Fitting an MC20 cartridge to the J.H. Formula IV tone-arm

The story of how one reader overcame the obstacles of attaching a good moving-coil cartridge to an arm originally designed to take a moving-magnet type — and discovered new depths in his sound system.

Peter Good

WHEN I purchased my J.H. Formula IV tone-arm I resigned myself to never buying a moving-coil cartridge. Twelve months later however, when in the market for a new cartridge, and after reading the myriad reviews available, I found myself seriously considering that previously outlawed breed of cartridges, the main reason being that I'd heard for myself the difference between a Supex and my own moving magnet.

I purchased an Ortofon MC20 and installed it in the J.H. arm which I had mounted on my Thorens TD160 MkII. This was done on the basis of three separate stimuli:

a) John Wright's reviews of the SL20E and MC20 in Gramophone. (Manager of IMF speakers – makers of my own, the super compacts);
b) Your own reviews;
c) Most importantly, my own listening.

I'm not writing this to describe the virtues of moving-coil cartridges, but rather to note the problems I had with mine and how I solved them for the J.H. arm. I suspect that many people own a J.H. and may have been unwilling to install a moving-coil, or disappointed with the results owing to its extreme low mass and flexible headshell.

The problems noted with the MC20 were:

a) Lack of bass extension;
b) Soft and flabby bass, lacking in detail;
c) Average to poor low frequency tracking.

The cures I reasoned were:

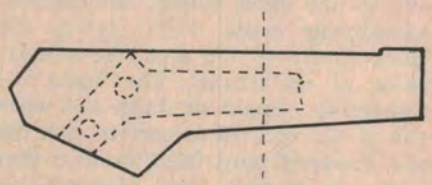
i) A more rigid headshell;
ii) More mass to suit the MC20's low compliance.

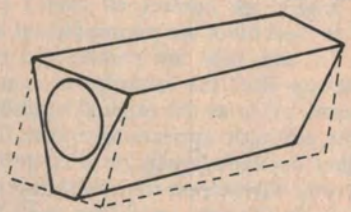
I had previously experimented with the moving-mass of the J.H. arm by adding plasticene to the headshell and re-balancing, but the results were not good enough. After a lot of different ideas had proved improbable or impossible, I settled on making a magnesium headshell, fashioned from the old one (only covering the whole of the cartridge's surface) and attaching this to an aluminium block which in turn could be attached to the arm tube.

A small sheet of magnesium alloy was obtained from a friend, along with a piece of aluminium 10 x 10 x 20 mm with a 6 mm hole drilled exactly down the centre. From the magnesium sheet was cut the headshell (really only a flat sheet).

To facilitate positioning etc, the old one was placed over it to provide rough positions for the holes and overhand adjustments etc.

I cut the aluminium block down to the shape shown in the diagram using a fret saw. This reduced the mass somewhat as the complete block was a little too heavy at 8 gm on its own. The ▶





Above: how I revamped the headshell
Below: cutting/drilling the aluminium block

The revamped tone arm assembly mounted on my Thorens TD160 Mk II turntable

mass of shell and block worked out to just over 6 gm in the end. The plastic headshell weight was about 1 gm so I computed an addition of 5 gm or so to the moving mass, (probably a little more since the counter weight was moved back), but just about the amount that I was after – see 'Note'.

Araldite was used to attach the shell to the block (after both surfaces were scoured). Overhang adjustments were carried out, the cartridge holes drilled and all the other tedious but essential adjustments made while glueing the block finally to the arm (the nervous point of no return). The home re-constructor should sit down and write out all the essential parameters that the new headshell must fulfill in order that overhang tracking error, distance between cartridge top and arm tube, that angles are correct all round (i.e: shell to steel pivot are perpendicular and shell to arm tube are parallel) so that the set-up sites the cartridge in exactly the same place as the original headshell.

The aesthetic appearance of the final product depends largely on what sort of tools you have access to. I used only the most basic of tools, small files and a fret saw. Consequently the finish is not of a professional class – a bench grinder etc, could have solved that problem though. What is most important is that it's rigid, infinitely more so than the J.H. one, and provides a solid platform from which the MC20 or any other moving coil can operate effectively.

By the way there *was* an improvement in sound in all the areas I expected. One improvement I didn't expect was in stereo imagery – an added bonus!

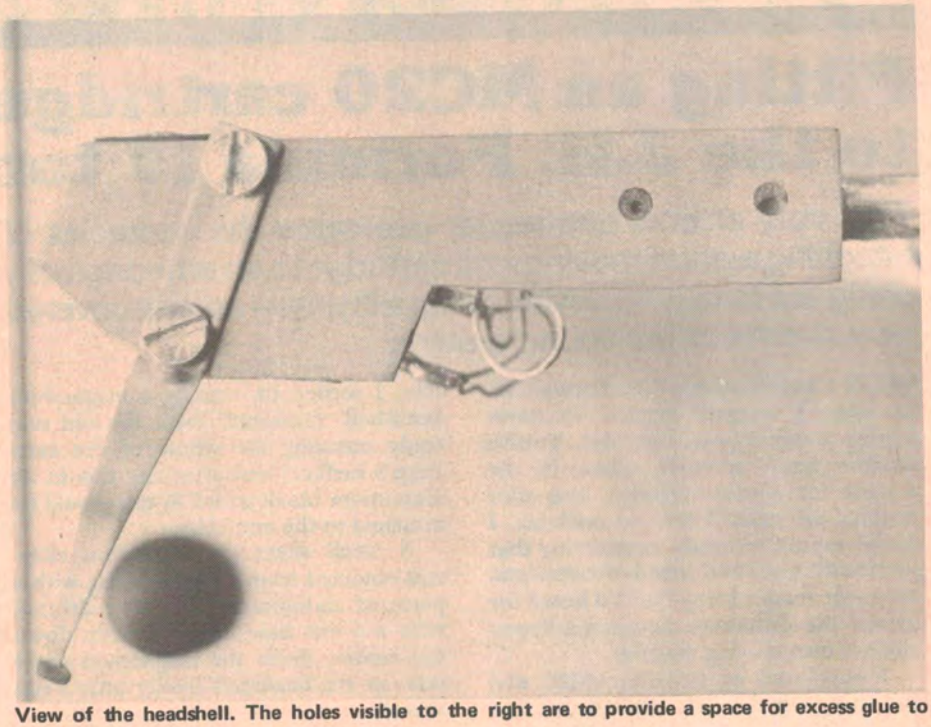
This improvement was carried out following a basic premise that applies to all disc playing systems – you can't discount physics. A turntable is a mechanical environment, dependant on the physical construction of its parts to perform the required function. The duty of the designer (or the enthusiast) is to recognise those requirements and maximise the turntable's chances of performing its function.

The remodelling of the headshell locked up a circle; the circle through record, mat, platter, suspension system, arm base, arm tube, headshell to cartridge and back to record again. This circle must be kept as rigid as possible.

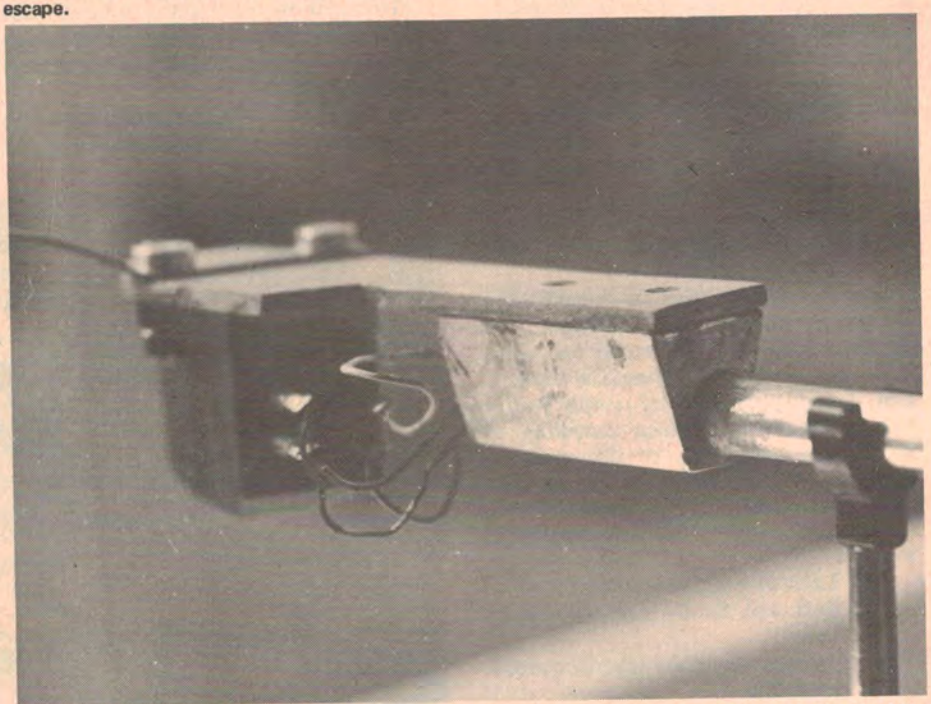
Other ways in which I have strengthened this circle are:

1) By replacing the Thorens moulded soft plastic arm base with a thick piece of perspex, supported by metal spacers and strong screws.
2) The Thorens mat was discarded as soon as possible.

After trying many experiments with plasticene mats and antistatic felt ones, I decided to buy a heavy commercial one. On discovering the price I rede-cided and for $3.20, bought one square foot of 5 mm thick red natural rubber from Clark Rubber. After cutting it out, I rounded the edges off and sanded out the centre where the label sits. This enabled the record to come in complete contact with the mat and damped it ▶



View of the headshell. The holes visible to the right are to provide a space for excess glue to escape.



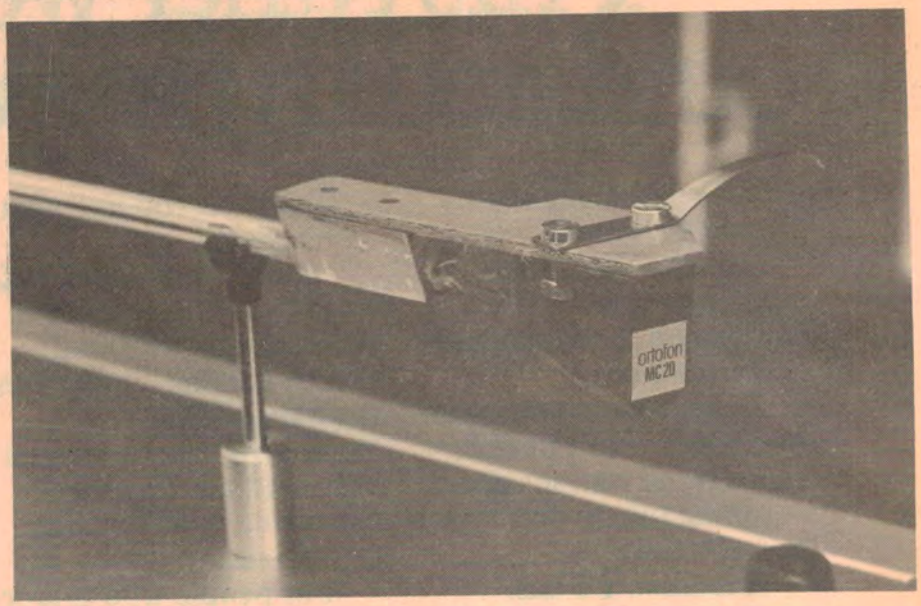
Another view of the headshell assembly, showing the aluminium mounting block. Araldite provides an exceptionally strong bond between the different surfaces.

superbly – it's also very easy to clean and weighs about 500 grams. So much for rigidity. The mat's main characteristics are those of damping. Damping enables the turntable to operate with some freedom from its hampering environment – the feedback from speakers and other structural sources needs to be filtered by a sub-chassis construction and damped by adding mass to a rigid plinth.

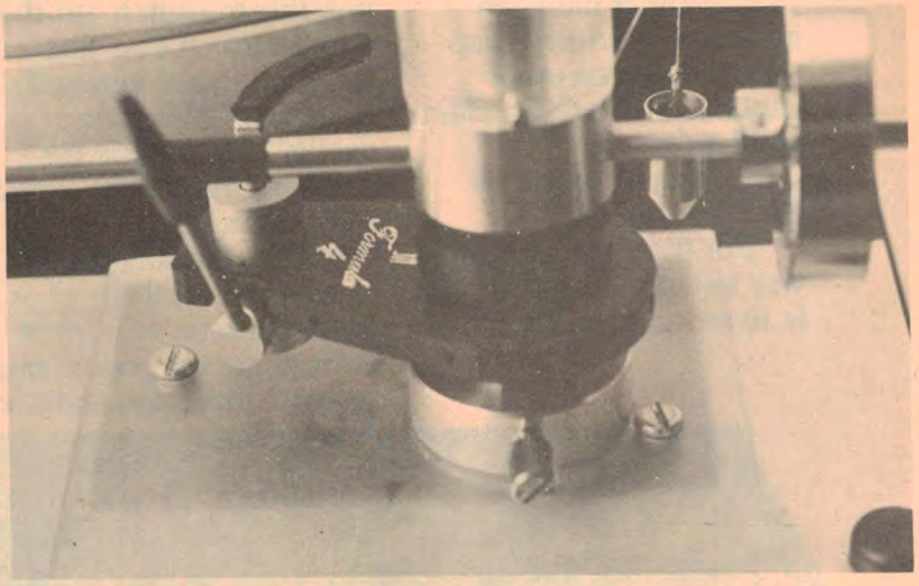
The Thorens plinth is reasonably well made but rather light, (picking up a Linn-Sondek or tapping the side of it reveals some of the clues to its freedom from feedback). Adding lots of plasticene and several kilograms of lead shot to the inside of the plinth can help any turntable resist vibration – it certainly helped mine.

The masonite bottom was removed and substituted with 13 mm particle board to strengthen the plinth structurally. I suppose it all goes to show that you don't have to spend a fortune on good quality hi-fi to turn it into something a lot better.

The improvements I have noticed satisfy *me* immensely. I can only urge other people to think seriously of the disc playing system and how it operates. People with badly designed turntables, sitting on flimsy shelves a few centimetres from their speakers, often blame their system quite unjustly for the horrendous sounds that are produced. Music is what we're after and it's all in the record groove. If it can be extracted without losing any of it or adding anything else, then half the job is done. ●



Further view of the headshell assembly, showing the cartridge mounting.



A new perspex base was fitted to the J.H. tone arm mount, providing quite a rigid support.

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Note:

Resonance frequency of stylus/arm/cartridge interface

$$f = \sqrt{\frac{25330}{MC}}$$

Low frequency resonance of MC20 in SMEIII = 15 Hz

Approximate moving mass of MC20 + SMEIII
= 7gm (MC20) + 5 gm (SME) + 1 gm bolts etc)
= 13 gm (only 1 gm more than that of the J.H. Formula IV)

Thus, compliance = $\frac{25330}{13 \times 225}$ ~ 9 c.u. (dynamic) of MC20

Approximate moving mass of reconstructed J.H. arm = 3 gm (old mass – 1 gm for plastic headshell) + 7 gm (MC20) + 8.5 gm (mass of block, shell, bolts, etc)
= 18.5 gm

Thus

$$f = \sqrt{\frac{25330}{18.5 \times 9}} \sim 12.3 \text{ Hz}$$

These figures and calculations cannot be taken at face value of course. The HFNRR test which the compliance figure of 9 c.u. is based on could well be unrepresentative of *music* playing on a disc. The calculations do however show that for the MC20's low compliance and the reconstructed J.H.'s additional mass the resonance is lowered towards the 10 Hz ideal – from about 15 Hz to 12 Hz.

This figure satisfies me as any more mass added to the J.H. arm would not only lower the resonance further but introduce new problems of warp/cartridge clearance etc. The moving mass would have to be 27.7 gm in fact – a totally unacceptable figure and no longer a "low mass" arm as Ortofon recommend.

(c.f.:- Hi-Fi News & Record Review, Aug. 1978
Hi-Fi News & Record Review, Aug. 1977)