channels as to compare favorably with the quad discrete master tape. Of course, such refinement costs money, but fortunately integrated circuit technology has come to the rescue, and a forthcoming chip will be cheap enough for general use. Summation; at it's best, the SQ system produces quad sound many people find indistinguishable from discrete.

The Sansui QS matrix disc system was initially a more sophisticated approach than the SQ system, and has found favor among many knowledgeable engineers. The QS system went through much of the same peregrinations as SQ, and now has reached a peak of refinement with their new Variomatrix, which is said to afford channel separation of up to 20 dB. Sansui has given many demonstrations matching the sound of the decoded disc through the Variomatrix versus the quad discrete master tape which seems to support this claim. The problem with the QS system is that they have no major record company (as yet) using the system. In this country they are supported by A&M Records, Ovation and ABC/Paramount and Command. They have many labels in Japan, where it is known as RM (regular matrix) and is considered a standard matrix. Summation; a good matrix system with heavy support from engineers. Here too, an IC chip has been developed, greatly lowering cost of incorporation into equipment.

JVC (Victor Corporation of Japan) developed the CD-4 discrete quadraphonic disc system, which is technologically vastly more complicated than the matrix systems. RCA adopted the system in this country and the joint development of the CD-4 system by these companies has taken considerable time to reach the point of commercial fruition. Working in much the same fashion as FM multiplex broadcasts, a subcarrier of 30,000 cycles must be superimposed on the walls of the stereo groove. This poses a formidable challenge in disc cutting technology necessitating cutting the disc master at one third of the normal 33⅓ rpm speed, in order to achieve response to 30,000 cycles. Recently, half-speed (16⅔ rpm) cutting was accomplished, permitting improvements in bass response and the overall level of the disc. In the CD-4 system, the front and rear signals from the quad master tape are mixed together to form the primary signal . . . that which can be picked up by any standard stereo phono pickup cartridge and reproduced in the conventional stereo fashion. At the same time however, the front and rear signals on each side are electronically subtracted, producing a left/right difference signal which is "piggybacked" onto the high-frequency subcarrier. To reproduce the subcarrier cut on the walls of the stereo groove, a special phono cartridge with response of 45-50K cycles is required. As in the matrix disc systems which require a "decoder", the CD-4 system uses a demodulator to "unscramble" the subcarrier and finally to deliver to the amplifier inputs the front/rear, left/right signals in the original configuration of the quad master tape. Because of the high frequency subcarrier, the CD-4 disc must be made from a harder record compound and contain more of a special lubricant than conventional disc compounds. All this is in aid of minimizing wear to prolong the usable level of the subcarrier signal. Detractors of the CD-4 system had stated that the delicate signal of the subcarrier would be erased after relatively few plays, which of course would destroy the quadraphonic capabilities of the disc. Along with the special record compound, a super-sensitive "phase-locked loop" circuit was incorporated into the demodulator which allows hundreds of plays with no loss of subcarrier signal. As might be expected, the CD-4 circuitry (at least the demodulator section) has been reduced to an IC chip with subsequent lower costs for OEM users. While nit-pickers can say that even the CD-4 system uses a form of matrixing (mixing) in the initial signal processing, the fact remains that the disc contains four separate signals with as much as 28 dB between them, thus it is essentially discrete. Summation; while there are certainly special requirements in the recording and reproduction of a CD-4 disc, and admittedly more things that can cause problems if misadjusted, there is no denying the superior separation and instrumental positioning add up to an impressive quadraphonic experience.

Okay, there are the quad disc systems, matrix and discrete. Each has its virtues and its drawbacks. The fact that there is an alignment of the tremendous resources of Columbia Records for their SQ matrix disc, and the equally formidable RCA forces for their CD-4 disc has made for a competitive battle, in which derogatory statements are flung back and forth, about the relative worth of the quad disc systems. Fortunately for the record-buying public, all the quad discs are compatible with present stereo disc playing equipment. One can buy a quad disc, either SQ or CD-4, and play it with a conventional stereo phono pickup, with the assurance that he is not damaging the disc and that if he eventually acquires quad playback equipment, the disc will perform as advertised.

In the past year and a half, it has become very apparent that true to past form, neither RCA or Columbia was about to get together to settle their quad disc differences. This was a cause of considerable concern in the hi-fi industry, since the lack of a quadraphonic disc standard was confusing to customer and dealer alike. Only the "avant garde" audiophiles were really buying quad equipment, and it is readily admitted that sales of quad equipment were far behind anticipation. I should modify that last statement a bit, since strangely enough, quite a fair quantity of "cheapie" compact quad systems were sold, largely to the young set, and