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

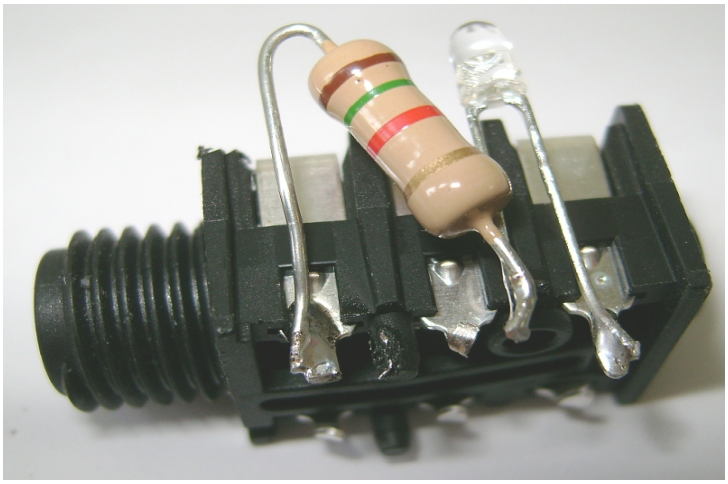
Step 1:
Remove earmuffs from headband.
Pull earmuff covers off, very easy.
Remove foam.

Step 2:
Mark holes for phone jack, volume control pots, crossover wire.

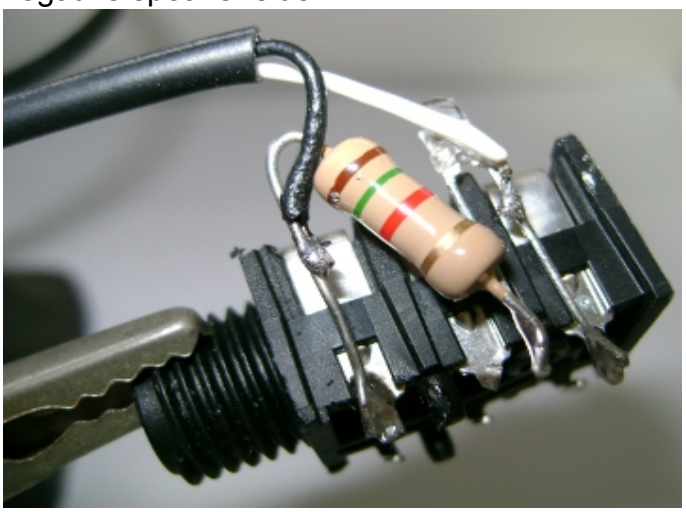
Drill holes, I used special drill bits for plastic. They drill perfect holes without melting the plastic.
Fit parts.

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.

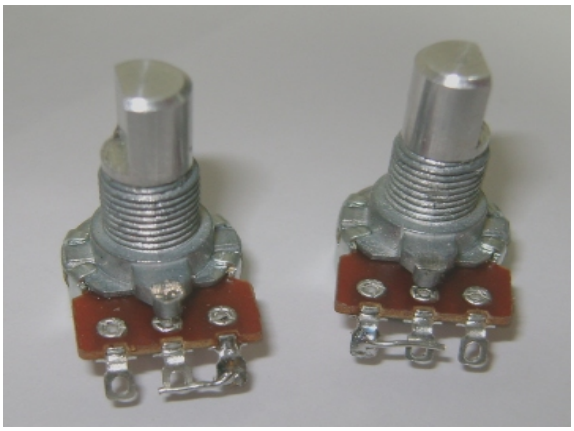


Solder two white wires to the LED leg that goes to the rear tab, one goes to the one end of potentiometer. The other white wire will be from the crossover wire that goes to the other pot in the other ear cup.
Solder two black wires to the resistor leg of the front tab. One wire will go to the negative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

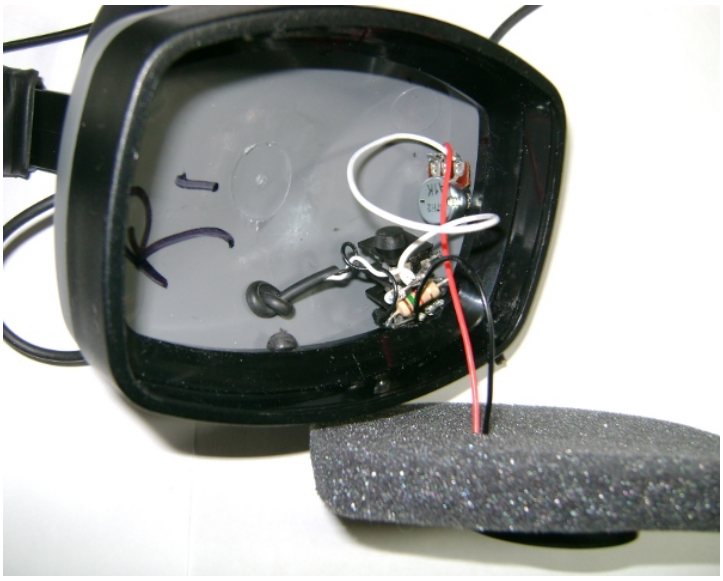


If not using the limiter, just wire white wires to rear jack tabs. And the black wires to the front jack tabs.

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



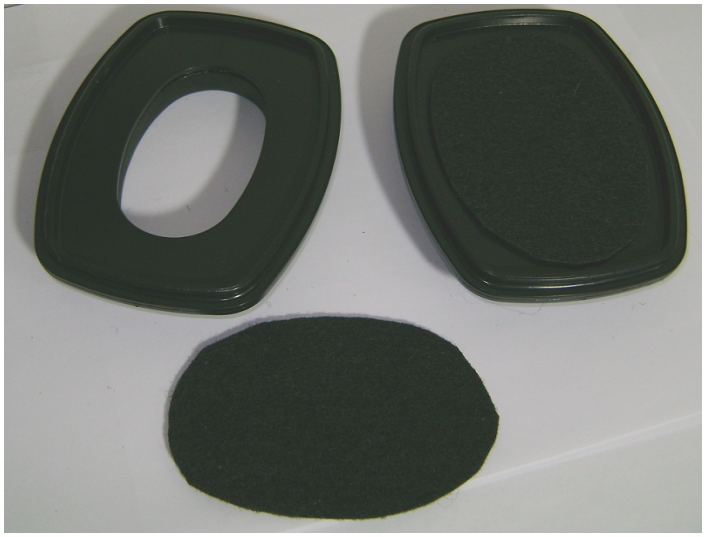
Run your crossover wire through the hole in the earcup. Adjust your cross over wire, so it's not too loose or too tight. I ran the crossover wire through some shrink tubing on the earcup frame to keep them tucked in neatly. Take a crosswire and feed it through the headband sleeve.
It may take some time.



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 deading 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:

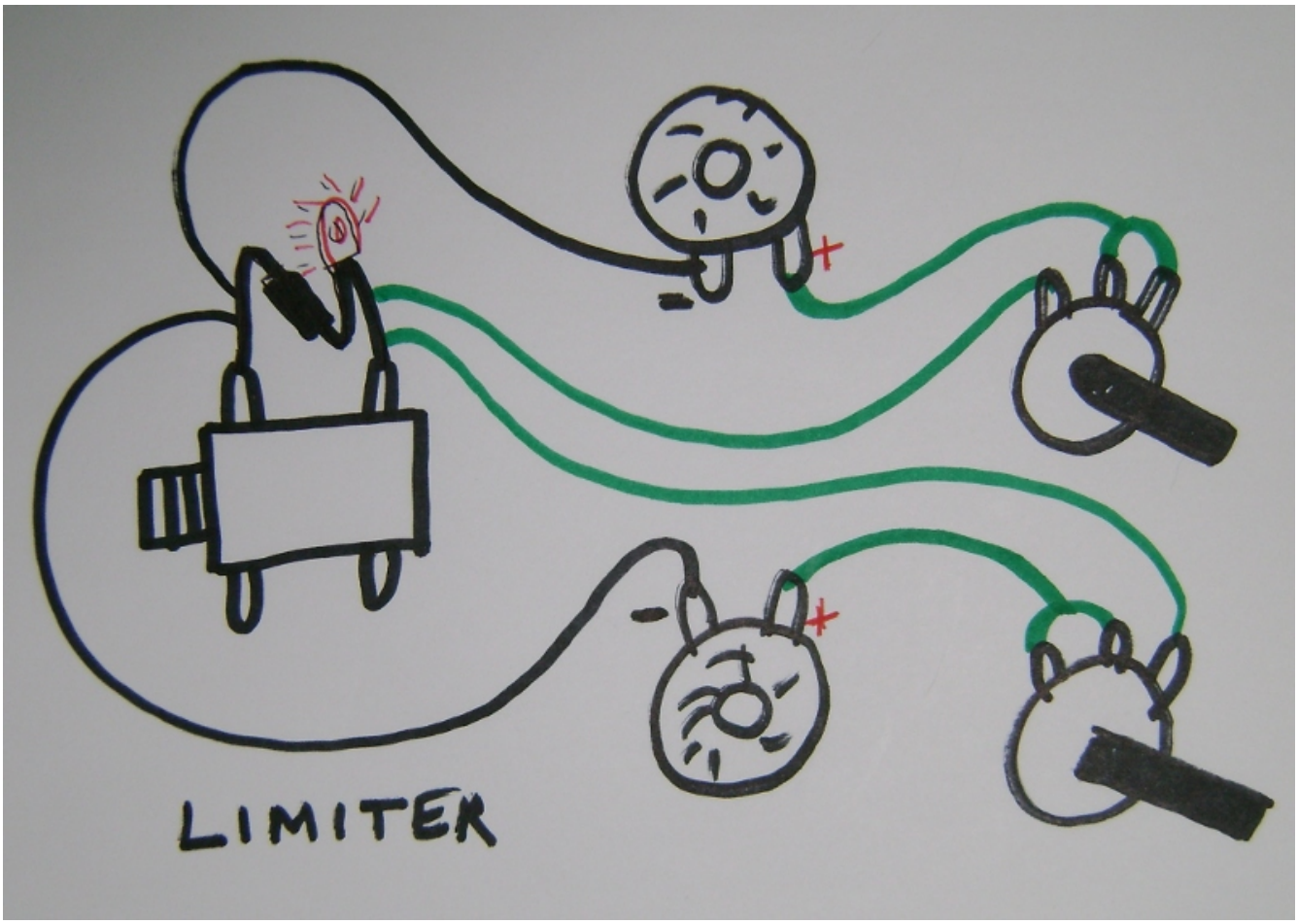
Thunder 29 new from Ebay.....$4.00
2 potentiometers.....2 x $2.16 = $4.32
Phone jack and nut.....$0.65
2 Speakers.....$5.14
Resistor and LED.....$0.50
Wire, shrink tubing, knobs, left over from other projects... $0.00
Guitar Cord.....$14.99

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

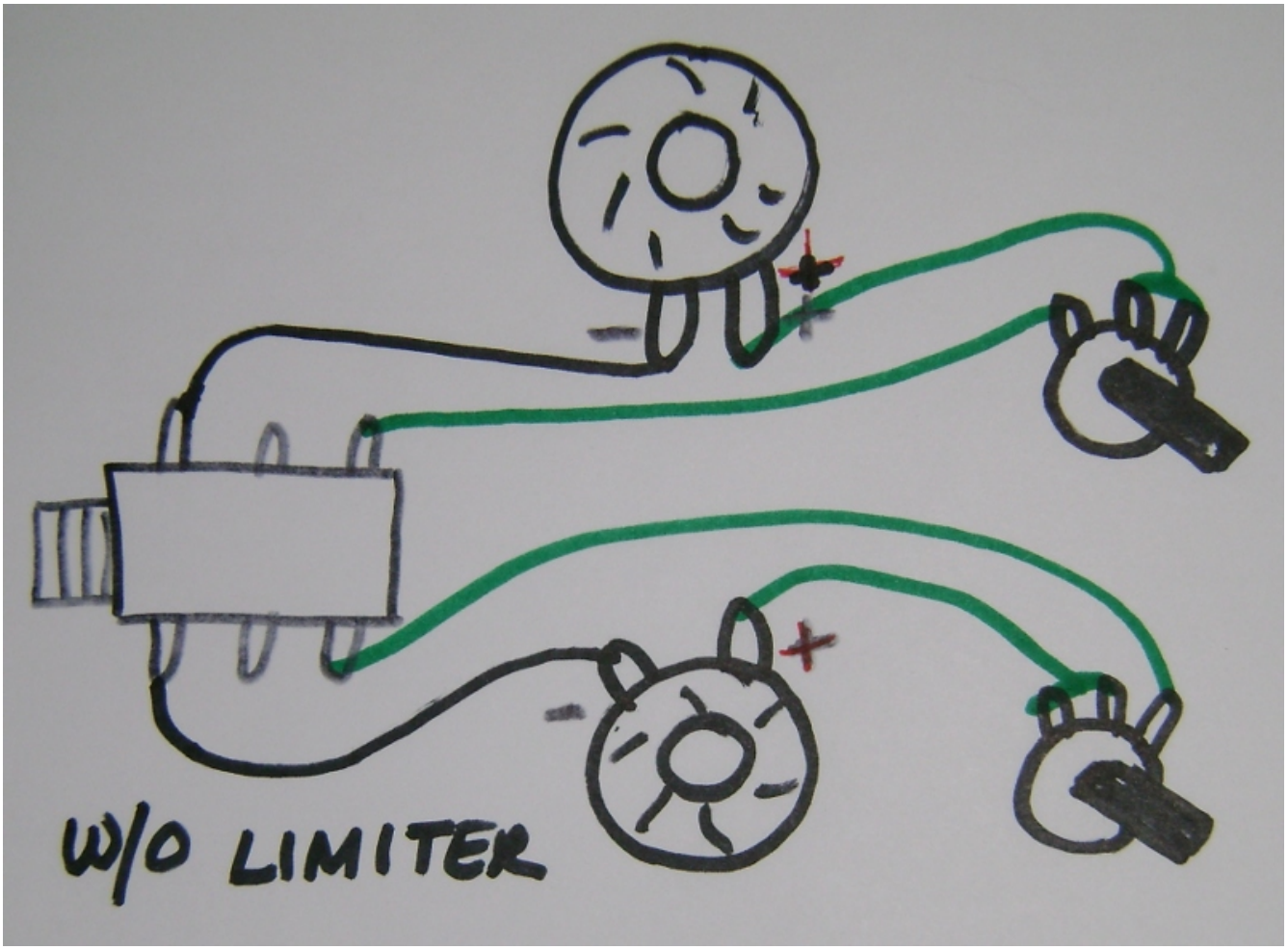


REVISION May 29, 2010

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.

Without Limiter



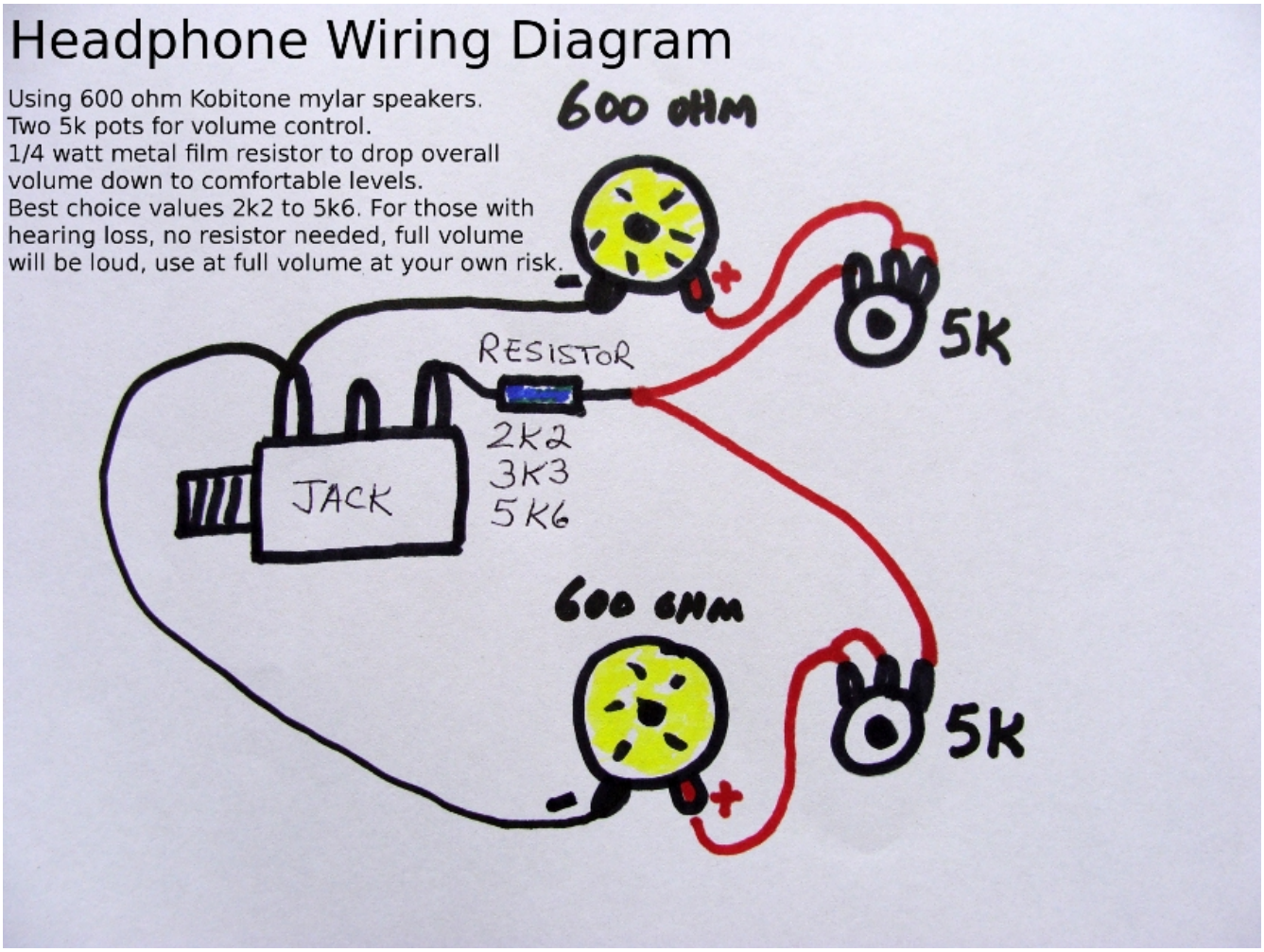
Volume Too Loud??

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 ¼ watt. Or the volume power coming from the detector will wear out the wiper inside the pot. Then add a ¼ resistor in line to reduce volume at low and high potentiometer settings. You can taylor 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.

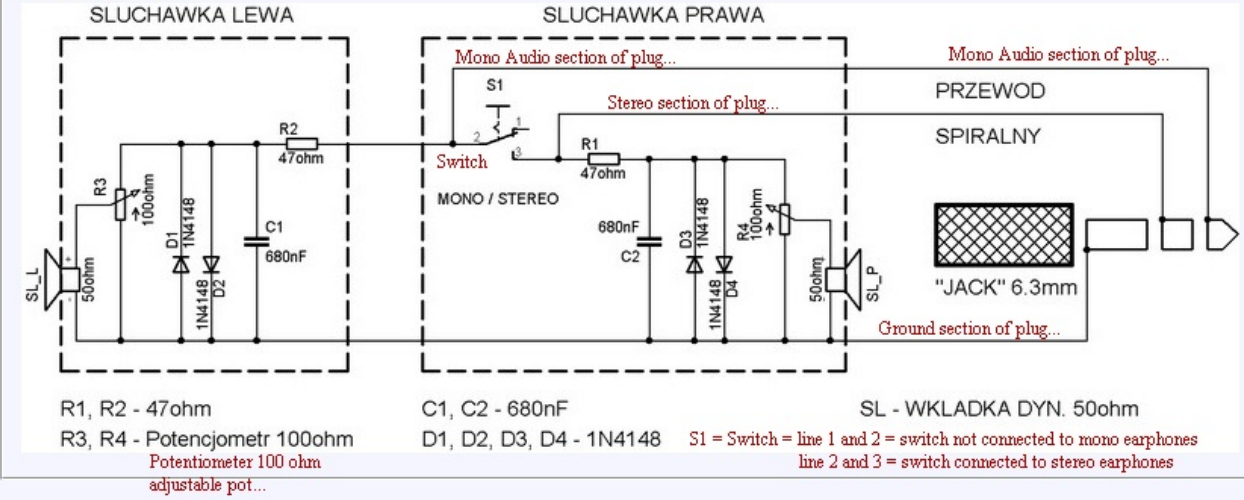
If you don't have Audio pots on hand, you can also use Linear pots. I was told no real advantage in detector headphones if you use Audio.



Mrand
Member

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

Attached Images

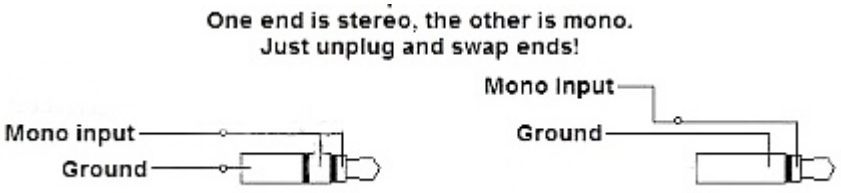


MONO TO STEREO PLUG

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.

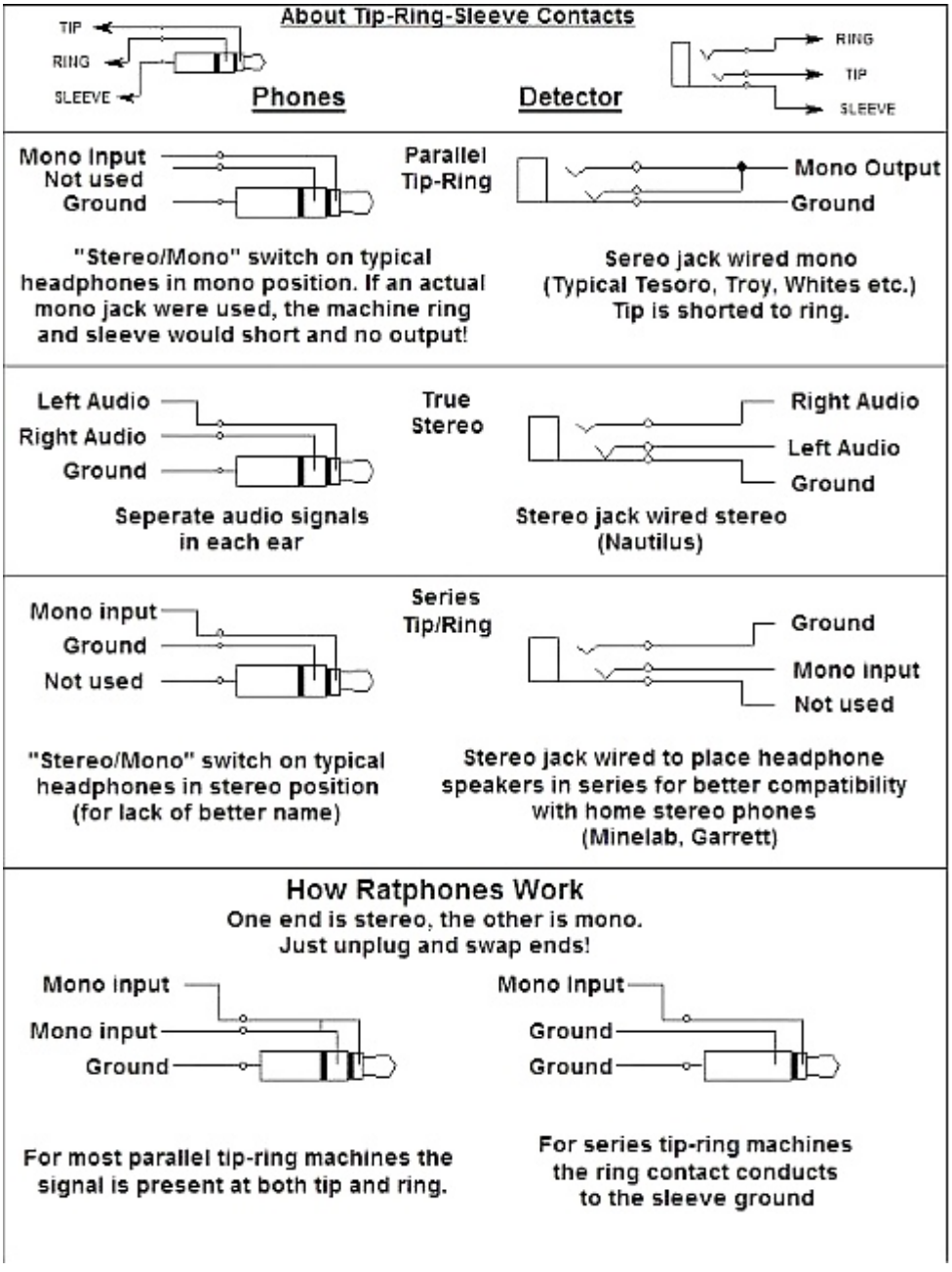


Stereo Plug **Mono Plug**

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



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**

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

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

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

[51] **Int. Cl.**[4] **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

[56] **References Cited**

U.S. PATENT DOCUMENTS

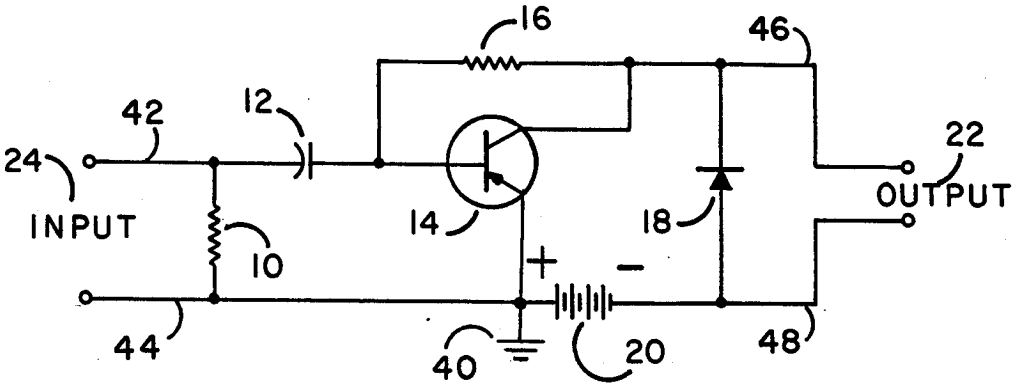
4,376,267	3/1963	Chu et al.	330/284
4,486,712	12/1984	Weber	324/329

Primary Examiner—James B. Mullins
Assistant Examiner—G. 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.

2 Claims, 2 Drawing Figures



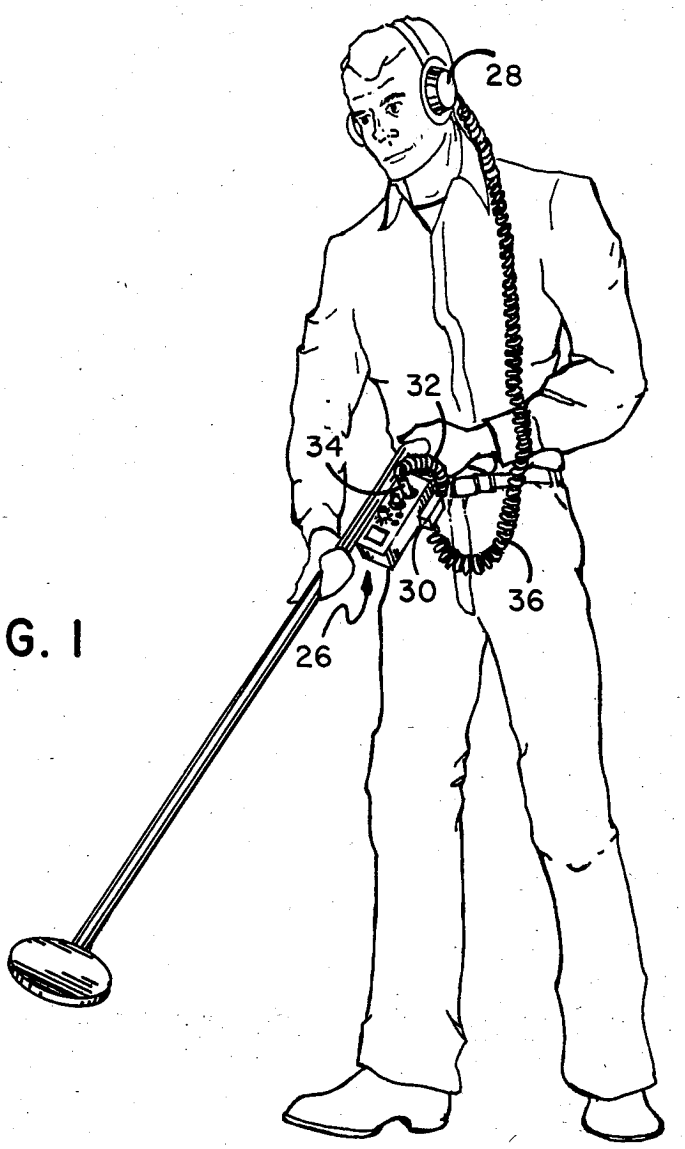


FIG. 1

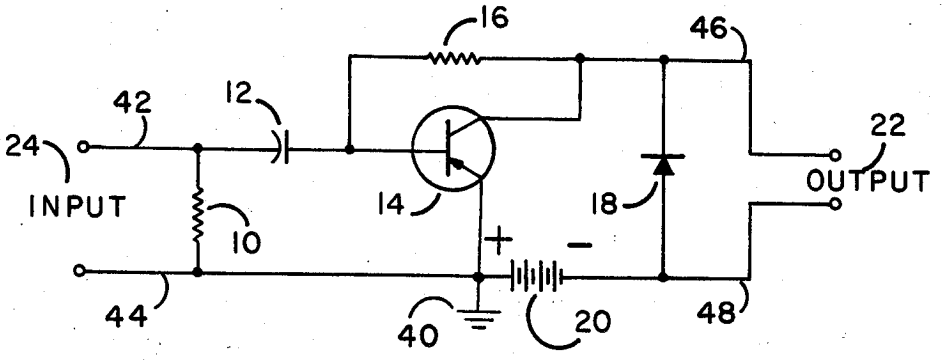


FIG. 2

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 were 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 detector 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

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:
a diode having its first end connected to said first output line and its second end connected to said second output line; 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 to improve the sensitivity tuning of said detector's coils, said device being connected to the audio output of said metal detector comprising:
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 wth 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.**[4] **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

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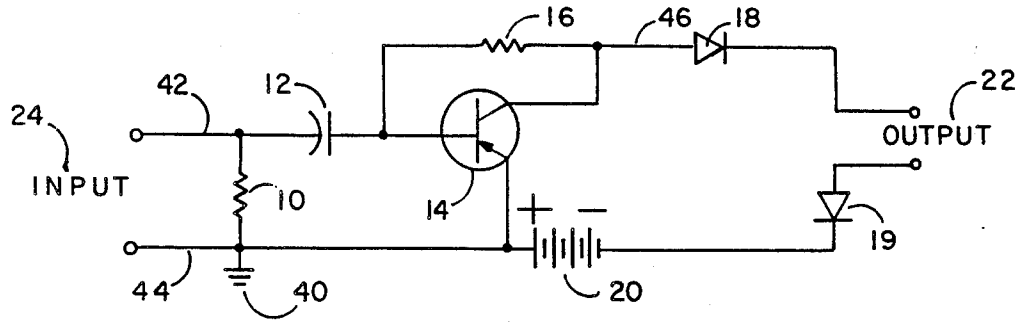
5 Claims, 6 Drawing Figures



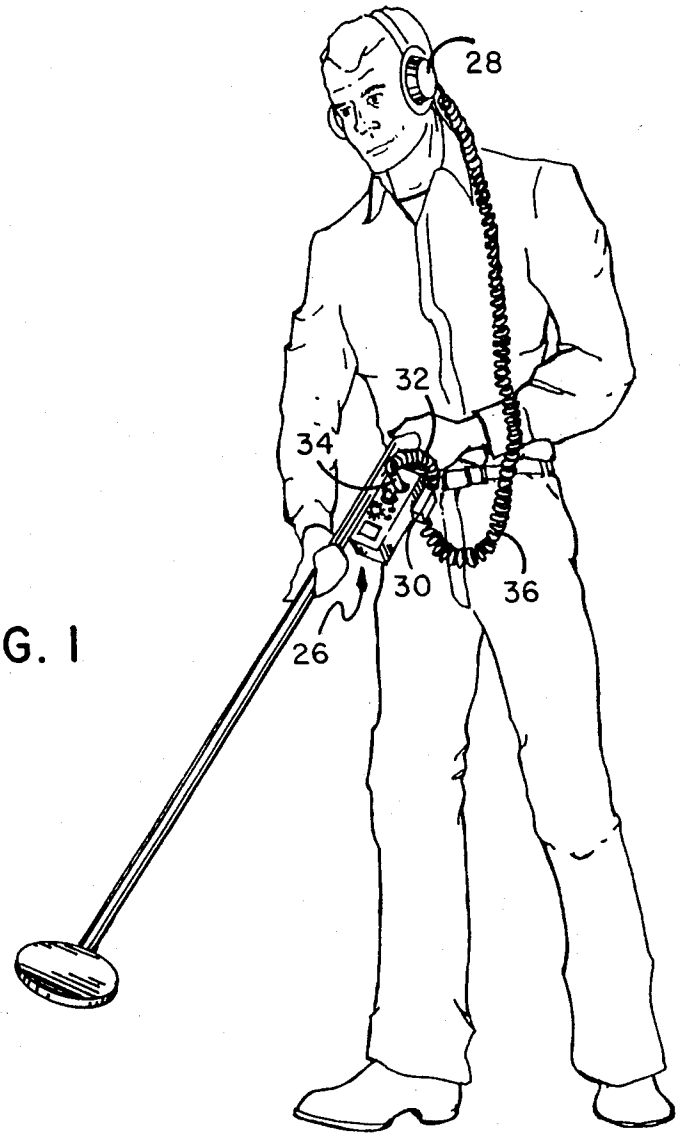


FIG. 1

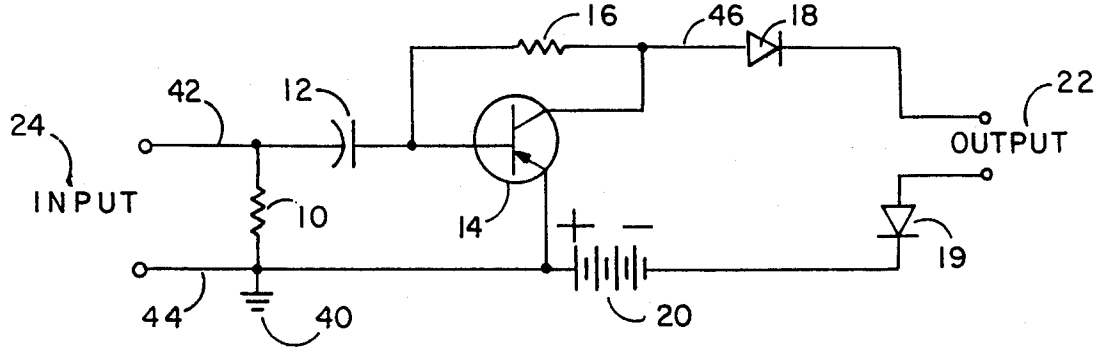


FIG. 2

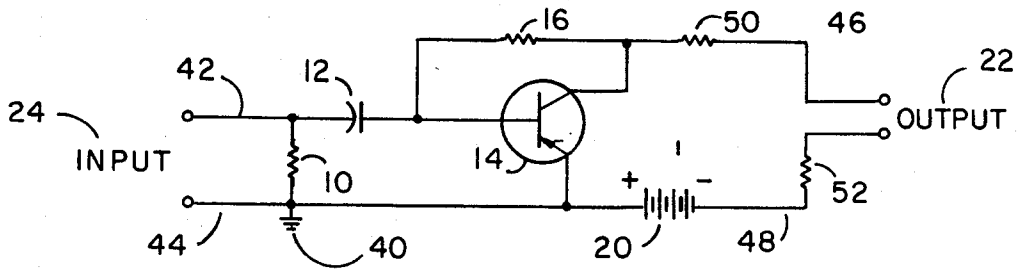


FIG. 3

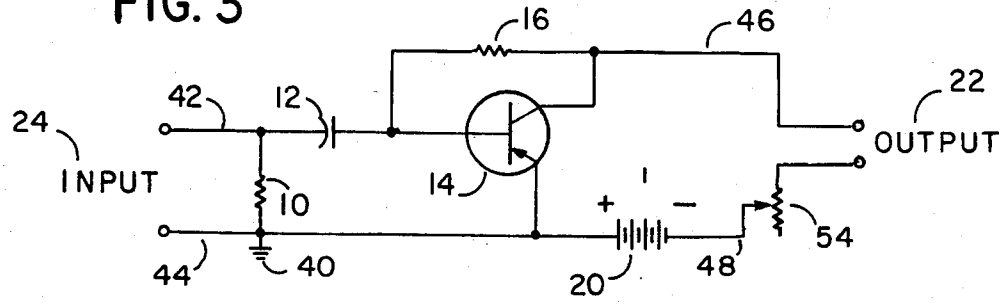


FIG. 4

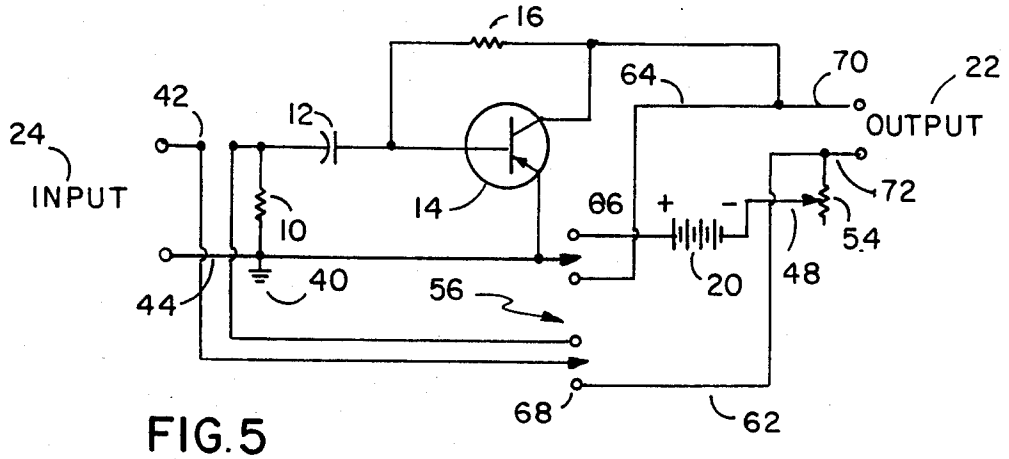


FIG. 5

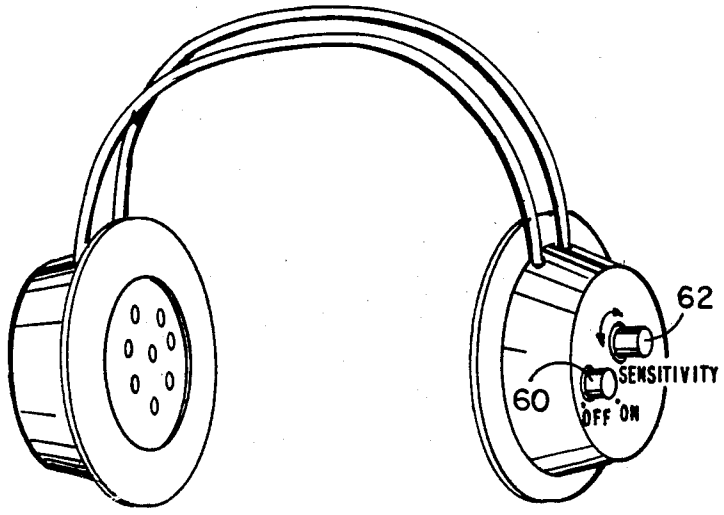


FIG 6

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. 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 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

Meal 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 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 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 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, eacn 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 were 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 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)

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** 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, 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 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** 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 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 directd 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**. 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 metal detector.

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 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:

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

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:

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.

* * * * *

Dual Volume Ratphones

RatPhones Dual Volume (Independent speaker controls)
Choose dual volume when you need to adjust volume in each ear independently.
New Pro-Form Leather ear cushions and headband!
Ratphones now offer Extreme comfort and isolation that cannot be beat!
Will not crack or harden. RatPhones
Sealed industrial controls! RatPhones Dual Volume (Independent speaker controls)

List $145.00
Sales Price - ONLY $122.00
ADD TO CART BELOW!

Features:
*Multi-Machine compatible.
*No switches needed. Higher reliability. Just unplug and swap cable ends!
*Compatible with both parallel tip-ring (Tesoro, Troy, Whites , Fisher etc.) and series tip-ring machines. (Minelab, Garrett). *Mono capable on stereo machines (Nautilus).
*20Hz to 20Khz natural response and loud!
*Rare earth cobalt speakers.
*Foldable design for compact storage.
*Sensitivity 117db at 1mW
*Noise reduction rating 28db for extreme isolation.
*270 ohms (285 single, 300 EX), 600 ohm speakers.
*Max in 8.4vac rms (4.2v single, 12v EX).
*1W Cermet sealed controls 250,000 life cycles.
*Aerospace Teflon wiring (600V/200°C)
*Replaceable pro grade polyurethane Cable.
*Dual low profile molded right angle plugs.
*Cable length 3 to 12 ft. (retracted/extended)
*Quality jack with gold plated contacts.
* Head weight 10.72 ounces. That's 1.28 Oz lighter than other brands and you still get the full 28db cup.
*Lifetime limited warranty!
*Custom stereo and limiter circuit available.
*Complete with warranty, instructions & Rat tail.

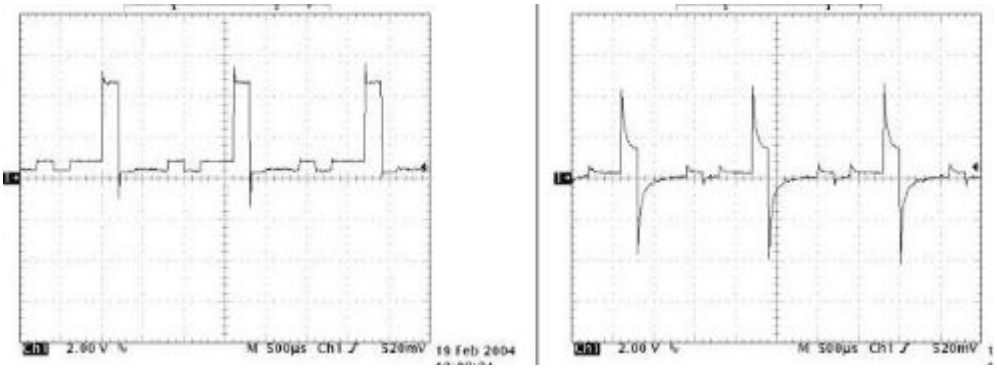
Do your headphones sound a little like tin cans?

This is why:
On the right is an oscilloscope picture of what you hear in a set of typical narrow frequency response headphones.

On the left is Ratphones reproducing exactly what your machine is sending.

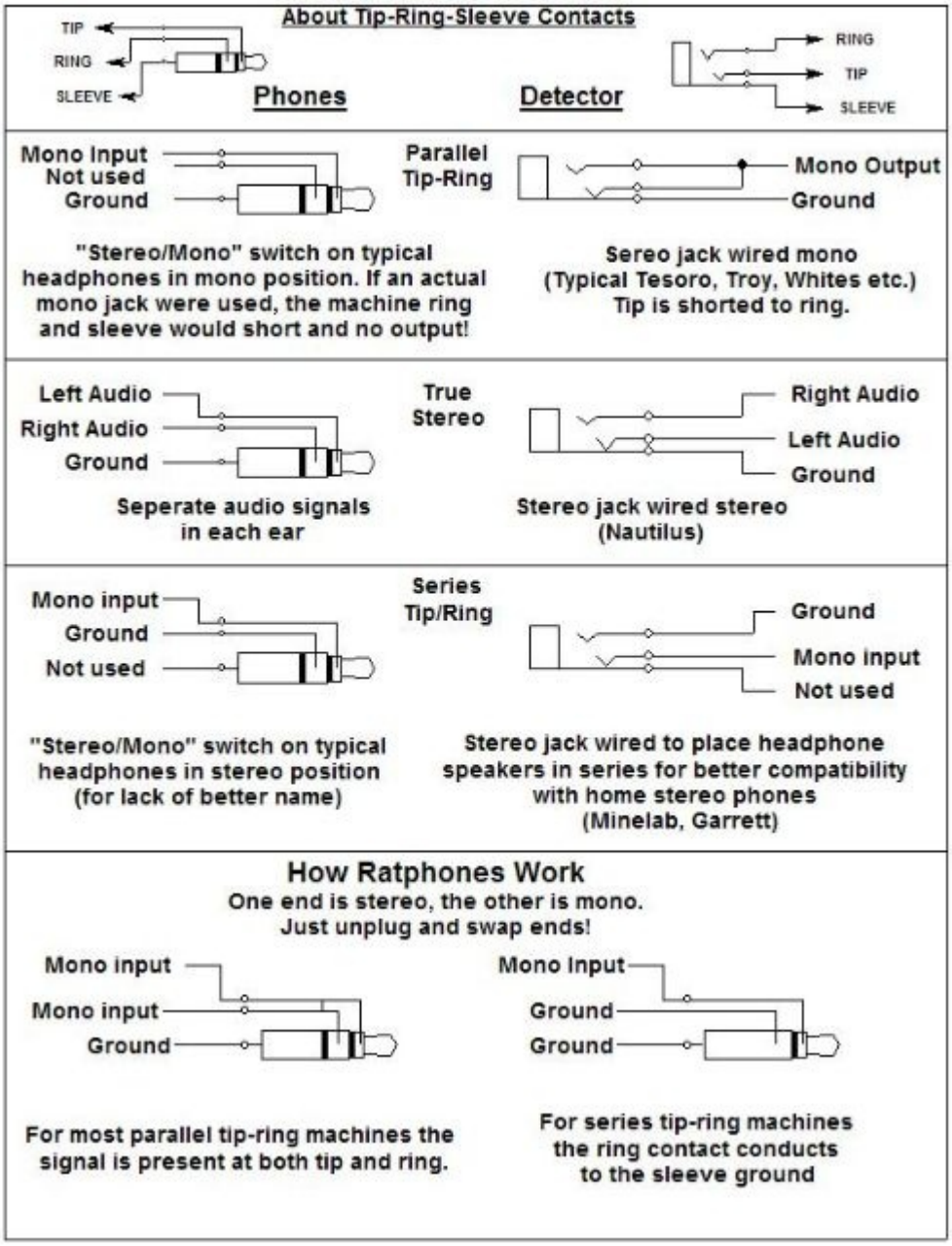
Why not hear every signal as it was intended?

In a comfortable, well built, high isolation set of Ratphones!
Get up close and personal with your machine and find more targets.



The mystery of the Stereo/mono switch
(This will probably confuse most, but here it is).

Detector headphone switches are not really stereo/mono switches.
The ground conductor is what is switched to make the phones
either series tip/ring or parallel tip/ring as seen below.



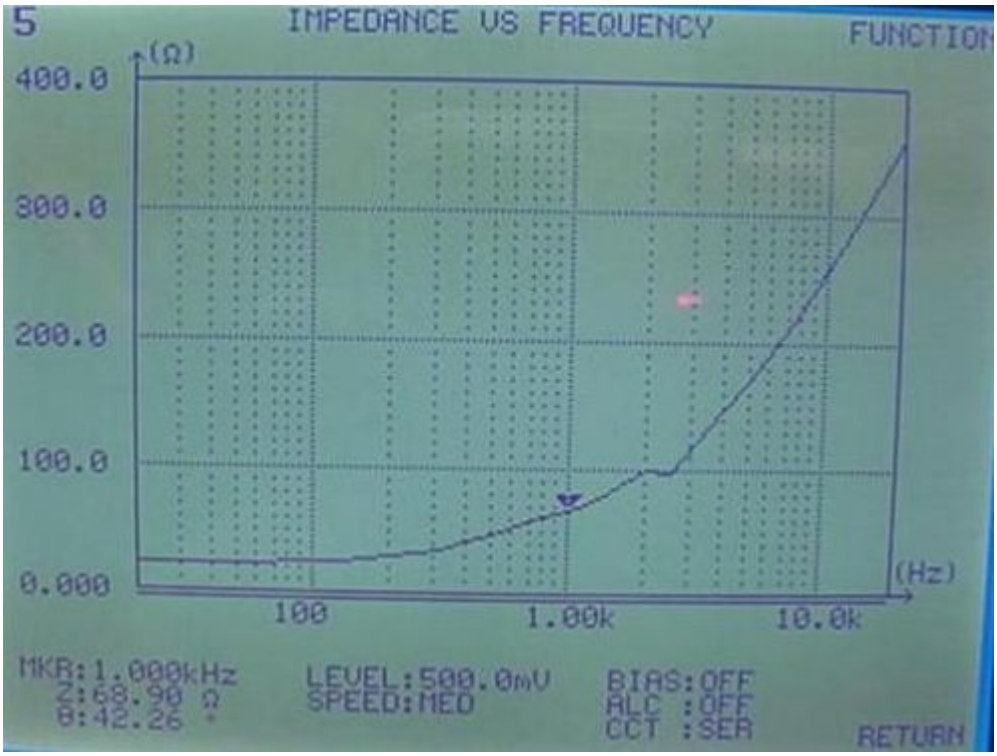
TIP:
You can make your own emergency Rat Tail
with a coiled guitar cord
and an adapter (stereo plug to mono jack) for the machine side.
Adapter not needed for Minelab or Garret machines.

Headphone specs and advertising
by Rick Viola
Detect USA

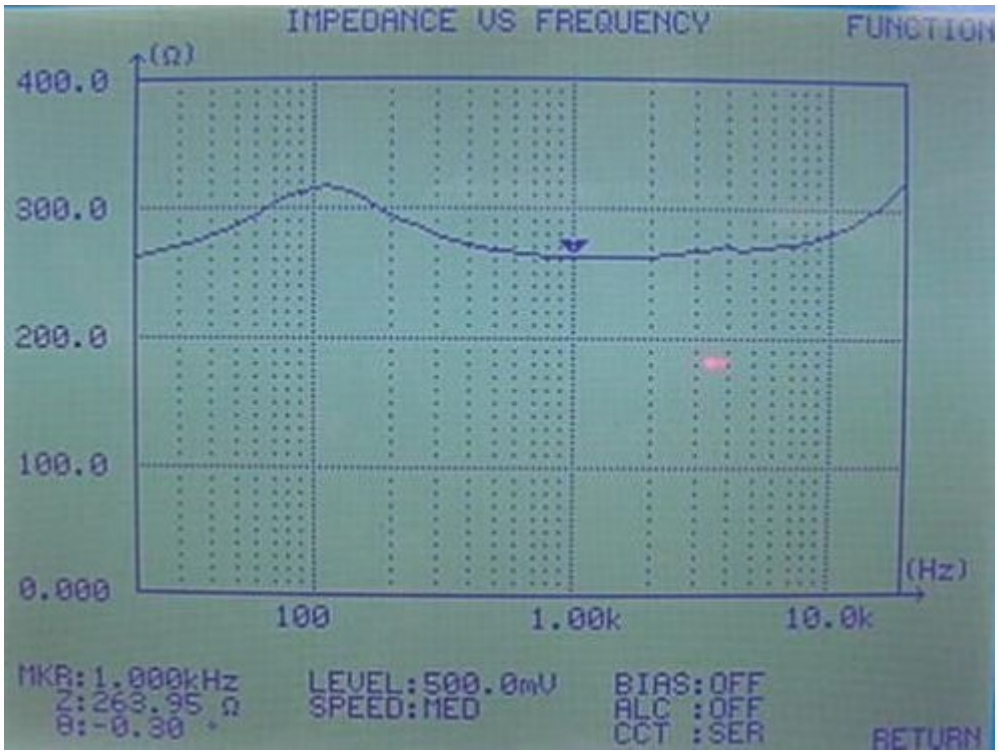
Impedance

The most confusing spec to understand and advertisers make it even more confusing. Basically, you get the most power to the speakers when the headphone impedance matches the machine. What is the machine impedance? Well, it varies with the manufacturer. Many machines are 150 ohms and a few are 300 ohms. However, headphone advertisers seem to often claim 150 ohms. Well, that may be the impedance of the speakers used, however, unless you are swinging a true stereo machine (there are very few) your headphone speakers are in parallel. This makes your so called 150 ohm headphones really 75 ohm headphones. There are also so called 100 ohm headphones that, you guessed it, are really 50 ohms when you connect to a typical machine. The further away you get (up or down) from the machine impedance, the less volume you get. This will most likely affect distortion also, making the sound you hear further away from the sound that was intended.

Here is a scan of impedance through the entire audio range of so called 150 ohm headphones with the usual speakers. Impedance numbers are on the left.

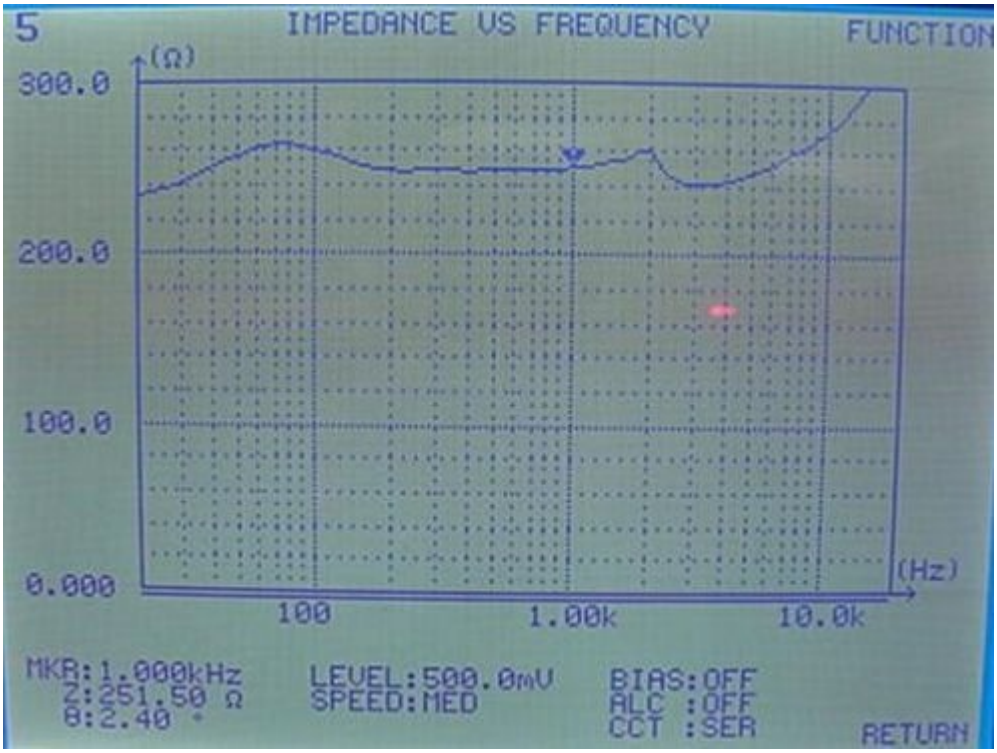


Here's Ratphones. More constant though the entire audio spectrum:



Then there is Minelab. Some of their output circuits actually vary impedance depending on the headphones. Minelabs working better on low impedance headphones is not really correct. Minelab has phones they ship with some machines that say they are 100 ohms. Well since they are stereo that means each speaker is 100 ohms. Minelab machines jacks connect stereo phones in series. That means you are connecting 200 ohms to the machine. So where is the low impedance? The newer Minelabs have better circuitry that is not designed around home stereo headphones!

Here is an impedance plot of Koss UR-30 headphones as connected to a Minelab machine:



So it seems they ship 250 ohm headphones with their machines!

However, impedance matching alone does not make a good sound Other features such as the speaker efficiency, magnets, materials and durability are also important. The final judge will be your own ears. Some customers actually like a loud distorted screech!

Ratphones use 600 ohm speakers resulting in true 270 ohm total impedance delivering more power to the speakers and match a wider range of machines. They draw less power from your batteries, have less distortion and higher clarity.

Speakers And Frequency Response

This is an interesting subject. As you are searching though the specs, see how many 150 ohm (actually 75 ohm as discussed above) have a frequency response of 200 to 3200 Hz. Sound familiar? Well, most of the major brands that I took apart have the exact same speakers! Why not, they have been around a while, they seem to hold up. Yes they have been around because they were developed for telephones. We all know how bad telephones sound. Sure, nice and loud, but a bit distorted. Engineers in those days had the attitude that if the human voice was about in that range then that is all the frequency response you need. Maybe if your name is Alexander Gram Bell. Not for today's electronics. We want to hear every nuance of the sound from soft to loud!

It's also interesting how some headphones are "specially made" for a certain type of detector but have the same speakers. Making phones that only work with machine "x" or "y" by removing the compatibility switch, does not make it optimized.

Ratphones frequency response is 20 Hz to 20KHz which is the full spectrum of human hearing. Believe me, you will hear it! Since Ratphones do not need a switch, the failure rate is greatly decreased, not to mention the replaceable cord. Since the cord is reversible to make them compatible with all machines, there is no need for a switch or to produce a "special" version, except stereo, or maybe a single volume. If you want something different, just let us know.

Ear Muffs

Many headphones we see use three basic styles. They are excellent for metal detecting. No metal parts, comfortable and look stylish. There are two typical ways that earmuffs are rated, NRR (noise reduction rating, North American) and SNR (single number rating, European). They are just different standards based on different test procedures. The SNR is always a little higher that the NRR., so you will hear that number more often in advertising. The original type that appeared has SNR rating of 28 db. The ones with the added an additional plastic piece is 29db. To put that in perspective you need 2 or 3 db to notice a difference. Then there are the "lighter" cups you see that are 24 db. Do they feel lighter on your head? I don't think anyone would really notice. You may notice the slightly more hollow sound due to the thinner plastic. Well, they cost less and are almost as good.

But that's the three major designs. 29, 28 or 24db. That's all. No matter what the ad says. Some like the super light home stereo phones also, which sound good, but are uncomfortable and not really made for outdoors. In the end, it's a personal preference. I'm just saying, if they look the same, they are.

Ratphones use the popular 28 db NRR version in a handsome gloss black. They are professional looking and cartoon picture fee. (Well, just the little RAT logo). The new Pro-Form Leather cushions and headband offer maximum isolation and comfort. The headband is now more flexible to insure uniform contact for any user. The material looks and feels like natural leather without getting hard with age and more comfortable in hot weather.

Limiters

This is a “circuit” that tends not to affect the lower volume sounds and prevents the loud sounds from being too loud. If you have a modulated audio machine that has weak and loud sounds, some users like this. They like to defeat all the time detector companies spend on getting the audio just right, or make up for a machine with too much dynamic audio range.

We will gladly insert our limiter circuit for free. It has a softer, more natural limiting effect. If you are convinced you need it, you've got it.

Switches

Hey, who doesn’t like switches? Sometimes they are necessary to turn features on and off or to make headphones compatible with different wiring schemes of the machines. They will increase the failure rate. The better ones that fail less are very costly (and rarely seen by the way).

Ratphones don’t need a switch.

Circuitry

OK, let's call volume controls, speakers and wires circuitry. Is there much engineering here? In our case, yes.

Ratphones controls have been selected to take less power away from the speakers and still provide a good adjustment range. To do this requires higher resistance controls, or "pots" and to get away with that you need higher power pots. They are industrial sealed and cost 5 times more than the typical low cost carbon commercial control. They will not be affected by moisture, dirt or other elements and the rotation life of these controls is much-much longer. Rated at one watt, makes them unprecedented and just not found in the industry. The max input voltage is 8.4vac rms (4.2v single volume version), where the typical competitor is 2v or 1v for single volume models. We like a little more headroom than that because many machines deliver 1vac rms during battery test tone!

Detents (clicks) are not needed here. They have just the right feel for continuous adjustment to get the exact setting you want. Our wiring is military/aerospace grade adding even more to the value and dependability. The Teflon insulation can endure longer soldering time to insure proper solid connections and resist stress. We even thread our own cross wires with the same wire to insure the quality. No compromises!

Ratphones…something new….really.

Manufactured with a lot of care and thought by Detect USA.

No hype needed. Satisfaction guaranteed.

RATPHONES V.T.F. (Variable Tone Frequency) HEADPHONES

By Sven Stau
2013

These headphones were made in limited quantity. I had one of the first pairs made for my White's MXT & Tesoros with a limiter. All I can say is they were fantastic. They were discontinued as they did not perform well with some detector makes and or models. Since there is some current interest in variable tone control due to personal hearing loss, I have compiled info on the VTF's.

Sorry I sold mine back in 2006. I did contact Rick at one point to see if he could built me another set. At that time the answer was he was not going to build any and just concentrate on his current line of Ratphones. The secret to the VTF's was the circuit board inside the headphones. I obtained pictures of the board in one pair. Unfortuntaly the chip numbers and cap numbers were black out or wiped off, making ID impossible at that time. Rick was so kind, he recently released the schematics to build the circuit board. For those interested in trying to build a VTF, the schematics are in this document along with the pictures. This should prove helpful in wiring.

Anouncing RaTPhones VTF ---2005 Forum Post

> It is finally here! Headphones that can change the tone frequency on your machine!
>
> RaTPhones VTF (Variable Tone Frequency) can actually vary the tone of your metal detector to your liking. What is more incredible is that they do this with no battery.
>
> You heard right, NO BATTERY! The energy already present in the machine output is used to power the circuitry. We use advanced components that did not even exist a few years ago and have taken advantage of new technology to achieve this amazing feat.
>
> Detect USA has done it again with innovative ideas that have never been done before.
>
> RaTPhones VTF are in limited production, but we could not wait to make the announcement and welcome you to email us about this exciting new product.
>
> Will they replace your regular RaTPhones? Are they for everyone?
>
> No.
>
> Most machines are fine the way they are, plus RaTPhones VTF work best on machines that do not have modulated audio, that is, if your machine has low volume audio for deep targets, you will hear the regular tone of your machine for those deep targets at a lower volume than you are used to. Medium to shallow targets will have the new tone that you have selected. You can use the RatPhones VTF to zero in on the medium to shallow targets to cherry pick. On machines without modulated audio, all depths will have the same volume as usual, but now you can change the tone.

Were you ever on an early morning hunt and find yourself not paying attention to your tones? Well, dial in a different frequency and your ears will perk right up!

RaTPhones VTF can be just what you have been looking for. Love your machine but don't like the sound? Get a pair of RatPhones VTF and change it.

RatPhones VTF look exactly the same as Regular RaTPhones that are becoming quite popular and are getting great reviews. The VFT use the same speakers, muffs and innovative replaceable cord. The VTF have two controls. One is for volume and the other for frequency that can be varied between 200 and 1100 Hz.

Again, we are in very limited production and would like to hear from you.

Rick Viola
Detect USA

V.T.F. - RATPHONES- FANTASTIC--- FIELD REPORT

Date: August 03, 2005 04:58AM
THESE HEADPHONE WORK ON MOST DETECTORS,AND HAVE GREAT FEATURES, VARIABLE TONES,PINGPONG-BELLTONE.
yes the vtf ratphones are fantastic,i cannot believe the clarity of target sounds,also the ability to select tones,and finaly the best feature of all the pingpong belltone mode.
this feature gives a nice belltone sound for shallower targets and normal sound for deep targets, so you have an excellent idea where and how deep the target is, before you start digging.OR YOU CAN BYPASS THE EXTRA FEATURES BY THE FLICK OF A SWITCH AND JUST USE THEM AS STANDARD HEADPHONES.
not me though i love the belltone feature.
GET A PAIR THEY ARE FANTASTIC HEADPHONES.
i was a bit unsure what advantage i would have getting a pair as i have the tejon which allready has the variable sound frequency knob. BUT BELIEVE ME THEY ARE GREAT ON THE TEJON.
a great advantage is LESS POWER DRAIN on the tejon as the circuit for variable sound isant needed so you leave it in the off position.
the sound produced by the V.T.F. headphones is more suttle giving a nice tone difference choice,and when switched to the belltone mode,gives fantastic depth perception,and as mentioned before shallow targets give the belltone sound,and normal sound for deep targets. setting the threshold sound on the tejon is a breeze,as you can get the sound of threshold just so you can barely hear it purring BUT IT IS CRYSTAL CLEAR AND STABLE.
whereas before the threshold would motorboat irregularly.
i bench tested the tejon with the V.T.F ratphones connected
and found i can easily recognise a change in sound at 17inches useing my gold wedding band, or a 20cent piece,which is about
1-inch round. SO DONT HESITATE TO GET A SET AS THEY ARE BLOODY GREAT. and believe me i do not exaggerate and all info here you can take to be rock-solid reliable. Regards

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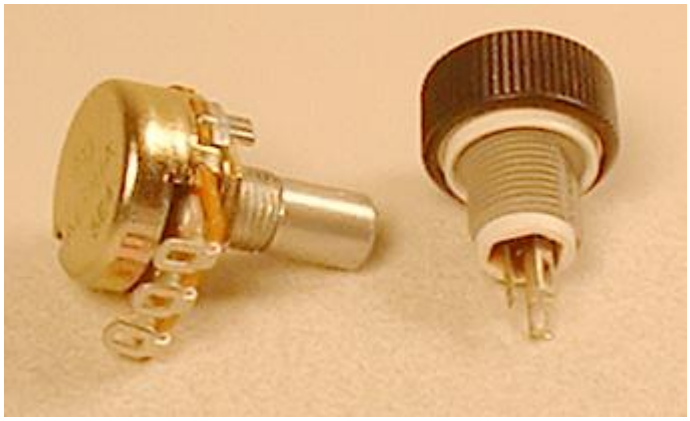
On the left is a typical volume control in most major metal detecting headphones and Ratphone VTF. On the right is the control in the current Ratphones. Sealed to the elements, better material and much higher power for excellent reliability.



Main Chip is a ZSCT1555

Probably going to be hard to find.

Direct replacement IC are the following, your choice:
LMC555
LM555CN
TLC555
ICM7555

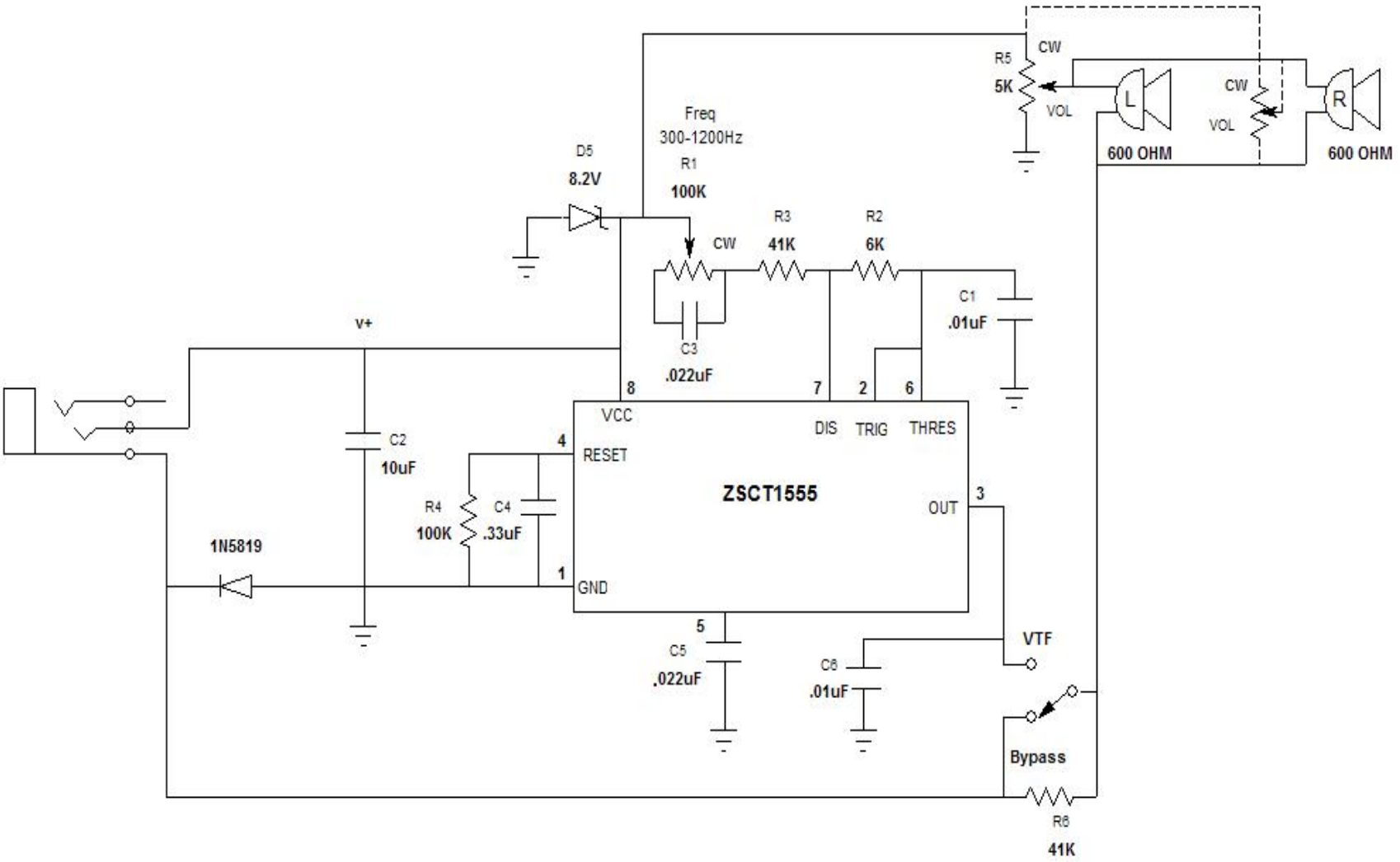
Note speakers are the 600 ohm are the Kobitones used in my headphone build. They are the same used in the Ratphones.

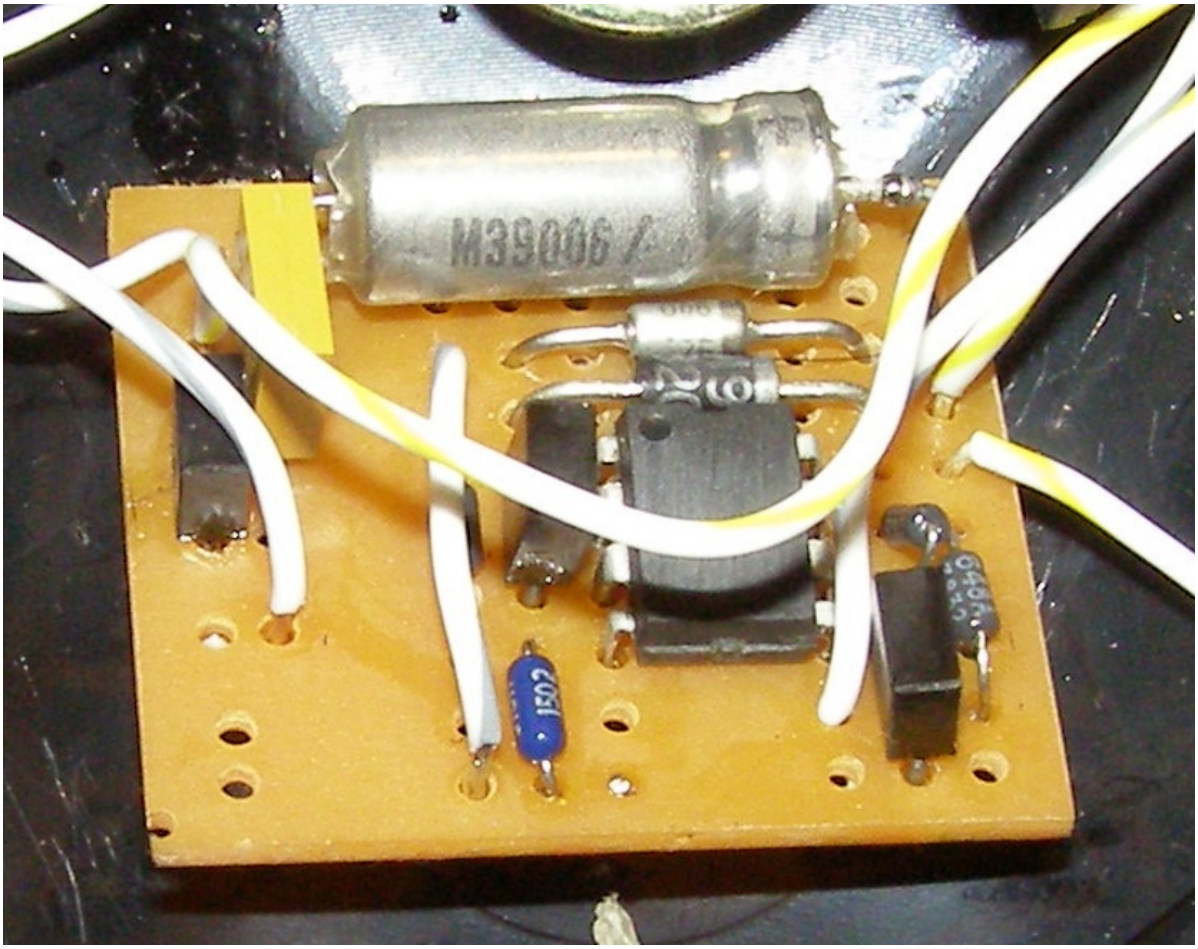
Use 5K ¼ watt volume control pots.

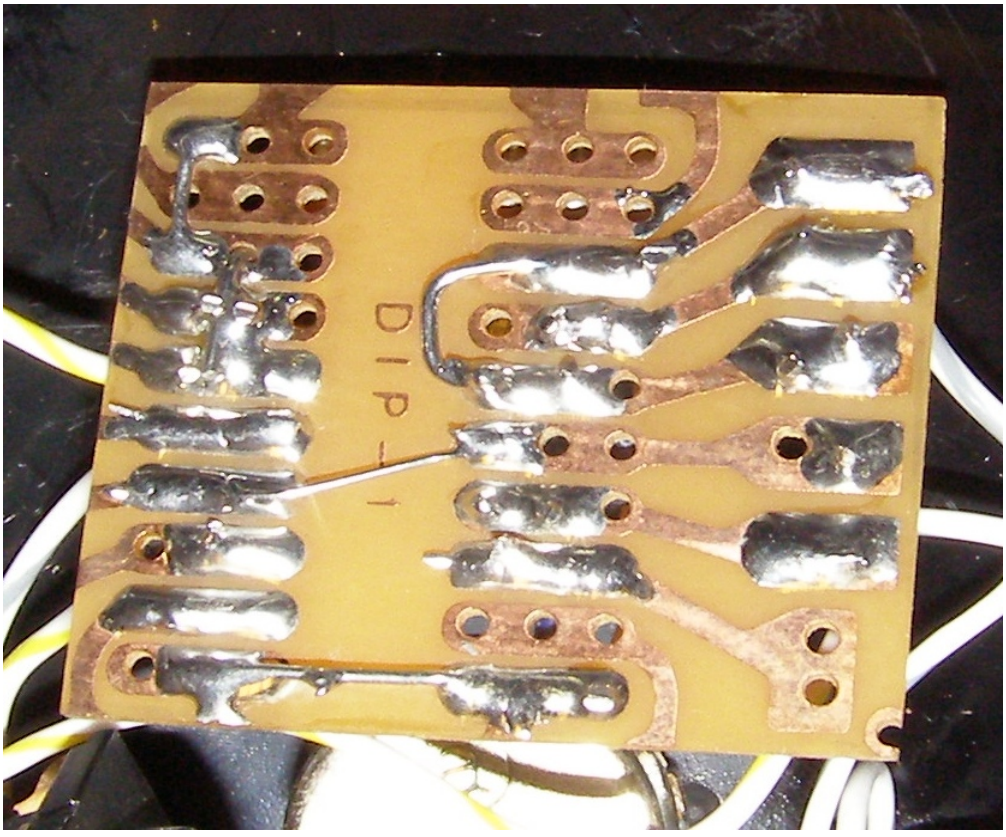
Use 100k pot for tone control.

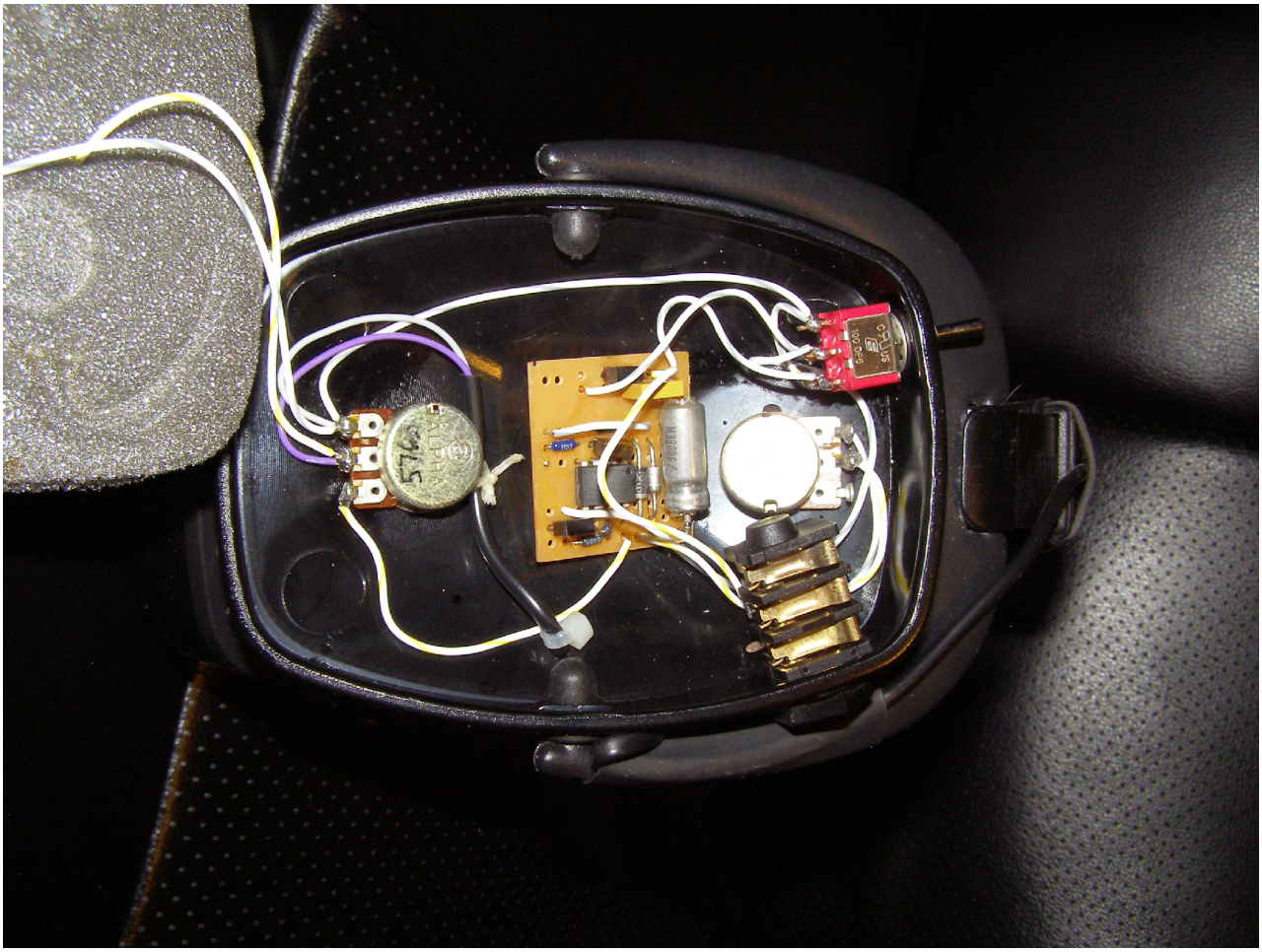
Ratphones
VTF 2
REV N
09-04-06
Rick Viola

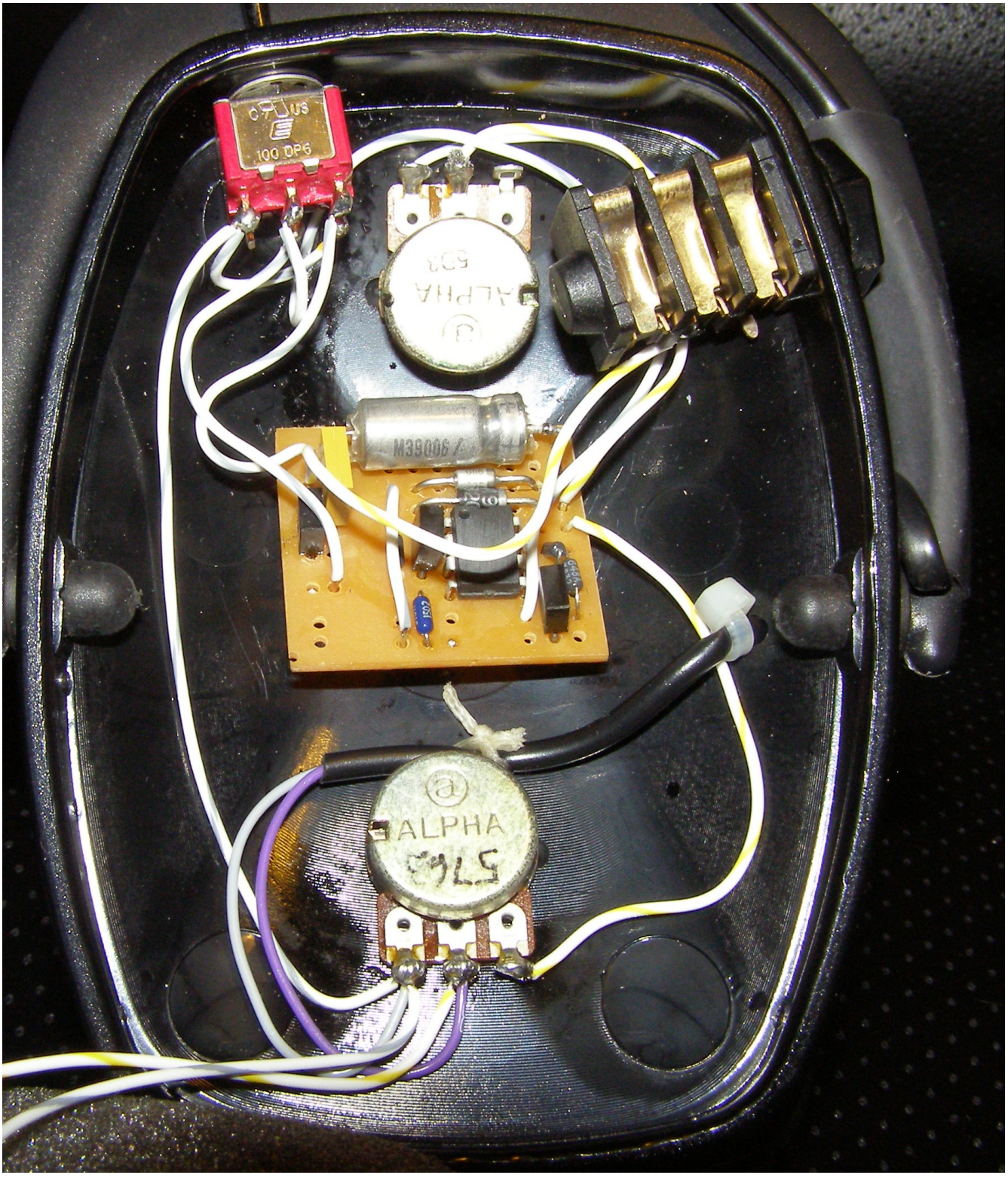
Freq= .62 / [(R1+2R2)*C1]
Duty cycle = [Rb/(Ra+2Rb)]*c




M39006
1502


DIP-1




100 DP6
ALPHA
ALPHA