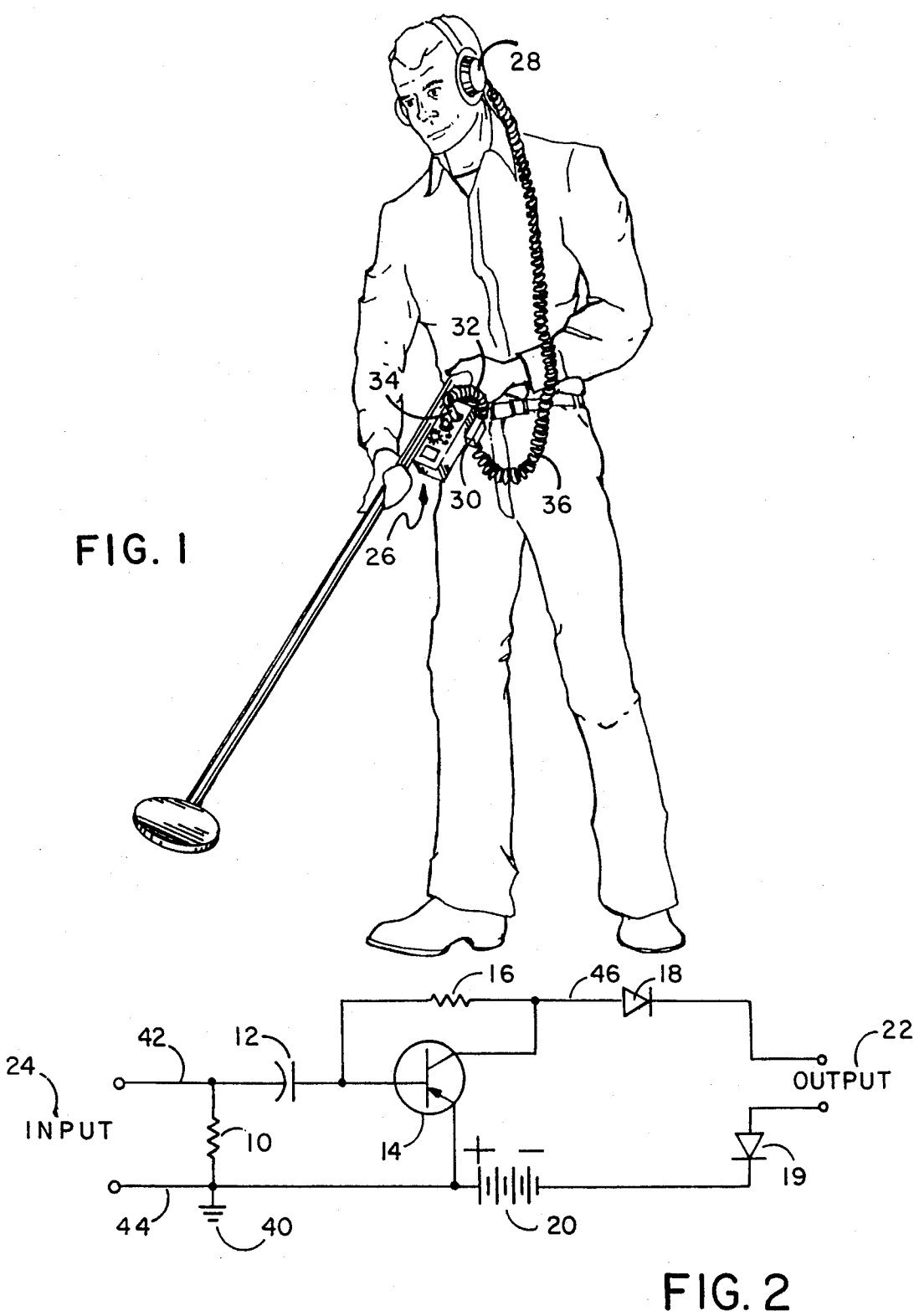
[57] **ABSTRACT**

An accessory device for use with a metal detector with means to amplify the low, barely audible audio output of the metal detector so that it can be easily heard with further means to dampen louder audio output signals causing those signals to be softer.

**5 Claims, 6 Drawing Figures**







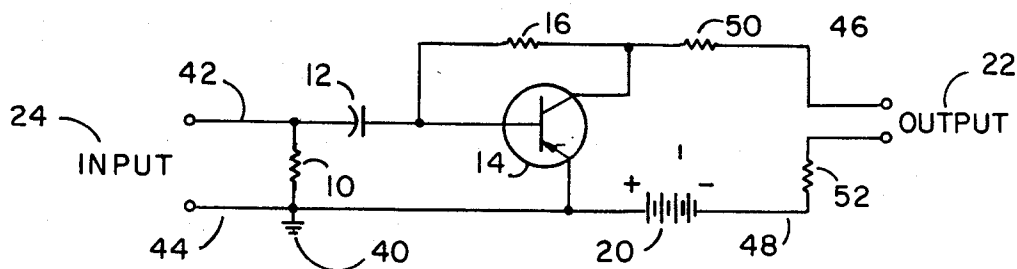


FIG. 3

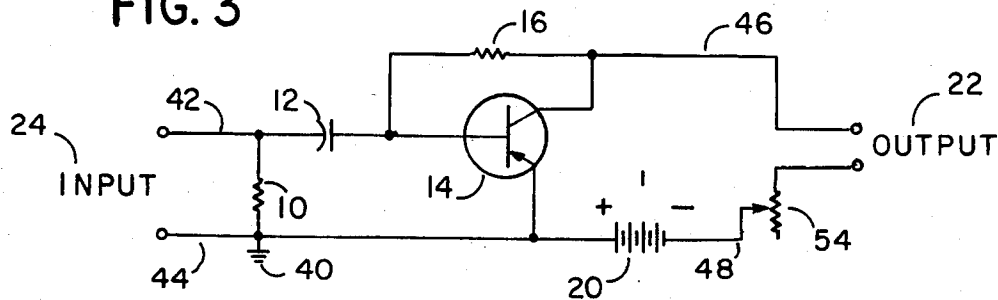


FIG. 4

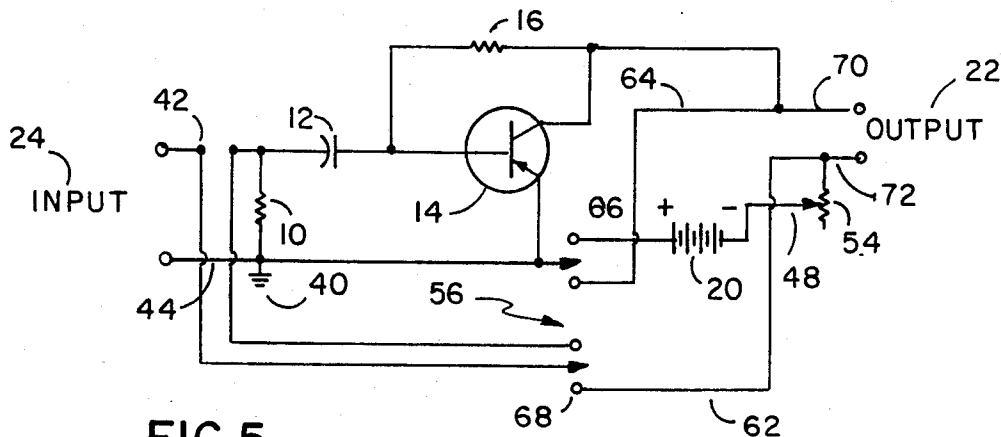
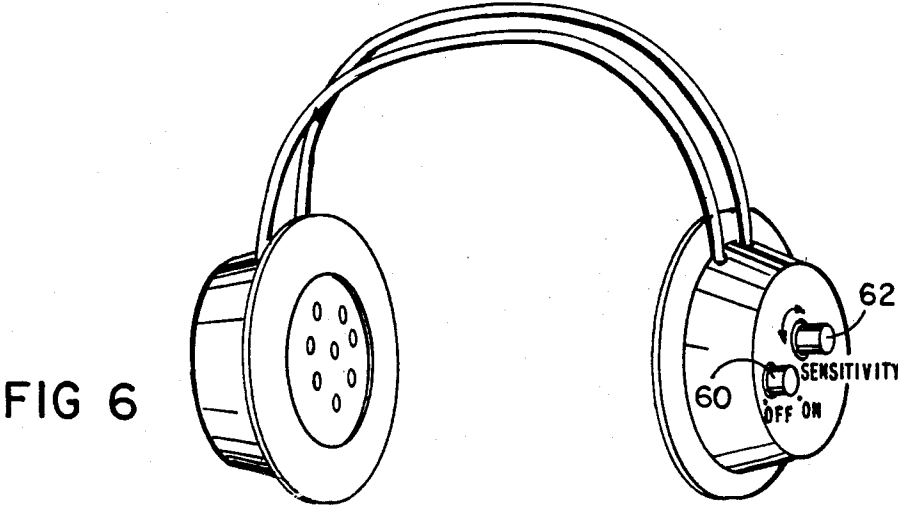


FIG. 5



## METAL DETECTOR AUDIO AMPLIFIER

This application is a continuation-in-part of my previous application of the same title filed 9/12/83, Ser. No. 5 531,295 now U.S. Pat. No. 4,594,559.

### BACKGROUND OF THE INVENTION

#### 1. Field of the Invention

The device of this invention is in the area of metal 10 detectors and more particularly relates to a device provided as an accessory or incorporated into headphones for amplifying the low volume audible signals while dampening signals of above a predetermined volume.

#### 2. History of the Prior Art

Metal detectors used by individuals can emit an audible signal when their search coil passes over buried metal objects. When objects are near the surface, the metal detector produces a loud audible signal while objects that are more deeply buried will cause the detector to emit a softer, less audible signal. These less 20 audible signals often represent more valuable objects such as older coins and artifacts. To hear these less audible signals better, the metal detector user will often use earphones connected to the metal detector which 25 brings the audible signal close to the ear and blocks out other distracting sounds from the environment making it easier for the user to hear the softer signals. Unfortunately when detecting buried metal objects located close to the surface, the loud signal generated can then 30 hurt the user's ears. Further, many times deeply buried objects cause the metal detector to produce an audible signal so soft that even with the aid of earphones, the signals are inaudible.

### SUMMARY OF THE INVENTION

It is an object of this invention to provide an amplifier for metal detectors which amplifies barely audible signals so that they can be easily heard and which also dampens loud signals so that they do not hurt the user's 40 ears. The device in one embodiment can be contained within a small casing which is attached to the metal detector. One method of attachment can be by the use of Velcro strips so that the amplifier is removable and reattachable. A coiled electric cable extends from the device's input and is plugged into the audio output jack of the detector. A line extends from the earphone to the device of this invention and is plugged into the device's 45 output jack. The device can also be incorporated in one embodiment into the headphone of the detector. The device of this invention acts effectively to increase the sensitivity of the metal detector because it increases the user's ability to tune the detector. Typical metal detectors have two wound coils in their search heads, each 50 tuned to the other. A control knob allows the user to adjust the tuning by turning the audible sound created by the two coils down to just where it is no longer audible. If the sound is soft then it may be difficult to fine tune the detector as the tuning may not be perfect. With 60 the signal amplified from the device of this invention, the coils can be more perfectly balanced and the detector will operate with a higher sensitivity than if it were not perfectly tuned.

### BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 illustrates a metal detector in use with the device of this invention which is held within a casing attached thereto.

FIG. 2 is a schematic of one embodiment of the circuit of the device of this invention.

FIG. 3 is a schematic of another embodiment of the circuit of the device of this invention.

FIG. 4 is a schematic of yet another embodiment of the circuit of the device of this invention.

FIG. 5 is a schematic of still yet another embodiment of the circuit of the device of this invention suitable for use in headphones.

FIG. 6 illustrates a headphone incorporating the device of this invention.

### DESCRIPTION OF THE PREFERRED EMBODIMENT(S)

15 FIG. 1 illustrates an individual utilizing a metal detector 26 having the device 30 of this invention held within a casing attached thereto. The device is interconnected to the metal detector by cable 32 with jack 34 inserted into the audio output of the detector. A second cable 36 20 extends from earphone 28 to the jack of the device of this invention. This embodiment of the device of this invention is small and lightweight, does not interfere at all with the use of the metal detector and, as mentioned above, can be attached to the detector by any removable and reattachable means such as by Velcro strips, 25 snaps, slide clips or any equivalent method of fastening.

FIG. 2 illustrates one embodiment of the circuitry of the device with cable 32 not shown to be attached to input 24 carrying the signals of metal detector 26 to input 24. First input line 42 extends from the input 24 to the base of transistor 14. Between input 24 and transistor 14 on line 42 is capacitor 12 which can be a 1 microfarad capacitor or equivalent. Before capacitor 12 on line 42 and before the emitter of transistor 14, the first 30 and second input lines are interconnected by resistor 10 which can be a 1K resistor or equivalent which is grounded at interconnection point 40. Transistor 14 can be a 2N4403 transistor or equivalent. The collector of transistor 14 is interconnected by a feedback loop through resistor 16 which can be a 3.3K resistor or equivalent to first input line 42 between capacitor 12 35 and the base of transistor 14. On second input line 44 after resistor 10 is battery 20 which can be a 1.5 volt AA penlight battery or an equivalent electrical source providing 1.5-3 VDC. The emitter of transistor 14 is interconnected on the second input line 44 between resistor 10 and battery 20. First output line 46 extends from the collector of transistor 14 through diode 18 to one pole of output 22. Diode 18 is directed to conduct electricity 40 away from transistor 14. Second output line 48 extends from the negative pole of battery 20 through diode 19 to the other pole of output 22. Diode 19 is directed to conduct electricity toward battery 20. Output 22 is interconnected by a jack direct connection or equivalent means to cable 36 to carry the signal to earphones 28. 45 The transistor and its related circuitry amplify the input signal while diodes 18 and 19 act as a sound dampener cutting off the amplitude of louder signals making their sound softer at the output while not effecting the amplified lower volume signals. When the device is not in use there is no power drain on the battery as the circuit only becomes operative when the earphone is plugged into the output jack or if the earphones have a direct connection, then when the input cable 32 is plugged into the 50 metal detector.

65 FIG. 3 illustrates an alternate embodiment of a circuit similar to that in FIG. 2 except the diodes are replaced by resistors 50 and 52, each of which can be 22 ohm



resistors or equivalent. This circuit exhibits a faster reaction time than that of the circuit of FIG. 2 and tends to reduce loud sounds more yet allow weak signals to come through with more clarity.

FIG. 4 illustrates an alternate embodiment without the resistors of FIG. 3 but with a variable resistor such as a 100 ohm potentiometer or equivalent. Devices with the circuit of FIG. 4 allow for fine tuning of the potentiometer to the adjustment of the intensity of the strong and weak signals from the metal detector.

FIG. 5 shows an alternate version from that illustrated in FIG. 4 with switch 56 to turn the circuit on or off when desired. When switch 56 is off, input 24 is connected directly to output 22. Switch 56 can be a double pole double throw switch of either slide or rotary type which when on allows the device of this invention to be used in the circuit and one can then adjust the potentiometer as reviewed above to the best setting for his hearing. Line 42 is directed down line 58 to first pole 68 of switch 56 which switch when in a down position connects line 42 to line 62 which extends to line 72 being one pole of outlet 22. When switch 56 is in an up position, it directs the signal from line 58 back to line 42 along line 60 for the device of this invention to be engaged. Line 44 from input 24 extends to the second pole of switch 56 and when in a down position connects to line 64 which runs to line 70 being the other pole of outlet 22 so that when switch 56 is in a down position, input 24 is connected directly to output 22 and the device of this invention is bypassed. When second pole 66 of switch 56 is in an upwards position, it completes line 44 to battery 20 and when first pole 68 is in an up position, the device of this invention is on.

The device illustrated in FIG. 5 is especially adapted for incorporation directly into headphones and such a headphone is illustrated in FIG. 6. FIG. 6 shows a headphone with off/on switch 60 and sensitivity adjustment 62 corresponding respectively to switch 56 and potentiometer 54.

Although the present invention has been described with reference to particular embodiments, it will be apparent to those skilled in the art that variations and modifications can be substituted therefor without departing from the principles and spirit of the invention.

I claim:

1. An accessory device for use with a metal detector of the type using earphones, said device being connected to the audio output of said metal detector comprising:

means to amplify low audio signals from said audio output to easily audible levels;

means to dampen loud signals causing those signals to be softer including:

a first cable means to attach to said audio output and carry said signal to said device;

an electronic circuit within said device including:

an input having a first input line and second input line extending therefrom, said input line being interconnected by said first cable means to said audio output;

a transistor having a base, emitter and collector; said first input line extending to the base of said transistor;

said second input line extending to the emitter of said transistor;

a first resistor, one end of which is attached to said first input line between said capacitor and said input and the second end of which is attached to said second input line between said transistor's emitter and said input;

a feedback loop with a second resistor thereon extending from said transistor's collector and said first input line between said capacitor and the base of said transistor;

a power source such as a 1.5 volt battery on said second input line;

a ground between said power source and said first resistor on said second input line;

a line interconnecting said transistor's emitter to said ground;

a first output line extending from said transistor's collector;

a second output line extending from said power source;

said means for dampening loud signals including:

a first diode on said first output line directed to conduct electricity away from said transistor's collector;

a second diode on said second output line directed to conduct electricity toward said power source; and

a second cable means attaching said first and second output lines to said earphones.

2. An accessory device for use with a metal detector of the type using earphones, said device being connected to the audio output of said metal detector comprising:

means to amplify low audio signals from said audio output to easily audible levels;

means to dampen loud signals causing those signals to be softer including:

a first cable means to attach to said audio output and carry said signal to said device;

an electronic circuit within said device including:

an input having a first input line and second input line extending therefrom, said input line being interconnected by said first cable means to said audio output;

a transistor having a base, emitter and collector; said first input line extending to the base of said transistor;

said second input line extending to the emitter of said transistor;

a capacitor on said first input line between said input and the base of said transistor;

a first resistor, one end of which is attached to said first input line between said capacitor and said input and the second end of which is attached to said second input line between said transistor's emitter and said input;

a feedback loop with a second resistor thereon extending from said transistor's collector and said first input line between said capacitor and the base of said transistor;

a power source such as a 1.5 volt battery on said second input line;

a ground between said power source and said first resistor on said second input line;

a line interconnecting said transistor's emitter to said ground.

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a second output line extending from said power source;

said means for dampening loud signals including:

- a third resistor on said first output line;
- a fourth resistor on said second output line;

and

a second means attaching said first and second output lines to said earphones.

3. An accessory device for use with a metal detector of the type using earphones, said device being connected to the audio output of said metal detector comprising:

means to amplify low audio signals from said audio output to easily audible levels:

means to dampen loud signals causing those signals to be softer including:

a first cable means to attach to said audio output and carry said signal to said device;

an electronic circuit within said device including:

an input having a first input line and second input line extending therefrom, said input line being interconnected by said first cable means to said audio output;

a transistor having a base, emitter and collector; said first input line extending to the base of said transistor;

said second input line extending to the emitter of said transistor;

a capacitor on said first input line between said input and the base of said transistor;

a first resistor, one end of which is attached to said first input line between said capacitor and said input and the second end of which is attached to said second input line between said transistor's emitter and said input;

a feedback loop with a second resistor thereon extending from said transistor's collector and said first input line between said capacitor and the base of said transistor;

a power source such as a 1.5 volt battery on said second input line;

a ground between said power source and said first resistor on said second input line;

a line interconnecting said transistor's emitter to said ground;

a first output line extending from said transistor's collector;

a second output line extending from said power source;

said means for dampening loud signals including: an adjustable variable resistor on said second output line; and

a second cable means attaching said first and second output lines to said earphones.

4. An accessory device for use with a metal detector of the type using earphones, said device being connected to the audio output of said metal detector comprising:

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means to amplify low audio signals from said audio output to easily audible levels:

means to dampen loud signals causing those signals to be softer including:

a first cable means to attach to said audio output and carry said signal to said device;

an electronic circuit within said device including:

an input having a first input line and second input line extending therefrom, said input line being interconnected by said first cable means to said audio output;

a transistor having a base, emitter and collector; said first input line extending to the base of said transistor;

said second input line extending to the emitter of said transistor;

a capacitor on said first input line between said input and the base of said transistor;

a first resistor, one end of which is attached to said first input line between said capacitor and said input and the second end of which is attached to said second input line between said transistor's emitter and said input;

a feedback loop with a second resistor thereon extending from said transistor's collector and said first input line between said capacitor and the base of said transistor;

a power source such as a 1.5 volt battery on said second input line;

a ground between said power source and said first resistor on said second input line;

a line interconnecting said transistor's emitter to said ground;

a first output line extending from said transistor's collector;

a second output line extending from said power source;

said means for dampening loud signals including: an adjustable variable resistor on said second output line;

a double pole throw switch having its first pole interconnected in a first position to break said first input line and direct said first input to said second output line and in its second position, to maintain continuity in said first input line to said base of said transistor, and having its second pole interconnect in its first position said second input line to said first output line and in its second position to maintain continuity of said second input line to said power source; and

a second cable means attaching said first and second output lines to said earphones.

5. The device of claim 4 wherein said device is contained within an earphone including an off/on switch corresponding to said double pole double throw switch and a volume control being the adjustment of said adjustable variable resistor.

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