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6 Pickup Arms

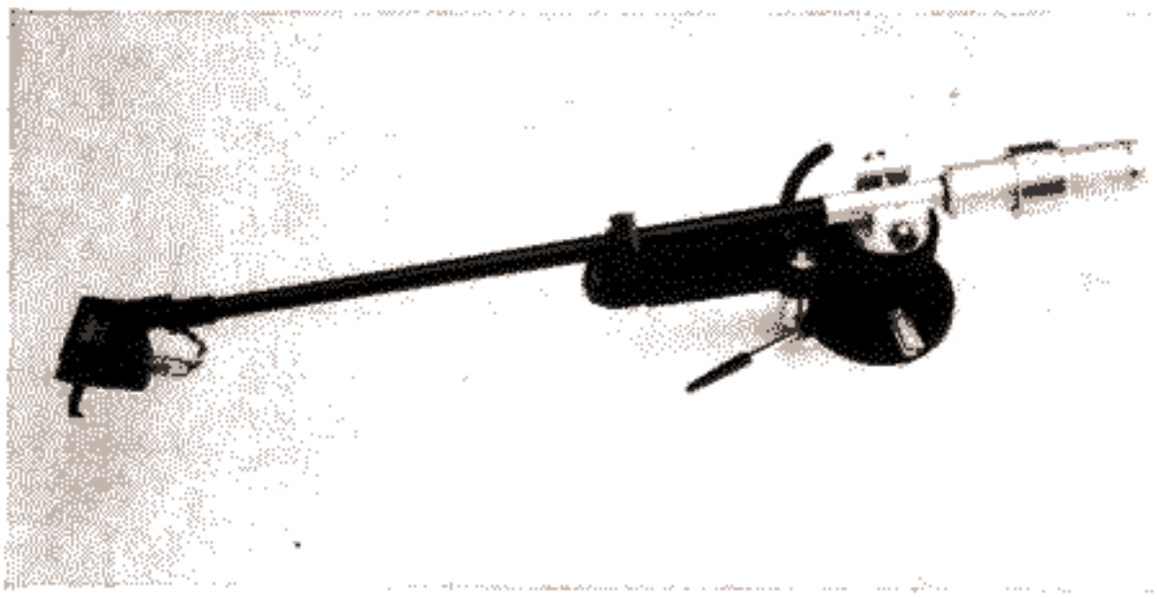
reviewed by Noel Keywood

LIKE other components within top-rate hi-fi systems, the role played by a modern pickup arm is currently being re-assessed. In recent times this item has been considered as a more-or-less inert lump of metal, simply defined by a few mechanical parameters. The feeling that measurement would reveal all seems in retrospect naïve; but in the near future we are likely to see just how simplistic some of the assumptions made about pickup arms have been, because, inevitably (and I believe correctly) scientific investigation is continuing, but now on rather more esoteric levels.

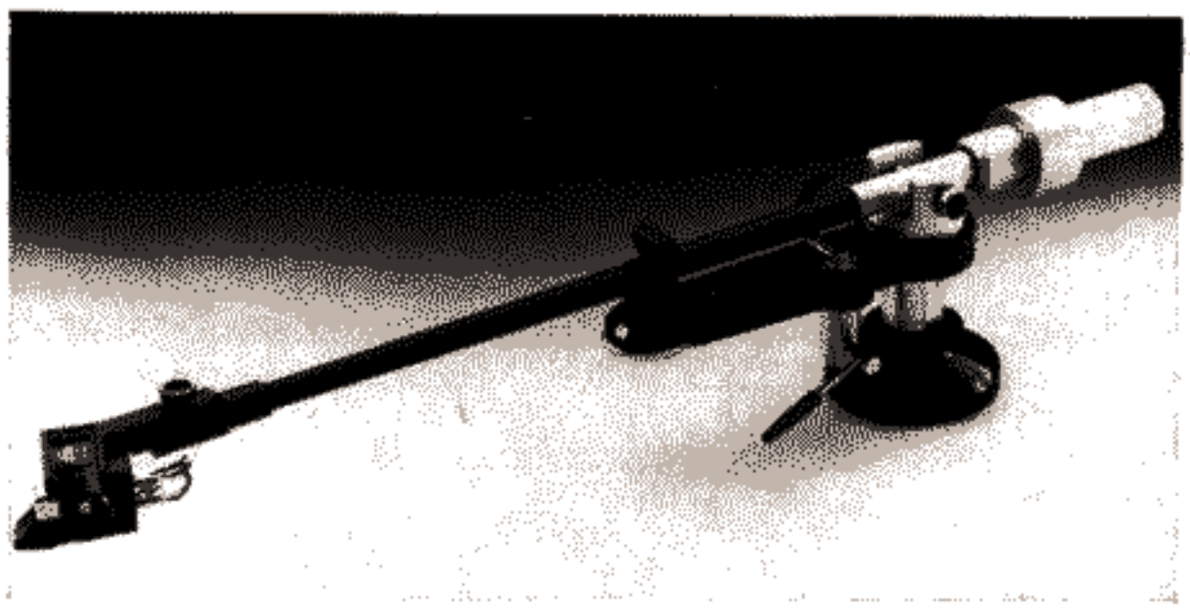
Those tortured academic souls who feel that audio equipment should be measured and not listened to must accept the fact that as long as we cannot measure *everything* we hear (and worse still correlate virtually anything), the less controlled conclusions gained from listening tests are at least a good second best. Naturally it is dangerous to generalise from the specific conditions of the listening tests, and results will vary to some extent with systems. Listening tests should therefore be considered advisory rather than authoritative.

The report presented here is therefore based partly on the audible effect of the arms in a system, as well as their measured performance, ease of setting-up, and convenience in use. Rather less attention has been paid to some traditional mechanical parameters such as pivot friction, since all six units tested were of such high quality that this was deemed irrelevant. Similarly, it is more useful to look at the effects of a high or low effective mass when working dynamically with a cartridge than merely to quantify it by measurement; consequently this dynamic approach was adopted here.

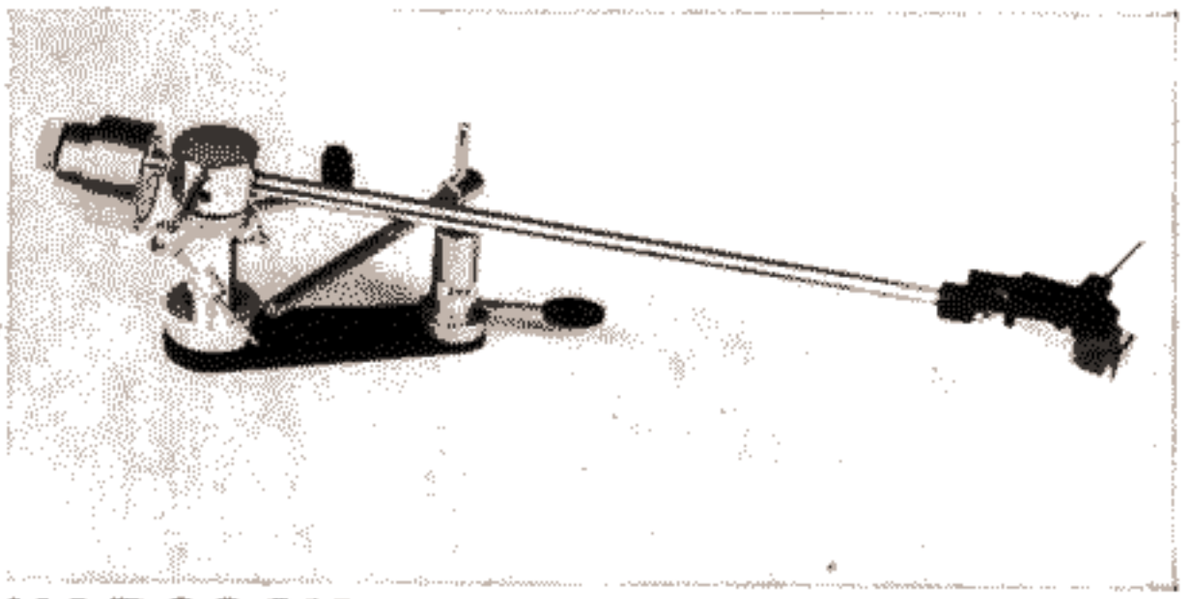
Listening tests were conducted using a Lux CL32/3600 valve amplifier, chosen for its extreme clarity and analysis, driving Wharfedale E70s. These speakers complement valve amplifiers curiously well and hide little in a music signal. Two Pioneer PLC-590 direct-drive turntables were used as arm carriers, but initial experiment showed that they did need to be carefully isolated in order to avoid the effects of acoustic feedback, so vividly demonstrated in earlier work for a report by Chris Rogers (Seven Turntables, *HFN/RR* Dec. '77). In isolating the turntables on a 2 cwt sand-filled shelf attached to the external walls of the building, feedback resistance was considerably improved, but I must point out that under worsened feedback conditions (not necessarily of the regenerative type) the performance of some of these arms will change considerably. For instance, I felt



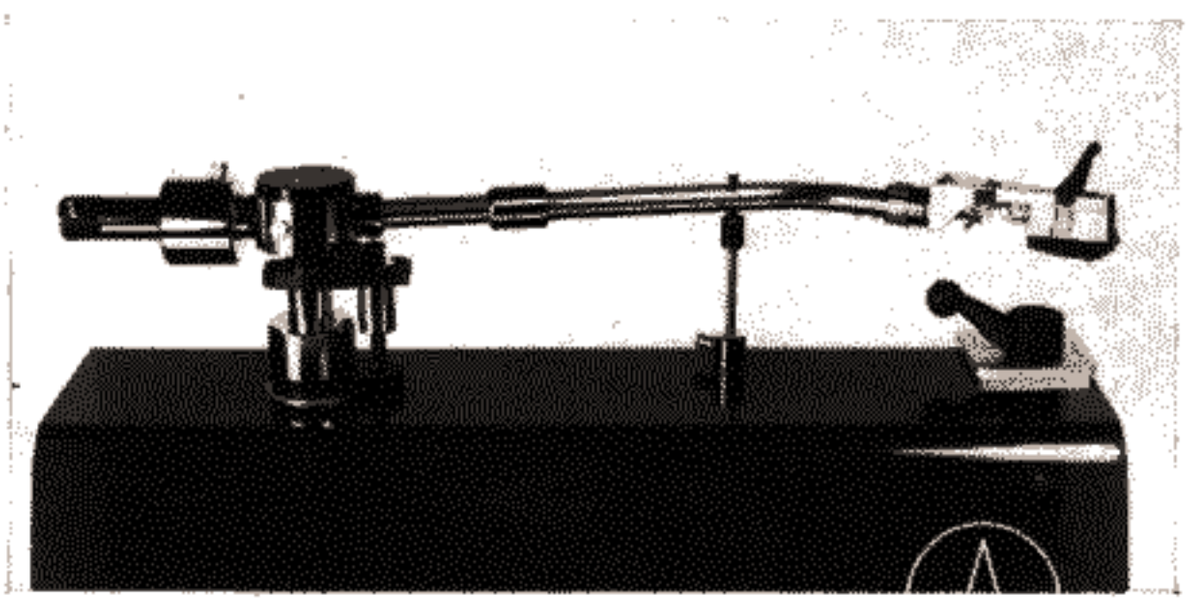
ADC LMF 1



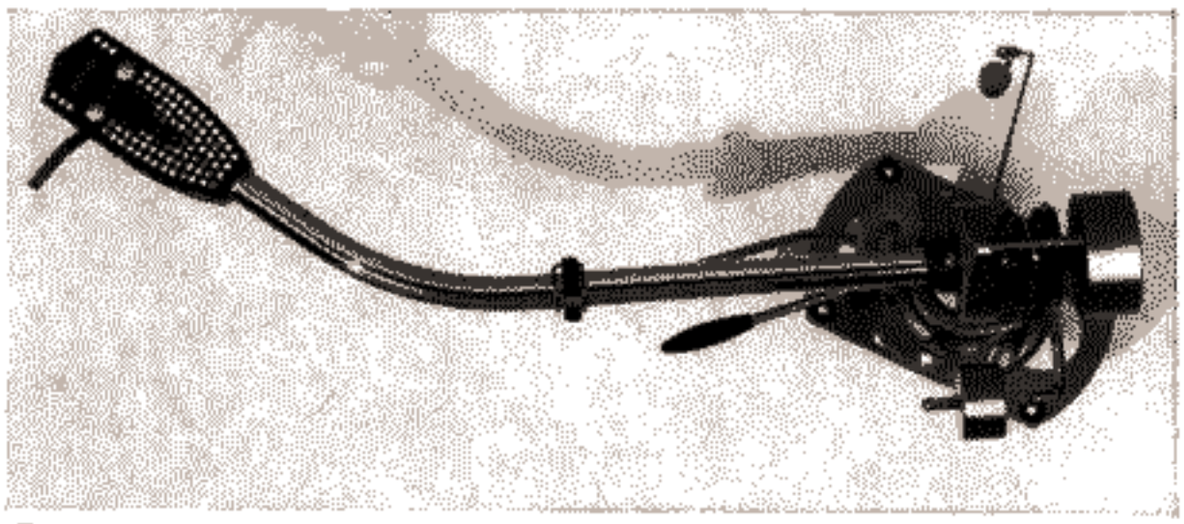
ADC LMF 2



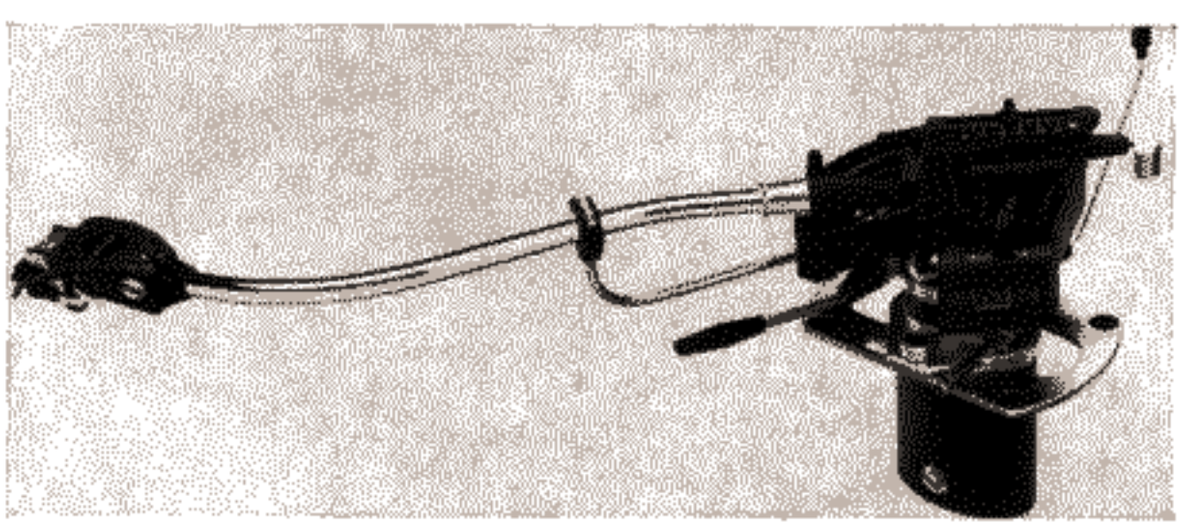
HADCOCK



AT 1009



SME II *(improved)*



SME III

that during use, before proper listening tests and feedback isolation had been carried out, the Hadcock GH228 was rather more upset by use on a typical shelf than the SME arm, this latter unit being heavier over its pivots and also not subject to the torsional movement of a unipivot when disturbed. Under these circumstances the Hadcock gave a glassily bright performance that verged on the painful with an Audio Technica TK7E cartridge. Various different cartridges were used throughout the review to ensure that results were not significantly cartridge-dependent.

Putting both decks, arms and cartridges onto the special shelf did however completely cure this characteristic, having a greater effect on the Hadcock than on the SME arm.

But let me pass on quickly to discuss the role played by a modern arm, the reasons for the various facets of its design and, perhaps most interestingly, what current and future investigations will reveal about its apparently 'inert' structure.

The basic mechanical format of today's arm was established in the 1920s, and one of the earliest mathematical analyses of its geometry was presented by Percy Wilson in *The Gramophone* in 1924. It was here that the mechanical ruse of overhang and offset was explained, and the geometry of pickup arms has remained much the same since that period. This technique minimised the tracking angle error between the longitudinal axis of the cartridge and the tangent to the groove, bringing down distortion by a factor of about 6 : 1 relative to that of a straight pickup arm. Use of offset did, however, result in a net inward force acting on the arm and so 'bias compensation' was born to counteract this.

All six arms in this report rely on overhang and offset to minimise tracking angle errors, but only two are of S-shape configuration and have a plane of vertical movement that is parallel to that of the cartridge axis through angled arm bearings in order to eliminate warp yaw; these are the SME Series III and Audio Technica AT1009.

As far as a cartridge is concerned, the arm must behave as a perfectly stable platform for ideal results, and it is here that attention has largely been focused. A pickup cartridge is simply a form of electro-mechanical generator where an output is generated by relative movement between the stylus assembly (rotor) and the cartridge body (stator). By way of illustration, if a drum recorded on a disc caused the stylus to move sideways very suddenly by an amplitude of 40 μm peak-peak (approximately 1·5 thou), and the cartridge *body* followed this movement faithfully because the headshell happened to be rather floppy, then there would be no resultant movement between stylus and body and hence no output, so you wouldn't hear the drum. This is a rather extreme example of course, but if hi-fi rather than some sort of vaguely representative thump from the loudspeakers which your brain required to interpret as a drum is the aim, then we are looking for accurate transduction of movements, in this example, of detail 40 dB or more beneath the signal peak, and amplitudes of 0·4 μm or one hundredth of 1·5 thousandth of an inch (assuming for simplicity's sake that velocity stays constant). If the headshell was to move by even this minuscule amount, then that detail would be seriously marred or lost.

And now a test: walk over to your pickup arm and gently pull it forwards and backwards along the arm axis and gently twist the thing too. If you just detect the vaguest movement then it has probably moved by at least 1 thou. Many will move by 5 to 10 thou. It won't experience the force you exerted during normal use, but both energy from the cartridge and from external acoustic feedback will cause the arm to flex in all planes, as well as the supported structure to move or rattle in its bearings if their design allows this. An arm will also be upset positionally when warp riding if the bearings are slack, leading to frequency modulation and loss of detail, as well as a muddling of the stereo image; indeed, these same effects may be produced by any random arm movement.

It is a fact that few if any current pickup arms achieve adequate rigidity, so that when used with a good modern hi-fi system (and that doesn't necessarily mean one that is inordinately expensive), their effect upon reproduction cannot be ignored. In basic theory at least, an arm provides a stationary platform above its low frequency resonance with the cartridge cantilever compliance, whilst the two items move as one below this frequency to allow system movement without stylus deflection when coping with warps, disc eccentricities and the groove spiral. In practice, both headshell and arm tube are subject to flexure and resonance, and mechanical weak points such as the joint between a removeable headshell and its tube add to the problem. The most telling demonstration of this effect is to 'play' a normally tracking arm at various points on its structure with a cartridge held by a retort stand. Connect the cartridge on the stand to an amplifier and headphones and listen to the program in the arm tube! Ideally there should be nothing; but in practice mid-band energy is prominent, especially from vocals. This is energy that the cartridge is losing into the arm and, as far as you the listener are concerned may well represent loss of detail, coloration and muddled imaging. In that their structure is often less rigid, lightweight arms can suffer more heavily than typical 'heavy' designs; but appearances may deceive, and some apparently solid arms 'ring' badly along their tubes and suffer some significant problems.

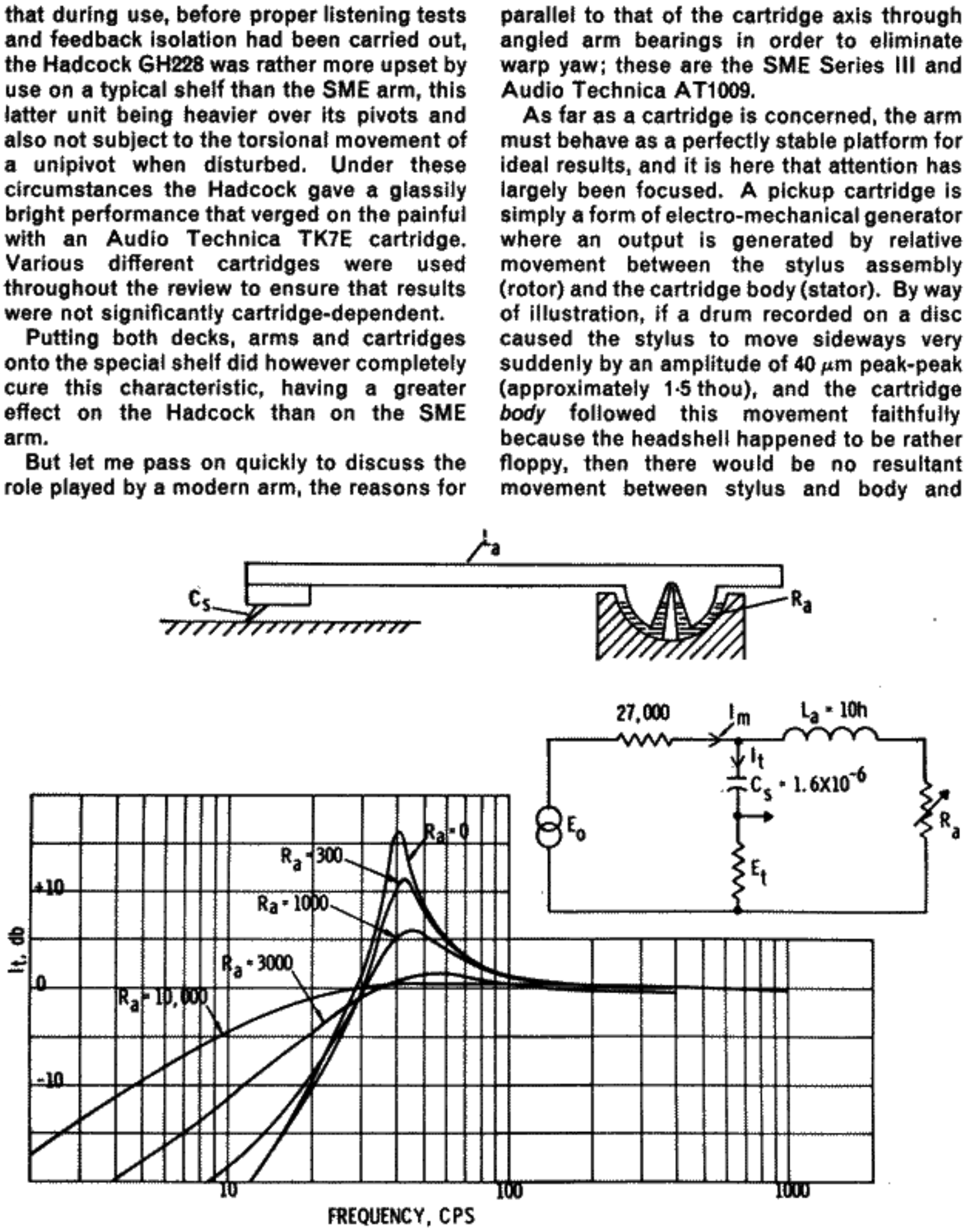


FIG. 1 Pickup arm viscous damping

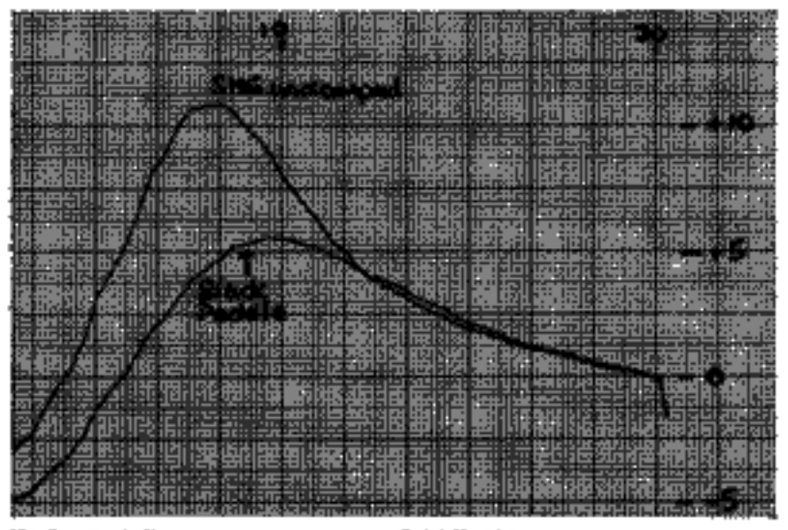


FIG. 2 LF resonance — SME III

Although problems of flexure and resonance in an arm are now receiving close attention, their existence has been known for some time. You might be surprised to know that Garrard used their fixed headshell and removable cartridge slide for so long to avoid the troublesome plug-in headshell, and further into this company's past I distinctly remember a rosewood and aluminium tone arm (Lab 80?) that was meant, I believe, to be non-resonant. More recently, SME introduced their fixed-head Series II model for the sake of improved rigidity as well as low inertia.

There is, however, a modern theoretical summary of pickup arm design that covers its mechanical analysis in great detail. Written by Peter Rother of Thorens, its contents are

illuminating and one or two passages in particular are worth quoting here:

'Since the tone-arm consists basically of a longitudinal member, the resonances are chiefly those of the tone-arm tube. Longitudinal, torsional and flexural resonances are characteristic of such a tube. It is advantageous to employ materials or a construction incorporating internal damping. To minimise the effect of such resonances, the tone arm tube must be mechanically matched to eliminate reflections at its clamped end. For this most important measure, it is essential to know the mechanical impedance of the tube in order to dimension the termination as accurately as possible.'

The paper goes on to analyse torsional and flexural waves down a tube and the above comments show that this tube can be considered a mechanical transmission line into which energy is fed. Correct termination of the line at its characteristic impedance should result in zero reflection back down the tube of transmitted energy. It is interesting to note at this point that the best way to terminate the mechanical transmission line is resistively and this can only be achieved by damping. At this point I would hazard a fairly safe guess and say that in the near future we can expect pickup arm design to move away from its current ad-hoc state and towards the more sophisticated realms of a mechanical science. Damping is likely to be studied more closely and become better controlled.

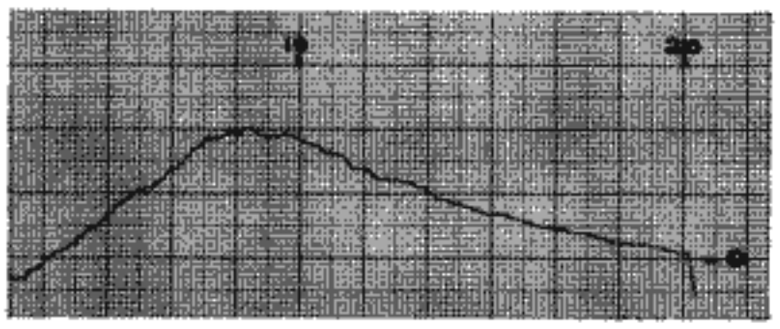


FIG. 3 LF resonance – HADCOCK

This brings me to the subject of damping with regard to two of the arms in this report. The Hadcock GH228 is a unipivot and needs to be stabilised if it isn't to rock on its pivot like a pendulum. Like most unipivots it relies on fluid damping for this, but the damping also reduces the output at the low frequency resonance as usual. SME's new Series III arm was tested with damping, although it is used in this design for the subjective benefits, as well as the reduction of output at resonance; damping can be varied or disconnected on the SME by changing paddles. It is interesting here, and perhaps pertinent, to look at a point noted by B. B. Bauer of CBS Laboratories on the effects of viscous arm damping. An electrical analogy to the mechanical structure of a damped tone arm and the result of different damping levels is shown in fig. 1. Note how increasing damping past a certain point not only decreases the low frequency peak in output but *increases* sub-sonic output below that point. The importance of damping is manifold, but the reduction of output at low frequency resonance is most commonly quoted because it can be easily illustrated. The graphs, figs. 2, 3 and 4 for the SME Series III arm, Hadcock and AT1009 respectively show this phenomenon in all its glory using a Signet TK7E cartridge. The AT1009 (fig. 4) introduces +13 dB (an amplification factor of 4·5) at 6 Hz, very close to the primary warp region. This arm is not a new design by any means and is rather 'heavy', or of higher effective mass, than many modern designs. Look now at the SME (fig. 2) and this resonance has moved up in frequency to 9 Hz due to much lower arm mass, and reaches +11 dB undamped and +6 dB damped in the lateral plane (B & K 2010, 5 Hz–20 Hz log sweep, lateral mod); output at warp frequencies is obviously very low. Hadcock's GH228 returns a fascinating result from this test (fig. 3). In spite of its damping fluid appearing to be somewhat thin compared with that used by Decca, Keith Monks and SME, the damping of the LF resonance is significant and output below this frequency extended in line with the observations by B. B. Bauer mentioned

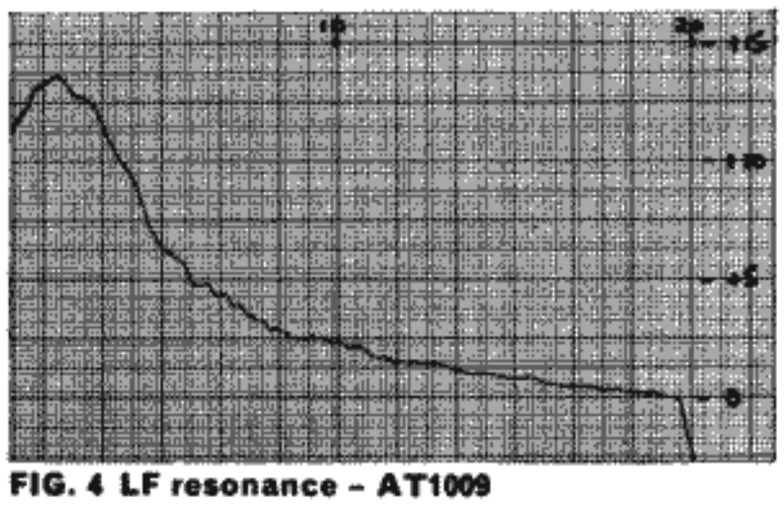


FIG. 4 LF resonance – AT1009

earlier. Damping can be altered on recent samples of the GH228 by raising or lowering the central pivot pin, which is clamped by an Allen screw. These graphs show that output generated by warps will be much lower from the Hadcock and SME arms relative to that from heavier designs, but perhaps a more important consideration is that the stylus of cartridges fitted to them will not be so severely deflected mechanically when warp riding.

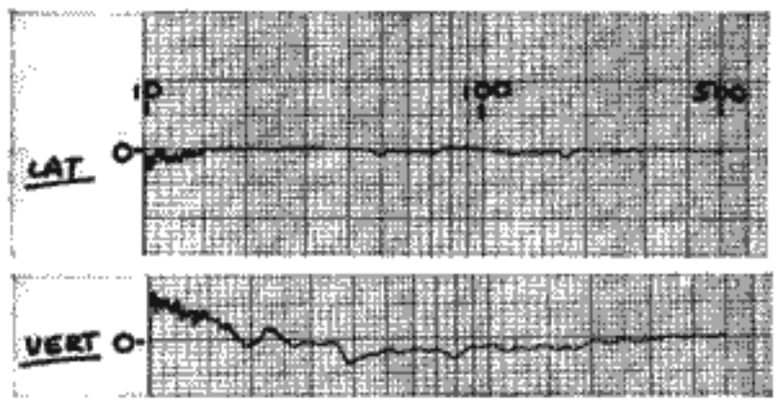
Most listeners will however be less aware of these obvious technicalities than they will of the subtle improvements in sound quality that damping can achieve. Generally, damping improves bass quality and added upper bass detail in the system used; typically, a plucked double bass became less a 'background boom' and more a tightly-defined realistic instrument, in which string action could be heard and the string's actual 'twang'. I believe that damping also stabilises arms on their bearings too, suppressing the random movement mentioned earlier, and it is this effect that aids stereo definition, cleans up treble quality and generally improves the subjective performance of an associated cartridge. Some cartridges and systems do not benefit from damping, but many do; finding optimum damping is a matter of experiment. There isn't at present correlation between performance in this area and sound quality, even though spurious theories about intermod, etc, abound. I believe that future investigation into energy transmission down an arm tube and the effects of damping upon this, probably through laser interferometry, will yield more meaningful information.

All six arms were hard mounted onto the Pioneer turntables to eliminate residual compliance in the arm/plinth/platter mechanical circle, rumble not being a problem with these units. This meant that the SME arms had their base grommets removed and the Hadcock was mounted without the rubber arm pillar washer supplied. The SME Series III was also used with its parallel cartridge loading capacitors removed, since these alter sound quality and would distort judgements.

Since the 5 Hz to 20 Hz sweep shown for three of the arms is limited in what it can reveal, being a lateral cut only and of limited frequency range, lateral and vertical response runs were made of each arm with a Signet TK7E cartridge from the CBS STR120 disc, between 10 Hz and 500 Hz; the rise in output above 100 Hz is due to the equalisation employed. Most readily measurable problems in pickup arms can be detected from response runs made across this part of the audio band, but, as with the frequency response of a loudspeaker, these traces only reveal a little of the total picture.

AT1009

THIS unit is a classic example of the Japanese approach to pickup arm design, although perhaps of a period now passed. Its construction is precise and beautifully executed, but by current standards the design may be considered unnecessarily ponderous. In basic construction it follows convention, with ball-bearing pivots for lateral and vertical planes of movement, a large arm tube along which slides the tracking force adjustment weight to a calibrated maximum of 2·5 gms, decoupled counterweight and detachable headshell. Fine adjustment of tracking angle is carried out by sliding a cartridge along beneath the slim but rigid headshell. Arm height is adjustable over a wide range and the cue platform is controlled pneumatically, allowing the remotely placed cue lever to be positioned at the front of a



AT1009

record deck even of the floating suspension type (*eg*, Thorens, Linn). Connection between the operating lever and platform is via a thin flexible rubber tube that can be cut to length.

Pivots of this arm are offset so that a cartridge will warp-ride without yawing, and lateral balance for distributing the load on the bearings is achieved by placing the counterweight axis on the opposite side of the vertical plane of movement to the angled arm tube. This produces only approximate lateral balance according to the counterweight position, but this should not be of great consequence. The arm pillar can be locked up firmly in its mounting and the arm bearings allowed great freedom of movement without significant play being evident, axial movement only being detectable at 0·5 thou. Bias compensation is provided by a falling weight and thread and worked well, as one would expect on an arm like this.

Fixing the AT1009 is straightforward, since it needs but one circular hole to be cut in the base board into which the pillar support bracket is fitted. Leads supplied are of low capacitance at 78 pF/channel. Having once

positioned the arm pillar bracket against a template supplied and mounted it to the base board, installing and setting up the AT1009 becomes a straightforward affair.

Response plots from lateral and vertical modulation sweeps show that, as expected, the arm/cartridge resonance lies well below 10 Hz, due to a relatively high effective mass compared with the other five units on test. The lateral trace exhibits two suckouts, one at 50 Hz which has to be discounted as a mains supply effect, and one at 180 Hz which is fairly typical of the sort of frequency at which arm tubes exhibit a sharp structural resonance. Although this dip is small in response terms, the artefact causing it may be rather more significant than one would expect. Also of interest is the ripple seen along the vertical modulation trace. This appears at first sight to be conversion ripple in the measuring equipment, generated by subsonic output from the AT1009, but since it is singularly absent from the other trace I doubt whether this cautionary analysis is in fact correct. It is just as likely, I feel, that the ripple is again indicative of structural problems in the arm.

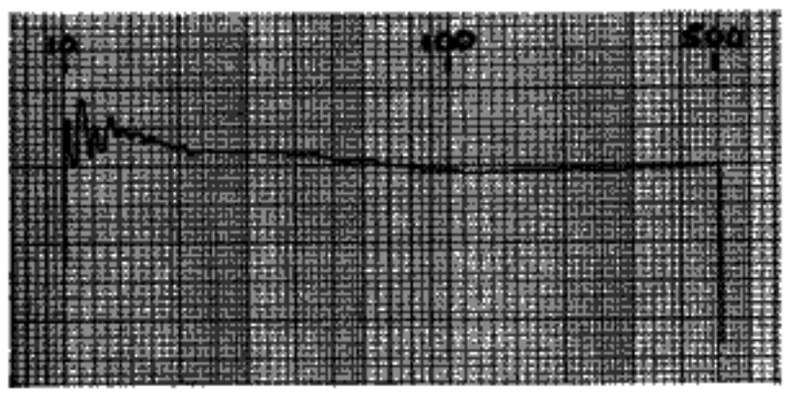
Perhaps most surprising about this substantially engineered arm was the consensus of opinion expressed over its effect on sound reproduction. The predominant feeling was that it was 'mushy', 'muddy' and 'ill defined'. This basic observation was repeated many times and in many different forms, so it was obviously the most noticeable characteristic of the AT1009 in this system. As a well-built but conventional arm, this unit had initially been chosen as a reference against which the other five units were to be judged. The Hadcock was first of the others to be compared with it, and it was apparent that this latter design had far more to offer as a reference, so the Hadcock was substituted in subsequent tests.

Hadcock GH 228

THIS particular unit turned out to be a 'specialist' design in the best and worst senses of the word. Like most arms produced in Britain on a limited scale, it employs the relatively simple unipivot construction principle wherein the arm sits atop a single point pivot and moves on a miniature ball race. As mentioned earlier, damping is a necessity on these types of arm to stop them oscillating on their pivots like pendulums, and they have to be balanced with care in the lateral plane too. In consequence a unipivot such as the GH 228 is a pain to set up, although this is more likely to affect a reviewer like myself than most owners.

On the plus side, the standard of construction and finish now being achieved by Hadcock has improved enormously from that seen on earlier models a few years back. A simple base clamps the rigid support column firmly by means of an Allen key and allows adjustment of arm height. The 228 comes supplied with an arm rest but no cue mechanism. A damped cue platform is available however and simply clamps under the arm base. Known as the Unilift, this can be adjusted for both cue height and descent speed, the latter being a trifle erratic.

Happily, simplicity coupled with solid engineering seem to have been the main tenets behind this model's design, and as a result it was less troublesome to set up than some equivalents, although still very difficult. The signal wires are led out externally from the upper arm and can be trimmed by hand to produce a net outward torque, whilst bias compensation is applied by a cranked 'falling' lever. The counterweight system is decoupled but sagged impotently on the review sample. This made counterweight and tracking force adjustment doubly difficult, since the weight had to be coaxed back into a normal horizontal attitude each time. I understand that this weakness is being cured by the use of a new type of moulding. Two counterweight sleeves



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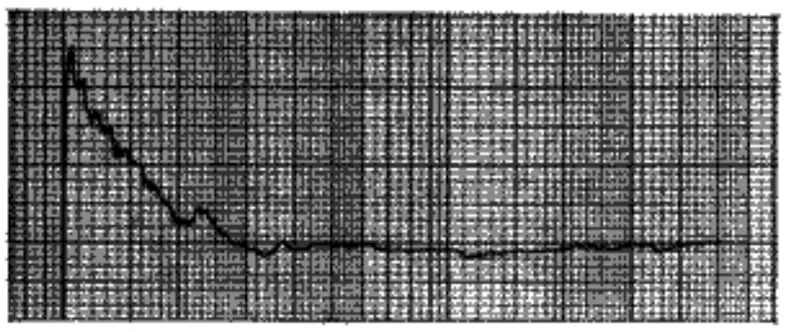


HADCOCK VERTICAL

are provided and allow a wide range of cartridge weights to be catered for, and even though the slender instruction sheet doesn't always say so, everything is adjustable on the GH 228 (apparently the instruction sheet is also being improved!).

The headshell clamps to the straight aluminium arm tube by an Allen key, and can be moved to and fro to minimize tracking angle errors, or be tilted to ensure that the cartridge is vertically aligned. The central arm pivot support pin may also be moved up or down by a small amount to adjust damping. Damping fluid is supplied in a disposable plastic syringe and can be squirted into the arm pillar well quickly and without difficulty. Fixing the Signet cartridge proved impossible with the screws supplied, since their heads were too large. The screw threads used in the tapped headshell fixing holes wouldn't accept the Signet screws either, nor any other cartridge fixing screws from a large collection I keep, which could cause problems and should perhaps be attended to.

Although making small quantities, Hadcock have now achieved a good standard of finish on the GH 228. A lightweight but rigid cast headshell attaches firmly to the straight arm tube and this is rigidly fixed to a solid bearing hub. Pickup leads come attached to the arm and are of high inherent capacitance at 350 pF/channel. This will complement many of the latest moving magnet cartridges by increasing upper mid-band output, reducing HF resonance output and attenuating high frequency distortion harmonics. Not all cartridges benefit, however, and this loading is disastrous for a Stanton 681EEE for instance. The leads were removed and substituted by low capacitance cable before tests. After setting up the Hadcock arm and firmly tightening the Allen type clamp screws, its structure was notably rigid and there was no detectable slack movement at the headshell.

The subsonic response trace between 5 Hz and 20 Hz (fig. 3) shows that the GH 228 is in fact quite heavily damped, and also that the effective mass is low (it is not surprising that the Hadcock appears to display nearly the same effective mass as SME's Series III, since their differences are largely swamped by the cartridge mass). Output from the 10 Hz–500 Hz lateral sweep was surprisingly smooth and free of the sort of dips indicative of arm tube resonance. These comments also apply to output from vertical modulation, although it is interesting to note the curious perturbations at LF which show similarities to the behaviour of the arm fitted to the BD103 (tested Dec. '77); it is perhaps not a coincidence that these are the only unipivots we have tested with these methods, and may perhaps be linked to comments concerning a 'soft' bass quality.

Subjectively the Hadcock arm was credited with a sense of openess and clarity, a feature on which all listeners commented and were impressed with. It was effective in providing some perspective to music rather than shrouding it in a veil of coloration. Comments were also made on bass output appearing slightly soft, although this aspect was not conveyed as forcefully in the listening notes.

ADC LMF–1

THE new LMF–1 from ADC is certainly an attractive looking design which is made in Japan. The most arresting feature is undoubtedly its long, slim and tapered black carbon-fibre arm tube. Carbon-fibre is used

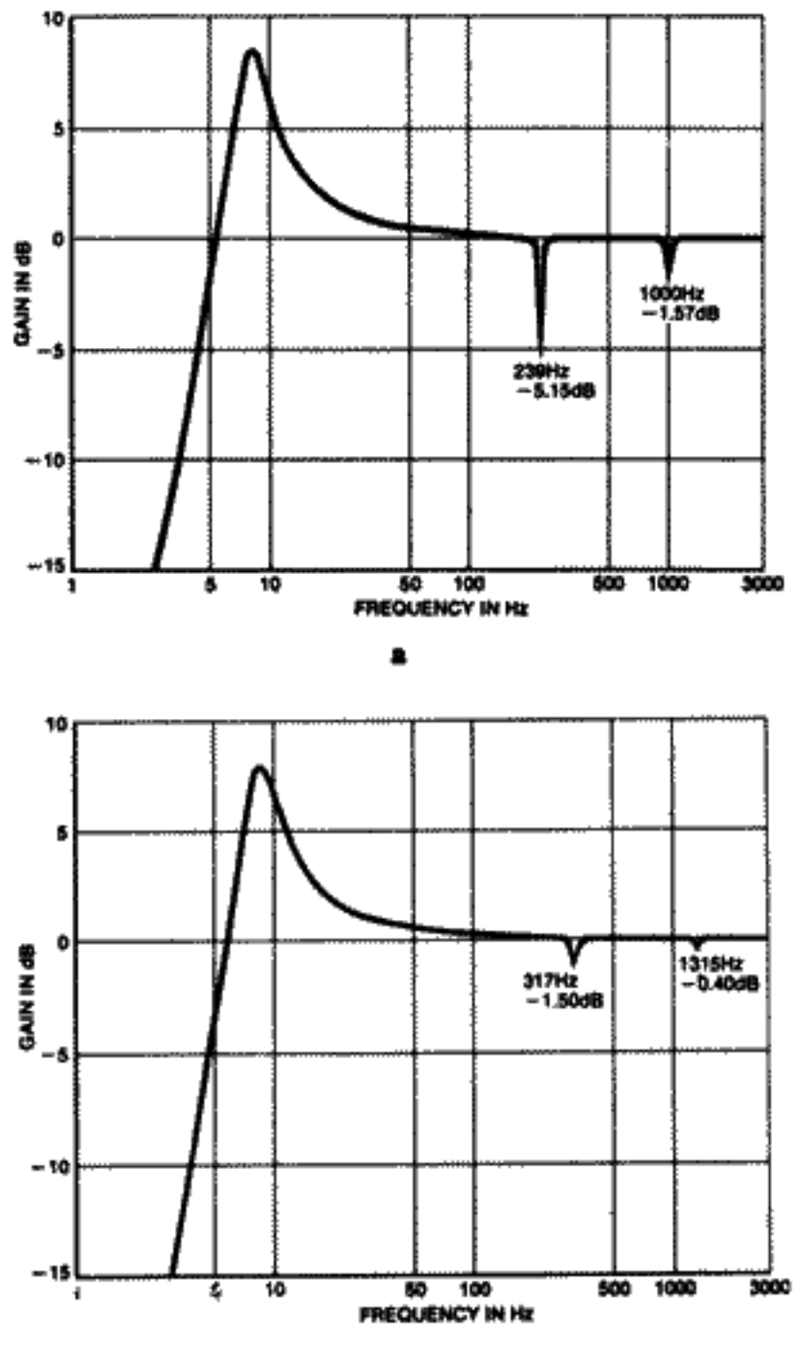
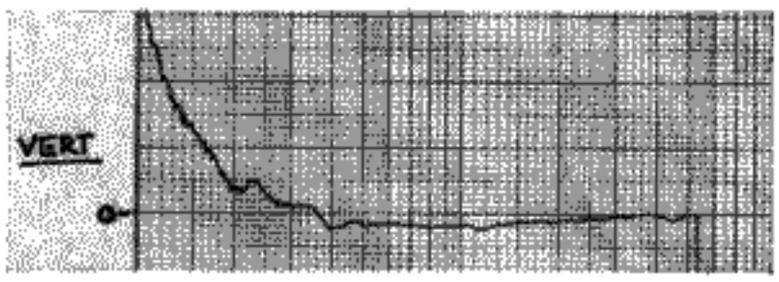


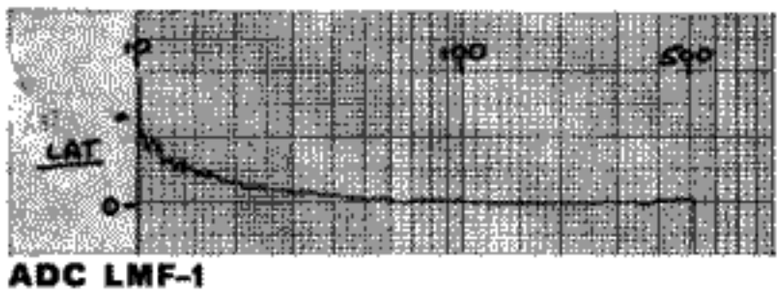
FIG. 5 Comparison of carbon fibre and aluminium (by Sony)

for its rigidity, expressed mechanically as Young's Modulus or the ratio of applied stress to cause a particular unit of length deformation (strain). It is also a low density material and therefore combines light weight with strength, but I understand that unfortunately this material's properties vary considerably according to composition and manufacturing treatments. In other words, there is carbon fibre and carbon fibre! Sony's theoretical analysis of the behaviour of a carbon fibre tone arm and its aluminium counterpart (fig. 5) is of interest here, but should not be taken as a 'whole-truth' depiction of the behaviour of each and every arm using these materials, since the graphs come from a fairly straightforward mechanical model.

I hardly need say that the LMF–1, coming from Japan, was very easy to set up and almost fell into place of its own volition. Supplied as standard for this arm is an ordinary mounting-board pillar clamp of the sort used by Hadcock and Audio Technica. Overhang adjustment is made by sliding the cartridge along the slotted carrier. An optional SME-style sliding base is available which allows the arm to be bolted in directly to the same cutout that an SME requires, all dimensions and screw centres being the same. The LMF–1 possesses an integral 'headshell' or cartridge-carrier for low mass and improved arm rigidity. Bias compensation is applied through a calibrated dial on the arm-pillar/cue-support bracket, and the cue platform is actuated by a lever protruding from its barrel.

Cartridge tracking angle, arm height and cue platform height were all adjustable and no fewer than three additional weights are supplied to aid the primary counterweight in balancing out cartridges of different weights. Tracking force is applied by a calibrated dial that reaches a maximum of 1·6 gms, and some modern designs that require more than this will need to be set up using a stylus gauge.





ADC LMF–1

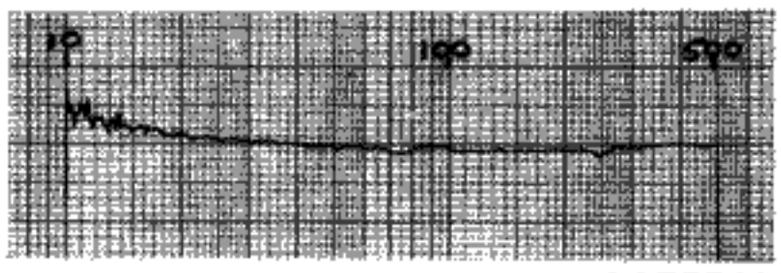
The leads supplied measure 150 pF/channel. The unit was well made and nicely finished generally, moved with freedom and displayed negligible slack in its bearings. In consequence there was no appreciable movement at the headshell when firmly clamped to the mounting base.

Lateral response in the LMF–1 shows that the effective mass lies between that of the Hadcock and SME Series III arms, being lower than the former unit but higher than the latter. The output sweep looks very smooth horizontally, except for a small perturbation at 360 Hz, and is notably flat; vertically it is also steady but for a slight dip at 450 Hz that appears to be an arm function.

This arm produced a somewhat more varied response from listeners than the others and appears to possess a competent if perhaps rather unexciting performance. Subjective agreement was good on the suggestion that the LMF–1 produced a 'relaxed, but flat sound'. Detail was also rated as good, but bass performance drew criticism all round for being of only average quality and lacking the definition of the Hadcock reference. All listeners suspected the existence of colorations too.

ADC LMF–2

THIS arm is a detachable head version of the LMF–1 and shares its construction and features in every respect, except that a very small headshell is supplied which screw-clamps into place on a female aluminium carrier at the end of the arm tube. This makes cartridge changing easy of course, but needn't be chosen for ease of cartridge fitment, since the task is reasonably straightforward on the LMF–1. In all other respects the appraisal of the LMF-1 also applies to the LMF–2, since these units are identical.



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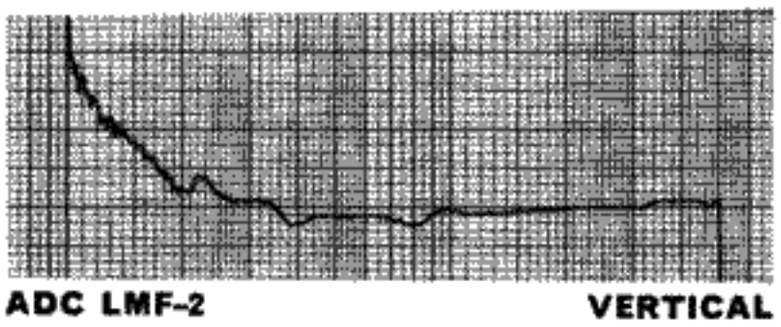


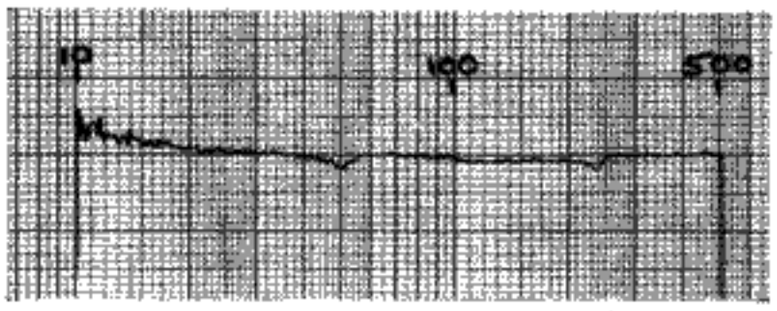
ADC LMF–2 VERTICAL

It is interesting, however, that although these arms are so much alike, the mere addition of a detachable headshell is enough to upset cartridge output and introduce suspicious suckouts in measured response. These two arms were chosen for checks on the accuracy' resolution and repeatability of the response runs made for this report, and whilst each arm showed identical characteristics between runs, the LMF–2 consistently caused suckouts to occur at 75 Hz and 250 Hz on the lateral sweep. Note also that the response to vertical modulation differs considerably from that of the LMF–1 above 40 Hz. As is also obvious, the effective mass of the arm is slightly higher and appears to be similar to the Hadcock in this respect.

It was felt that the LMF–2 was noticeably duller in performance than the LMF–1, and drew the comments 'messy' and 'thick', although a certain warmth to the sound it produced did incite one favourable reaction. Mention of coloration again occurred. On balance it would appear that the LMF–1 was generally preferred to the LMF–2, but this latter unit may appeal to some as its weaknesses did not sound particularly offensive.

SME Series II (improved)

PERHAPS one of the most popular high quality tone arms ever made, this unit remains in production as a less expensive alternative to the recent Series III featured in this report. It was included as we felt readers would be particularly interested in having the new SME placed into perspective with the old. Its design was optimised for low effective mass coupled with adequate rigidity, and for a long period there were few alternatives for those who wished to use a high compliance cartridge, since nearly all other pickup arms have displayed a very high effective mass until recently. An aluminium arm tube sits on knife edge bearings for movement in the vertical plane, whilst ball races are used to control lateral movement. The enclosed headshell makes cartridge fixing difficult on this fixed-head model, although the large horizontal arc of movement often allows the arm to be swung out over the edge of a turntable plinth to ease this problem in practice. A range of counterweights is available in order that both very heavy and very light cartridges may be used without problems, and a fluid damping assembly can also be fitted. Tracking force is applied by moving an outrigger weight forward, but to a maximum of 1·5 gms only. Higher forces can be achieved by screwing the rear counterweight forward, but stylus scales will be needed for accurate adjustment in this case. Bias compensation is by weight and thread, a simple but effective technique, and lateral balance is achieved by altering the distance of the outrigger weight from the arm pivots.



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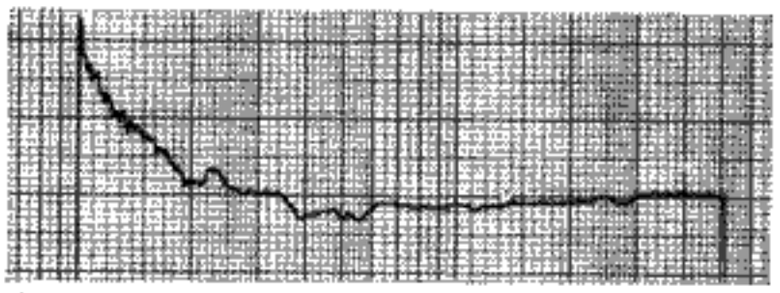


SME II VERTICAL

Fitting the 3009 II is more difficult than with most other makes, since a fairly large oblong cutout is needed to allow the unit to slide along its base in order that tracking angle error can be minimised. Once this is done, the assembly bolts into place in a straightforward manner. Arm height, cue height and headshell tilt are all simply adjustable and setting up the 3009 is not difficult, although to some it may be a bit of a fiddle at times.

This arm is noted for its excellent construction and fine standard of finish. The bearings exhibit no slack and allow great freedom of movement in all planes. Similarly the arm column attaches firmly to its base and there is no residual movement. Criticism is often made about the reversed arm rest that is awkward to use and always locks the arm automatically whenever it is returned to its rest, but this is a small point. Leads supplied with this arm have a capacitance of 80 pF/channel.

Two suckouts are visible in the measured lateral response of this unit, one at 50 Hz which must be discounted as a possible mains effect, and a second at 250 Hz which

is almost certainly caused by a structural resonance. Output from the vertical modulation sweep also shows a perturbation at the same frequency of 250 Hz and a suckout between 40 Hz and 60 Hz. Effective mass of the Series II fixed-head is low and appears to be about the same as that displayed by ADC's LMF–2.

There was consistent agreement in the listening notes that SME's 3009 Series II displayed a noticeable treble lift compared with the Hadcock reference, but treble quality appeared to be less sweet and a bit confused. However, this arm did not collect the coloration brickbats accorded to some of the others, and it was felt to be reasonably clear if somewhat lifeless in sound quality. Bass performance was considered good if a bit soft at times, but it was judged reasonably extended and in good balance tonally with the rest of the performance.

SME Series III

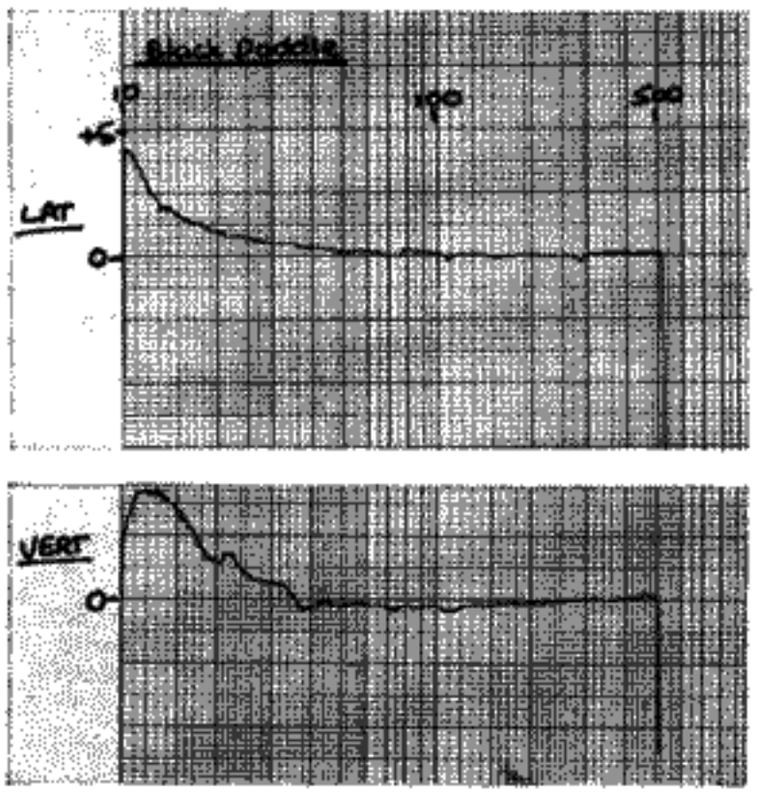
THIS new design from SME, the Series III, follows the course set by the Series II, as one of the main design aims has been to minimise effective mass. However, recent concern over structural rigidity and its effect on sound quality has also been taken into account by this company, and they have in fact been evolving this new unit over a number of years. Effective mass has been lowered by a number of design ploys, the most significant being the use of a light carbon-fibre headshell attached to a thin wall titanium arm tube. This tube is a tight press fit into the main hub, keeping the mass of the mechanical connector close to the pivots in order to minimise effective mass at the headshell, while still providing the convenience of speedy cartridge changing and ease of initial fitment.

The other significant change made has been to bring the counterbalance mass further forward towards the pivots, and whilst this again reduces effective mass it also means that the counterbalance assembly is more massive. Lead strips have been used by SME and are held in 'panniers' on either side of the arm. In order to improve the inherent damping displayed by the arm tube, it is subject to a special nitrogen hardening process that produces a hardness gradient through the thin sidewall and results in reduced energy transmission. On a visit to the giant Matsushita company of Japan, I was assured by them that in their investigations on the suitability of arm tube materials, carbon fibre had been discounted in favour of this form of hardened titanium for the latest Technics pickup arm. It's an interesting point, although Sony might have related an opposite view!

The Series III comes supplied with damping as standard and three paddles can be used to alter its magnitude according to the cartridge being used. It is a simple matter to disconnect a paddle in order to check on the difference the arm produces damped and undamped, and this is an aid to optimising the damping for what one feels is the best subjective performance. I understand also that SME are to provide a thinner for the viscous silicone damping fluid supplied, after some grumbles, but measurements made for this report suggest that the current levels of damping achieved are about correct. A thinner fluid might well be called for with some ultra-compliant cartridges such as Ortofon's VMS 20E or the Empire 2000Z, however.

Calibrated tracking force range has been increased to 2·5 gms maximum, and although the sample tested for this report was fairly accurate in achieving the VTF set, an earlier one was inaccurate. Since scale resolution is poor it is wise in some instances to double check VTF with a good stylus gauge. Arm height, lateral balance and headshell tilt can all be adjusted. The arm pillar is now moved along its base for tracking angle error correction by a small spanner which turns a pinion against a rack. Although this is fancy and easy to use, I was a bit unhappy about the movement in the arm pillar which this permits, not experienced in the Series II with its screw clamps.

The mounting hole required is identical to that used for the Series II, but setting up the arm is a lengthy, although not unduly difficult, process. Offset bearings now put the headshell on the same plane of vertical movement as a vertical tangential plane to the disc, and warp yaw is eliminated as a result. The arm moves with great freedom and there is no resultant slack at the headshell once the main pillar has been tightened. I jam it with a matchstick, but in this instance removing the rubber grommets and screwing down firmly to an aluminium plate was adequate.



SME III

The effect of damping upon sub-sonic output is shown in fig. 3, where output has been reduced by about 5 dB by the small black paddle. Output from the lateral sweep displays some aberrations, most notably between 80 Hz–100 Hz and at 280 Hz. On vertical modulation matters look healthier, and output takes on the smoothness displayed by the Hadcock and ADC LMF–1 arms. It is also apparent that this arm had a lower effective mass than the other five.

Subjective comments about this arm showed a very good consensus amongst listeners on its overall characteristics in the system, which was that it produced a soft, warm but clear sound, with some reservations over bass quality and relative level. Imaging was generally good and treble clean, but a lack of liveliness was noted. This arm did achieve a sense of perspective and avoided the flat, lifeless presentation of other arms assessed in this report. Its tonal balance showed low frequency emphasis, however, and overall reproduction didn't display the delicacy achieved by the Hadcock. An entirely different sort of sound and very distinctive in its own right, the Series III is a very interesting performer.

Conclusion

ALTHOUGH in some senses one might say that the subjective differences detected between the six arms reviewed for this report were small, this is not to class them as unimportant. People seem far more able to adjust to and accept the enormous differences that exist between loudspeakers, but are upset by certain other apparently small deficiencies that make themselves known in a typical hi-fi reproducing chain. For instance, the annoyance value of crossover distortion in amplifiers is undoubtedly great and yet it is not of the magnitude of distortion encountered in other parts of a hi-fi system. So it is with the six pickups reviewed here—their sonic peculiarities are small but not to be underestimated in their negative effect upon final sound quality. Even reasonably priced modern hi-fi systems can be fairly lucid with the right selection of components, correct location and careful setting up. Under these circumstances one would surely notice the curious properties displayed by many of the arms reviewed here.

Of the six arms, overall preference was for the Hadcock GH 228, which was consistently rated as coloration free and rather stronger in providing a sense of light and easy spaciousness. Following closely on its heels were the two SME designs, but these differ significantly from each other and the Series III delivers what is conservatively described as a different but creditable alternative to the GH 228. When considering these units, two points are especially pertinent. First is that the SME Series III arm is very expensive at around £120 against £50 for the Hadcock, but secondly the Hadcock is not so easy to handle in everyday use and will probably possess more appeal to the dedicated enthusiast. There is also more room for experiment with damping on the SME. Their Series II arm also lacked the masking and deadening effects heard on the other units but displayed a curious treble performance. This unit remains good value and now has the option of damping which may go some way to altering and improving its characteristics.

Of the other three units, only ADC's LMF–1 appeared able to warrant some guarded acceptance of its performance. It was considerably preferred to the LMF–2, but criticisms of colorations and bass performance were more severe than those applied to the SME III, which is its nearest competitor on price. Despite modest price and excellent finish, the Audio Technica's main problem lay in its high mass and attendant problems with compliant cartridges. Nevertheless these three Japanese made arms were much easier to set up than the three English ones. Poor setting up can considerably affect performance, so that the Japanese models may well be better suited to those less well versed in such matters. ●