



The Naked Truth

Because diamonds are so expensive, they are positioned only at the extreme tip of most styli and are glued to another, less expensive material which makes up the rest of the stylus.

The finer cartridge has a stylus of pure diamond. This is called the *nude diamond* stylus. Such a stylus provides the lowest possible moving mass, and crisper, more accurate response, especially in the upper registers of the music.

The Cantilever

Now that we've got this precious diamond moving at tremendous speed through the complex



groove of a spinning record, what transmits its motions to the generating system?

The cantilever. In order that the cantilever may relay the rapid movements of the stylus, it should be light weight so it can respond rapidly to the twists and turns of the record groove. But it must be rigid, for any bending or flexing would add distortion and sound colouration. Obviously, light weight and high strength requires great ingenuity in design and materials.

The Generating System

High fidelity cartridges are based on this law of physics: when material capable of con-



ducting electricity is set into motion in a magnetic field... or when a magnet is moved near such conductive material (copper coils), electrical voltage is generated. The direction and speed of the movement determines the amount of voltage.

Thus the generating system of a cartridge converts the movement of the stylus and cantilever into a voltage we call the output signal. There are three ways of doing this.

Moving the Magnet

The most common generating method is to mount a magnet on the back of the cantilever. As the motion of the stylus and cantilever causes the magnet to move, the magnetic flux changes in the nearby coils, and voltage corresponding to the changes is generated.

Moving magnet cartridges are less costly to manufacture since the coils can be machine-wound. They have high output, and when the stylus wears out, you simply slide the old stylus assembly out of the body of the cartridge, and slide the new one in.

Moving the Iron

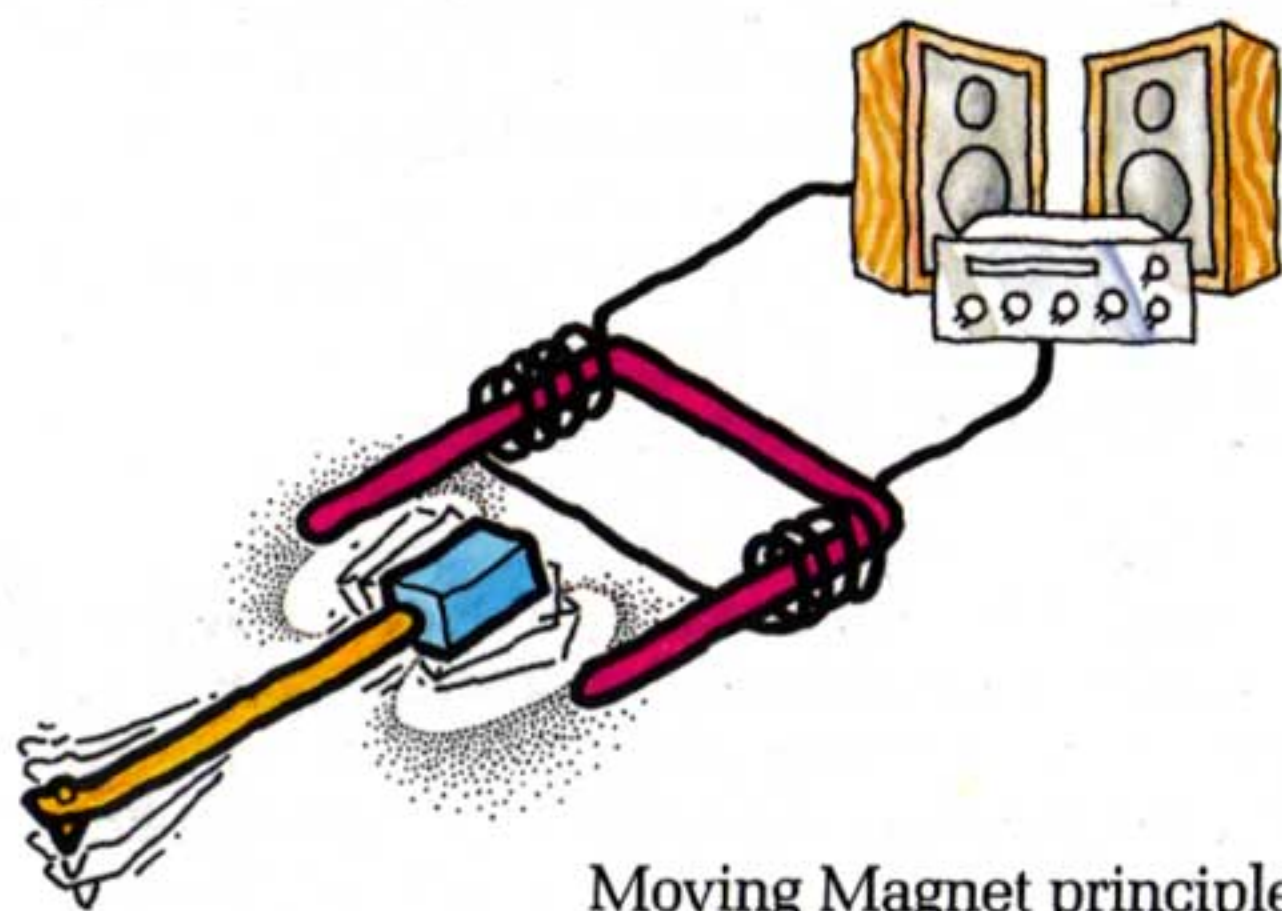
To improve tracking of the groove and achieve lower distortion we must lower the mass of those parts of the cartridge that move – the "moving-mass." We can remove the magnet from the rear of the cantilever as in the moving magnet types, and substitute a

Moving Coil

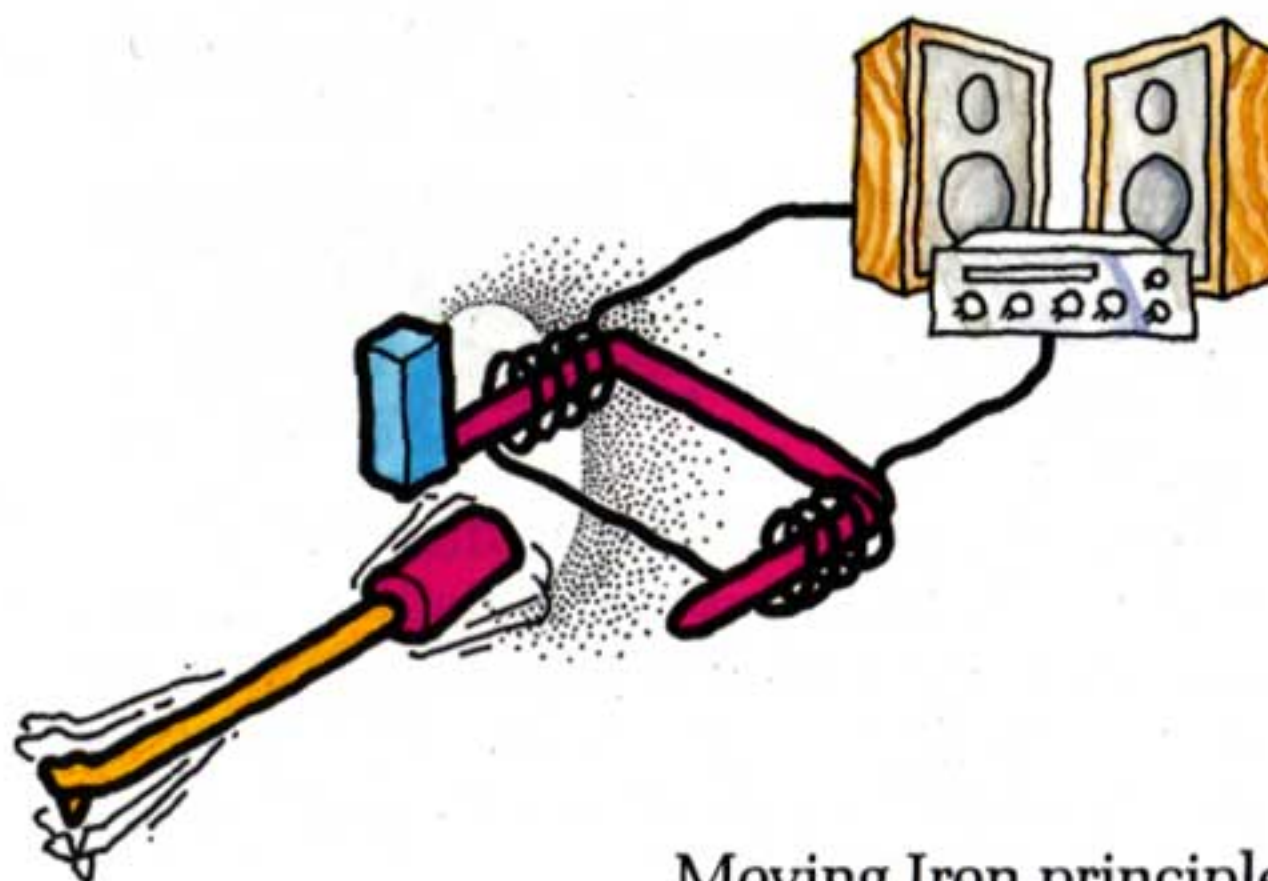
The most sophisticated – and most expensive – way to generate voltage is the moving coil system. Instead of a magnet or iron, carefully hand-wound coils are mounted on the cantilever, and move in the field of a stationary magnet. Voltage is generated directly, with a minimum of distortion. To keep moving mass as low as possible, there are usually very few turns of the coil. For example, stationary coils (as in moving magnet or moving iron cartridges) may have as many as 3,000 turns of wire – the moving coil, only 15 or 20. But fewer turns mean lower output voltage. So unless your amplifier is already designed to work with such a cartridge, the best moving coil models require an accessory that boosts output – a preamplifier or a step-up transformer. Also,

because the coils are part of the moving system, the stylus usually cannot be replaced without disconnecting the tiny wires inside the cartridge – a job for a technician. With all these "requirements", why are moving coil cartridges so desirable? Performance. Moving coil cartridges have a distinctive, unmatched musical sound. This may be because the recording cutterhead also operates on the moving coil principle, and the moving coil playback cartridge provides an exact complement – or it may be because the voltage is generated directly in the coils. But moving coil cartridges consistently win acclaim as the finest in the world.

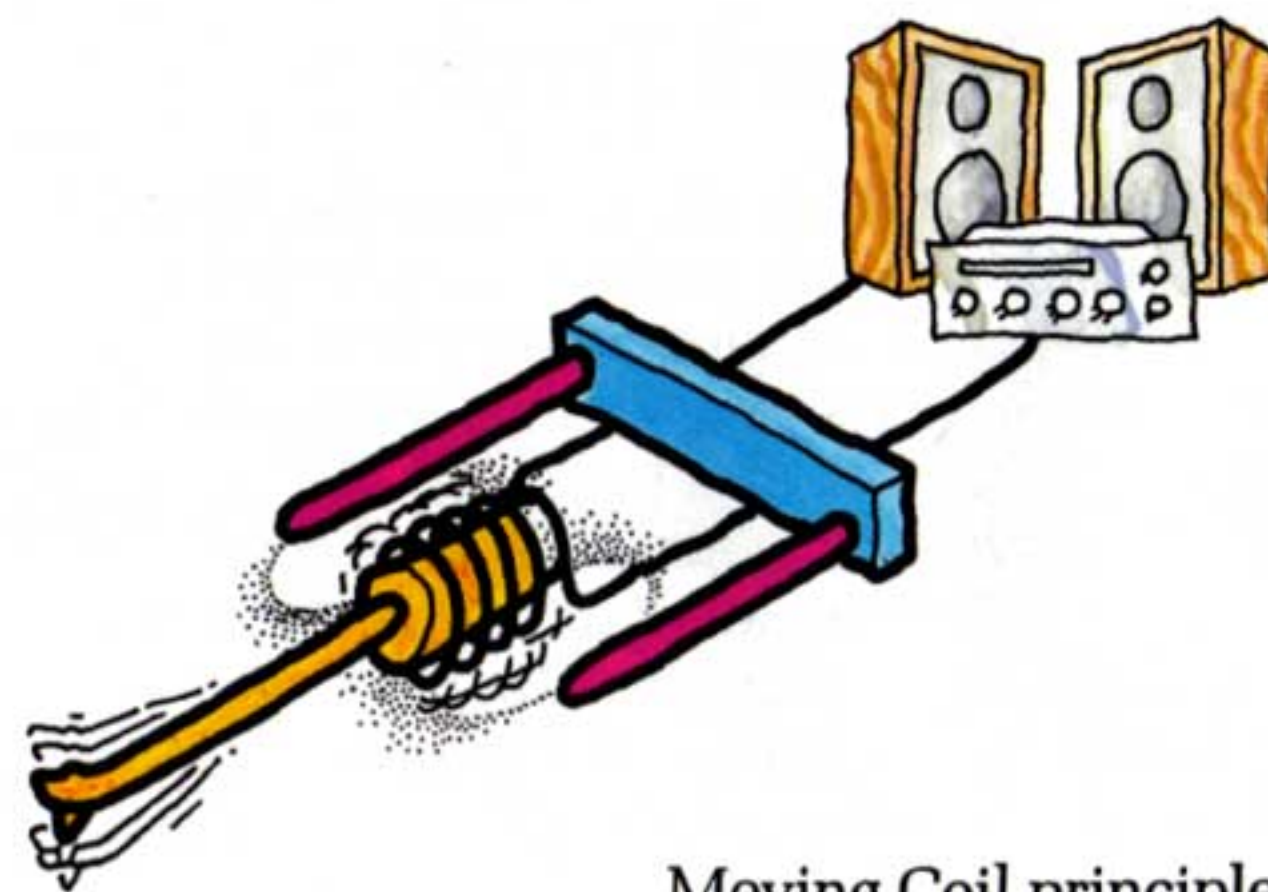
tiny, very light, hollow piece of iron. That iron would move in the field of a stationary magnet, changing that field and generating a changing voltage in the coils. Voila! Lower mass, better tracking, lower distortion with all the advantages of the moving magnet types: moderate cost, high output and slide-in/slide-out stylus assembly.



Moving Magnet principle



Moving Iron principle



Moving Coil principle

Taking It Lightly

When the moving parts of a cartridge (the stylus, the cantilever, and the moving magnet, iron, or coil) are low in mass they respond more faithfully to the undulations of the record groove. Only when moving mass is low will the record be safe from premature wear or damage.

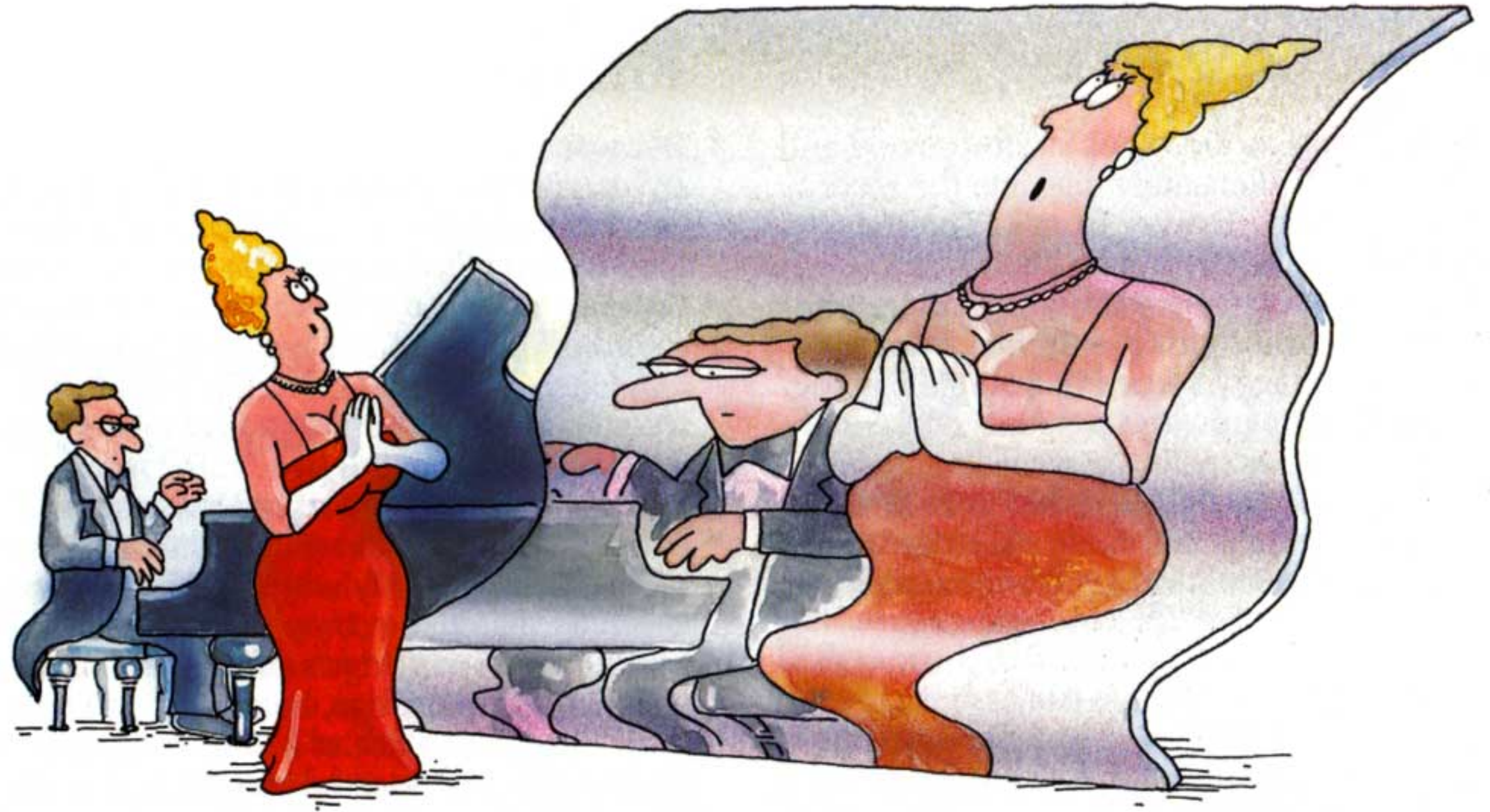
While low *moving* mass is critical, low mass in the cartridge's *fixed* parts is also a factor in the reproduction of music from records. That's because all records are warped to some degree. Some warps are obvious and can be spotted by the naked eye. But most



Fixed mass

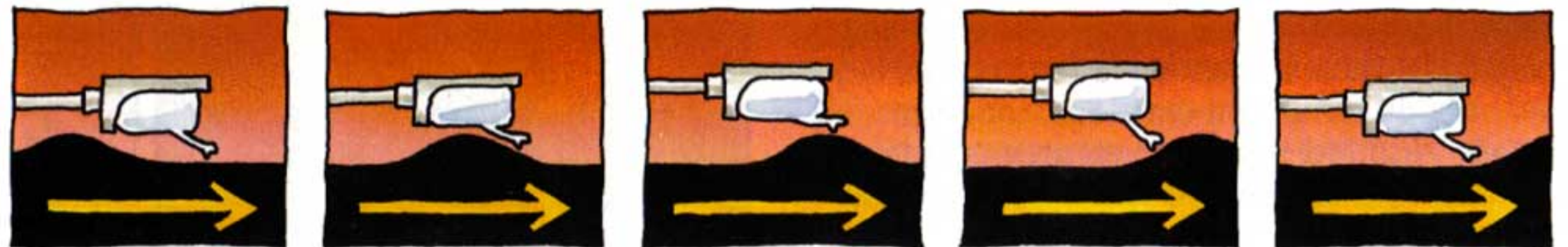


Moving mass



are not so easily seen – the tiny bumps and warps that are "manufactured" into the record, together with eccentricities caused by imprecise centering of the record hole. As it goes over a bump or warp, the stylus of a high-mass cartridge responds to the warp as well as to the music. When the cartridge

climbs towards the crest of the warp, the stylus is compressed towards the cartridge body. As the cartridge descends the far side of the warp, the stylus is extended away. This motion causes the cartridge to generate unwanted signals, and a host of related problems:



Mistracking: as the stylus is compressed and extended, it alternately digs into the record groove, and pulls away from it. The stylus can even leave the groove altogether.

Premature wear: such stresses shorten both the record and stylus life. In fact, mistracking can damage a record in a single playing.

Distortion: the unwanted signals of record warp, get mixed with the recorded music, causing audible intermodulation distortion. For these reasons, turntable manufacturers have made low cartridge/tonearm mass a



top design goal. But their efforts have been limited by a simple physical fact. The tonearm is a lever. The parts farthest from the pivot make the greatest contribution to effective mass. Because the cartridge is located at the end of the tonearm, lower cartridge mass is the most effective way to achieve low mass in the entire cartridge/tonearm system. And low system mass means better tracking, reduced record wear, and cleaner, clearer sound.

Finding a Perfect Match

Because the tonearm is "suspended" on the stylus/cantilever during record play, and because the cantilever has a spring-like action, they form a vibrating system. Like all vibrating systems, this one has a favourite place to sound off. It's called a "resonant frequency." Obviously it's important that the resonant frequency – the sounding-off point – of such a vibrating system fall in a "safe" range above the frequencies of record warp and below the frequencies where the music takes place. The only way to avoid this is to carefully match the compliance – "springiness" – of the cartridge's cantilever with the weight of the cartridge, headshell and tonearm. Here the advice of a knowledgeable dealer (like one selected by Ortofon) or an audiophile friend is invaluable.



Ortofon High-Output Cartridges

Ortofon offers three series of high output cartridges. The low mass, LM Series provides astonishingly reduced mass. The standard-body VMS Series offers superb performance at modest cost. The Concorde Series, ideal for universal-mount tonearms, combines a cartridge and headshell in a single entity, yet each model weighs less than most cartridges or headshells alone! There is an Ortofon model with the correct compliance for every tonearm.

The VMS System

All Ortofon high-output cartridges share the extraordinary performance of the patented Variable Magnetic Shunt (VMS) generating System. With VMS, a minuscule, hollow armature moves in the field of a tiny, stationary ring magnet. When it moves, a portion of the magnetic field is shunted (short-circuited) causing voltage to be generated in nearby coils. (Diagram shows one channel only).

VMS provides unparalleled tracking ability, reduced distortion, high output, consistent separation and high frequency clarity.

Moving Coil Cartridges and Accessories

Ever since Ortofon patented the moving coil cartridge in 1948, it has retained leadership in moving coil design. Moving coil playback cartridges are the only type that are precise complements of the moving coil recording cutterhead, so it is no accident that the Ortofon Moving Coil Cartridge Series is the most highly acclaimed in the world. And, if your amplifier does not already have a built-in step-up device for moving coil cartridges, it's a good idea to examine Ortofon's full line of high-performance, step-up transformers and pre-preamplifiers.

A Little About Ortofon

As far back as 1945, Ortofon established a reputation as the leading designer and manufacturer of the cutterheads that inscribe master records. But the phono playback cartridges of that time just were not good enough to test our cutterheads for low distortion and wide frequency range. So we made our first playback cartridge for ourselves. Not long afterward, we offered Ortofon cartridges to the public. To this day, Ortofon is the only company that makes both recording cutterheads *and* playback cartridges. And, because the skills involved are intimately related, Ortofon maintains a unique advantage over competitors.

The Final Measure

The final measure of any cartridge is sonic performance. In this respect, Ortofon has earned the most enviable reputation in the world. Musicians, music lovers and critics agree – an Ortofon cartridge means that records can be played with exquisite fidelity.

The 5 Golden Cartridge Rules

1 ● It always pays to change to a better cartridge. It is the component in a Hi Fi system that makes the first and only contact with the record groove. So it can never be too good.

2 ● Be sure to choose a cartridge with a compliance that matches your type of tonearm.

3 ● Never play old or damaged records with a new cartridge. This may ruin the diamond stylus which in turn will spoil your *new* records.

4 ● Remove dust from records and stylus each time you play. When necessary, use a recommended cleaning fluid.

5 ● Have your cartridge checked regularly (at least once a year) at a good Hi Fi dealer.

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accuracy in sound

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