Stan's Safari *43*

IN WHICH STAN EXAMINES RECORD PLAYER DESIGN AND ASKS WHY NOBODY HAS COME UP WITH RADICAL SOLUTIONS TO SOME INHERENT PROBLEMS

I can't help but notice that sales of high-end record players are doing very well despite some manufacturers quoting horrendous prices. This has led me to wonder how much design development there has been in the last 50 years, other than the availability of more exotic materials and increasing manufacturing precision. I wonder if we could have done better and if some opportunities were missed along the way?

It must be admitted that this is the one area of hi-fi design where I've had little practical experience, having designed but two record players in my career. Ironically, one of these won a prestigious industry award, which I've always seen as a bit of a fluke, so I remain an interested observer who looks over the shoulders of more experienced designers and sometimes wonders if, just possibly, there might be a better way.

For many years record player design was a bit of a backwater, where the pursuit of low wow & flutter and low rumble figures was the primary aim. Then along came a generation of suspended subchassis designs from AR, Thorens, Ariston, Fons and Linn (to name just a handful). Quite suddenly there was a workable theory about how record players should perform. It was a hard sell at first but Linn in particular did some sterling work in educating the hi-fi industry about suspensions and bearings.

Essentially the subchassis principle is quite simple. A strong frame (usually in a cross shape) supports the rotating platter with its bearing; the pickup arm and, sometimes, the motor. The whole assembly is then supported on a suspension to give some isolation from external noises and vibrations. The intention is that all the components are solidly locked together so that they all move in unison.

Ideally the only moving part should be the stylus cantilever in the pickup, tracking the horizontal and vertical components of the groove on the record. Get it right and the system becomes inert and the only signal generated in the pickup coils is an electrical facsimile of the grooves in the record. If only it were so simple!

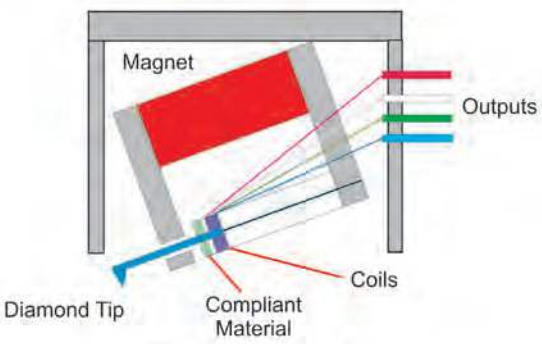
Starting with the main bearing supporting the platter it is apparent that any roughness or irregularity in the bearing motion will give rise to vertical and horizontal movements. Since the stylus tip is responding to dimensions in the groove of 0.1 microns (0.0001mm), the bearing needs to be close to perfect not to degrade the replayed signal.

The next area of concern is the pickup arm or tonearm. Essentially this is a device to carry the pickup cartridge and ideally it should behave as a rigid structure except of course it has to be able to rotate laterally to allow the stylus to follow the groove and pivot vertically because the vinyl disc will have small warps which have to be accommodated. So the pickup arm will need two bearings (sometimes replaced by a single unipivot bearing – another can of worms won't be discussed today).

But bearings always have a little slack, otherwise they couldn't rotate, and that very slack is a source of small movements, or which will be added to the wanted stylus movement and so degrade the signal. Fortunately techniques such as pre-loading reduce the amount of slack to tiny levels, but it remains a consideration.

Finally we come to the pickup cartridge. As the sketch below shows a (moving-coil) pickup is essentially simple. The diamond stylus is mounted onto a small beam called a cantilever, sitting in the gap between two magnet pole pieces. The cantilever carries two small coils and as it moves it generates electrical signals in the coils. These signals correspond to the stylus movement that in turn tracks the shape of the groove in the disc. The electrical output signals should be facsimiles of the record groove; which is just what we want.

In an ideal world the cantilever would just float



The simplified structure of a moving coil pickup cartridge

there, but in practice we need to secure it; to do this we apply a lump of soft 'gunge' which acts as a support and pivot. The flexibility of this gunge is called the cartridge's compliance, and this becomes