A Moving Coil Cartridge Head Amplifier
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The moving coil cartridge seems to be able to extract those elusive refinements tucked away in the groove of your record that elude most moving magnet designs. Of course, a moving coil cartridge has the disadvantage of not having a replaceable stylus, so it is important for manufacturers to fit a good one in the first place knowing that the customer will be less inclined to buy the cartridge in the first place unless it is significantly better than one with a detachable stylus. Whether it is a case of a good stylus "reaching the parts that other styli cannot reach" or that a fully integrated stylus/cantilever/coil assembly is inherently superior, a good moving coil cartridge is certainly a worthwhile upgrade for any vinyl enthusiast.

This brings us onto the other problem associated most moving coil cartridges: their relatively low output impedance. Of course, if your amplifier already supports this type of cartridge, then there is no problem. However, many amplifiers only support the higher output moving magnet cartridges. There are two solutions to this problem: an impedance-matching transformer or a head amplifier.

I should say at this point that modern moving coil step-up transformers have come a long way since the types being sold when moving coil cartridges first made an appearance. Those available today are, in my opinion, considerably superior to the ones available in the late 1970s. Indeed, you cannot get away from transformers in the signal path of a valve amplifier. However, judging from some correspondence I have seem on the World Audio Design bulletin board, some people prefer not to have their moving coil cartridges feeding into an impedance-matching transformer and a head amplifier is therefore the only other option.

I must confess to feeling a bit of a traitor to the cause of valve enthusiasts by publishing the design of a transistorised amplifier, being a confirmed valve addict myself! My reasons for doing so are that the design presented here is very simple and will drive any phono stage, be it valve or transistorised. Furthermore, as it is battery powered, it can be situated close to the record deck without fear of induced mains hum and no additional power sockets are needed.

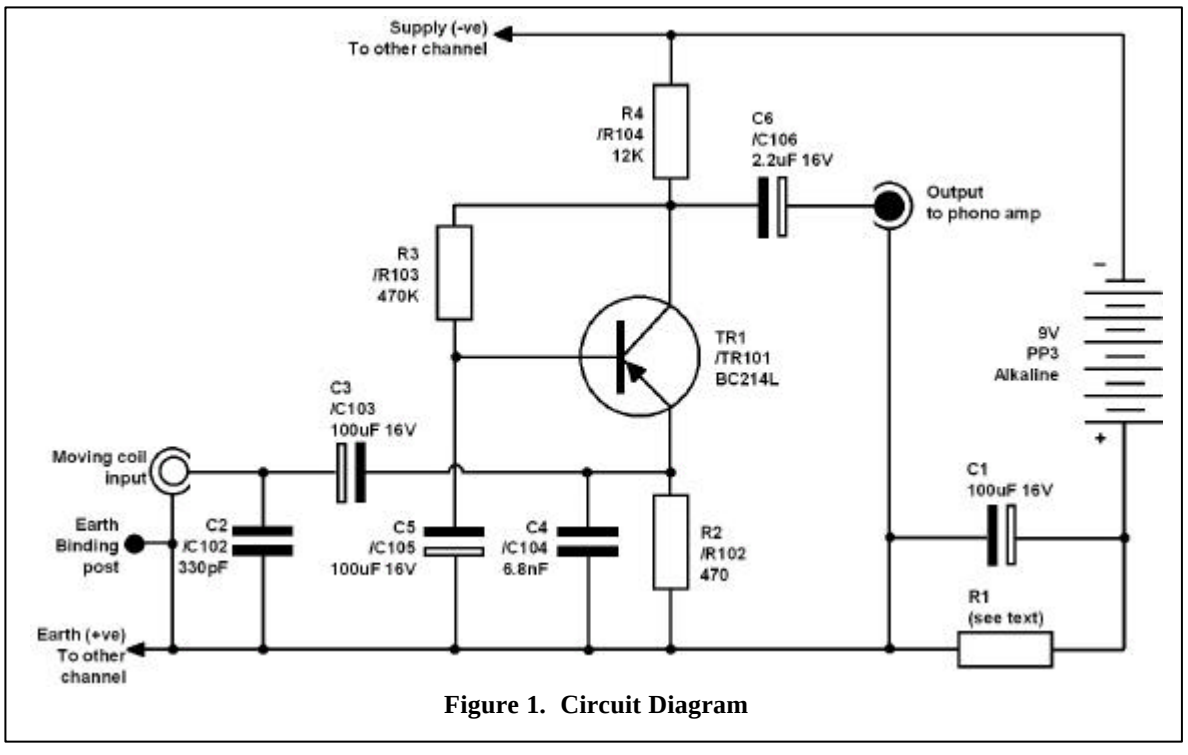

Figure 1. Circuit Diagram

Turning our attention to the circuit, the required characteristics of the head amplifier are a low input impedance, gain and a higher output impedance in order to match into the moving magnet input of the phono amplifier. A common base configuration is ideally suited to this task as it has all these characteristics. No RIAA equalisation is required as the phono amplifier already provides that. Note that on the circuit diagram, component numbers starting from 100 refer to the other channel. R1 and C1, being common to both channels, only occur once.

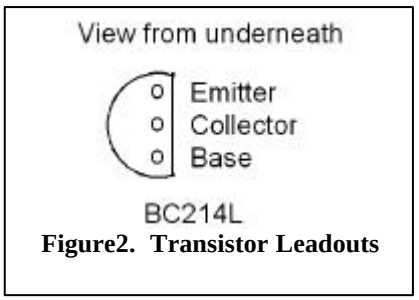

Figure2. Transistor Leadouts

The input from the cartridge is delivered to the emitter of the BC214L via a coupling capacitor, C3. C2 ensures no RF finds its way into the system. The input impedance of the amplifier is about 200Ω with a load capacitance of 6.8nF, which should suit most moving coil cartridges. If a higher load capacitance is required, then an appropriate value can be strapped across C2.

The output comes from the collector through C6 to remove the DC component from signal. It presents an output impedance of about 12KΩ and will happily drive a 47KΩ phono stage. The frequency response of the amplifier is essentially flat from 10Hz to about 45KHz and the signal to noise ratio is in the region of 60dB which should keep most audiophiles satisfied!

We also require a circuit that can be easily adapted to suit the wide range of cartridges available. With reference to the circuit diagram, it can be seen that the power comes in through a single resistor (R1) that is common to both channels. The value chosen for this resistor sets the gain of the amplifier. It also has an effect on the current consumption of the unit and hence the battery life. The table below shows the value of R1 for the required gain and the current drawn from the battery. As a guide, a 9-volt alkaline PP3 size battery will last about a year at a gain of x10. If desired, an on/off switch can be fitted so the unit can be switched off when not in use, thus prolonging the life of the battery. Battery replacement is indicated by an increase in noise and reduction in gain.

R1 (Ω)	Gain	dB	Current (µA)
220K	x4	12	35
150K	x6	16	50
100K	x10	20	75
62K	x15	24	120
47K	x20	26	180
30K	x30	30	240

Working out the optimum gain for your cartridge is best performed by fitting a 250KΩ potentiometer in place of R1 and adjusting it until the required level is achieved. Then remove the potentiometer, measure the value and find the nearest preferred value resistor and solder in permanently.

As far as construction is concerned, the amplifier can be constructed on a piece of stripboard or a small PCB can be fabricated if desired. The unit should be housed in a metal die cast box for maximum shielding. The input connections should be high quality chassis-mounted phono sockets, preferably gold plated. Most record decks require a separate earth connection and a suitable binding post can be fitted between the phono sockets to accommodate this connection. It is important to ensure that the metal box is earthed and this can be achieved by ensuring a good metal-to-metal contact of the binding post with the box.

Figure3. Interior View

On the circuit board, fit metal pins for the input, output and earth connections, as this will facilitate wiring the external connections in the box later. It is also a good idea to fit pins where R1 will be fitted to make it easy to set this value. The circuit board will need insulating from the metal box, of course. To this end, I cut a piece of clear plastic from an old CD jewel case just larger than the circuit board and glued it in place in the box. The finished circuit board was then fastened to this piece of plastic with a double-sided adhesive fixer, which makes a neat and resilient assembly.

If desired, an on/off switch can be fitted in the side of the box. Now wire the circuit board to the phono sockets, binding post and PP3 battery clip. The output connections can soldered directly to twin screened flying leads passed through a hole drilled in the box and terminating in a pair of gold plated phono plugs for connecting to the main amplifier. For initial testing, fit a 100KΩ resistor across the appropriate pins for R1. All that remains is to connect the unit into your system and attach a battery. Once you have determined that the unit is working satisfactorily, set the gain for your cartridge as previously described.

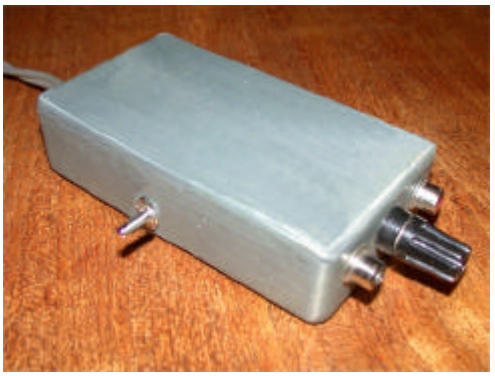

Figure4. The Finished Unit

All the components used in the design are readily available. Ceramic capacitors can be used for C2 and C4. The transistors cost less than 15p each from Maplin including VAT. In fact, the most expensive component is the box! Finally, I would recommend the use of Black Gate electrolytic capacitors throughout which are less than £2 each at these values and voltages.

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