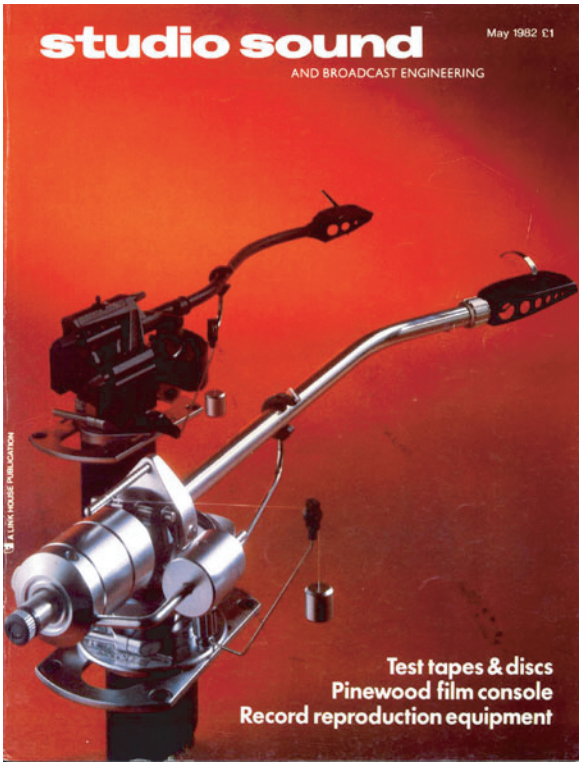
Early Stereo Recording
(Alen Blumlein)

By Barry Fox



Studio Sound
May 1982

Alan Blumlein

Early

WOE betide the inventor who gets his timing wrong. Antony Askew has meticulously catalogued the efforts of Clément Ader to interest the world in a stereo telephone system, a hundred years ago (*Studio Sound,* September, October, November 1981 issues). Although visitors to the 1881 Paris Exhibition of Electricity were queueing to hear the world's first stereo transmission of sound, from the stage of the Opera across the city, and although Ader patented his system, it was commercially ahead of time. The public was only just coming to terms with the idea of a mono telephone, let alone a stereo version.

Ader's ideas were many times rediscovered and re-patented, for instance by Harry Wier of Western Electric in 1921 and by Chicago inventor W Bartlett Jones in 1927. Harry Wier (in US patent 1 508 432) and Bartlett Jones (in US patents 1 855 149 and 1 855 151) took Ader's ideas a step farther. They both proposed ways of *recording* two channels of sound, whereas Ader was concerned only with transmission. Wier patented a double groove cylinder and Bartlett Jones a double-grooved disc. Bartlett Jones even suggested recording two channels of sound in a single groove, one channel recorded by vertical modulation and the other by horizontal modulation. Bell Labs ran a permanent demonstration of binaural sound at a Chicago museum in the '30s and '40s. The idea was forgotten but came to the surface again, mainly in Germany, in the '70s. Binaural stereo recording and radio transmission was then seen as a commercially viable alternative to the primitive systems of 4-channel quadraphony being foisted on an unsuspecting public. The time was then 'right' for binaural. But it still failed to achieve real commercial success because all the 'inventors' of binaural stereo have been up against a problem which is much more significant than that of nice timing. It still remains, and will remain, a curiosity for the simple reason that headphone listening is not only uncomfortable, and fatiguing, it is also downright anti-social. There is no more infuriating sight in this world than a companion revelling in invisible pleasures derived from a pair of headphones.

The need for a loudspeaker system to reproduce stereo, or 'auditory perspective' as it was originally known, was soon recognised. By the late '20s and early '30s research teams in both the UK and USA were working independently, but virtually in parallel, on an answer to the problem. By coincidence the success of those research teams in recording and reproducing loudspeaker stereo makes these winter months not only the centenary anniversary of anti-social stereo listening, but the 50th anniversary of stereo sound recording and reproduction as we know it today.

The British work, by Alan Dower Blumlein of EMI (now Thorn-EMI), has already been reasonably well documented. This followed an upsurge of interest in Blumlein's work during 1977, when the Greater London Council erected a commemorative plaque on Blumlein's last London home, in Ealing. This commendable gesture by the GLC was itself timed to coincide with the 35th anniversary of Blumlein's tragic death. He was killed in 1942 when a Halifax bomber, in which he was testing a radar prototype, crashed in the Wye Valley.

A biography on Blumlein has long been promised but nothing has ever appeared. For those whose memory needs jogging, Blumlein arguably contributed more to audio and video technology than any other Briton. In his short life he was responsible for no less than 128 patents, an average of one every six weeks of the time he spent on research at EMI's central labs in Hayes. Of these patents BP 394 325 was by far the most significant. It describes Blumlein's proposals for stereo recording on disc and film. It describes the techniques (which we today take for granted) which are needed to convert phase differences at a coincident pair of microphones into amplitude differences at a spaced pair of loudspeakers so that they create a stereo image spread. In searching for an alternative to headphone listening, Blumlein gave up trying to solve the problems of acoustic crosstalk and turned them to his advantage.

When a binaural stereo recording is reproduced through loudspeakers, the binaural effect is degraded. This is because of acoustic crosstalk. The sound from the left loudspeaker reaches both the left and right ears, instead of just the left ear as would be the intended case for headphone listening. Blumlein forgot about trying to re-create an accurate replica of the original sound field at the listener's ear. Instead he concentrated on fooling the listener's ear and brain into hearing an illusion of the original sound field. By converting phase differences at the microphones into amplitude differences at the loudspeakers, and relying on the fact that the sound from each loudspeaker would reach the ears of a listener at slightly different times, Blumlein recreated phase differences across the listener's head. This gives the listener reasonable freedom of movement between a pair of loudspeakers without loss of stereo image. It's the psychoacoustic principle on which all modern recording relies for its stereo effect.

Blumlein also developed, and patented in BP 394 325, a system of capturing the two channels of sound information necessary to achieve the effect. He did this using only a single soundtrack or single record groove. For film stereo he split a conventional 35mm optical soundtrack into two halves, one for the left sound channel and the other for the right channel. For disc stereo he recorded two channels of sound in a single groove by driving the cutting stylus in two planes at the same time. The two planes were vertical and lateral or, as is the established stereo standard today, each at 45° to the disc surface.

There is an interesting story behind the adoption of this standard for stereo recordings. The decision on 45/45 cutting was taken by the Record Industry Association of America (RIAA) on March 25, 1958.

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But the standard wasn't referred to as a Blumlein standard, instead it was credited to Westrex. This prompted an editorial outburst from the normally staid British magazine *The Gramophone.* In the April 1958 issue Percy Wilson, the technical editor, reminded the world that the 45/45 system was called the Westrex system only because Westrex "happened to give a demonstration of it at Los Angeles last September". Wilson also detailed the work of Decca in producing equipment that coped with both vertical/lateral and 45/45 stereo cut all based on the original work of Alan Blumlein. Decca had in fact also developed equipment for a third stereo system. This adopted the 'multiplex' approach proposed by Bill Livy of EMI in which the two channels were separated in frequency, in a manner similar to that later used by JVC for the *CD4* quadraphonic system.

"In 1498, we are told, Columbus discovered the Continent of America; and since that date the inhabitants of that wonderful land have from time to time discovered Europe. But only occasionally, it seems, do they discover what the Europeans have been doing—or at any rate given credit for it" *wrote Percy Wilson.*

Ironically, as we shall see later, the Americans had not even discovered what their own fellow countrymen had been doing! The Westrex system was not only anticipated by Blumlein's work, but also by the closely similar work of a team of engineers at Bell Labs. The Bell engineers had been working on the same problems as EMI at the same time, and had come up with some closely similar answers. The supreme irony here is that Westrex was once a division of Western Electric, which was the sister company of Bell Labs. Both Bell Labs and Western Electric are of course part of the giant American Telephone and Telegraph Company (AT and T) which controls the American telephone network, called the Bell system. We shall also see how Bell Labs came to develop, and patent, a stereo sound recording and reproduction system, with the enthusiastic help of Leopold Stokowski and the Philadelphia Orchestra.

Recently Bell Labs have issued (on limited edition and available only for libraries and archives) two LP discs of high quality recordings made in the winter orchestral season of 1931/32. As part of that coincidence mentioned above, which ties the centenary of binaural stereo to the 50th anniversary of high fidelity recording and loudspeaker stereo, the Bell releases contain what is arguably the world's first high fidelity disc recording. This was cut on December 1, 1931. Stokowski was rehearsing Berlioz' *Roman Carnival* and the Bell Labs engineers captured some excerpts on a high quality disc system. They also made what must surely be the first high fidelity stereo recording. This was made during a concert of Russian music given by Stokowski on March 12, 1832. The Bell Lab engineers were present and recorded two short extracts from Scriabin's *Poem of Fire.* This is also on the Bell disc reissues.

To complete the anniversary picture of coincidences the first documents that went to make up Blumlein's famous patent BP 394 325, were filed at the British Patent Office on December 14, 1931.

It would be nice to be able to say that EMI (now Thorn-EMI) has produced a tribute to Blumlein which is comparable to the Bell Labs tribute to the pioneering work with Stokowski in the winter season of 1931/32. Unfortunately it is impossible to bestow any such compliment on EMI.

Blumlein completed a stereo sound film, using the techniques described in his patent. These techniques are so closely similar to those used today by Dolby Labs for optical sound film stereo reproduction, that Dolby engineers have confirmed that the Blumlein film would be playable on modern Dolby stereo film equipment. But since the mid '30s, when Blumlein completed the production of his test films, what remains of them rests apparently uncared-for in the EMI Labs at Hayes. These early films are on nitrate stock, which is inherently unstable. Nitrate film burns explosively if ignited, but turns to goo and then dust if not carefully stored, ideally at low temperature. There is no evidence that EMI is storing the Blumlein film carefully. A few years ago it was simply sitting in a cupboard. Also, despite repeated promises, there is still no firm news of a transfer to modern safety stock. If the Blumlein film turns to dust in the uncaring hands of EMI; it will be to the company's everlasting shame.

Blumlein also made some stereo test disc recordings 50 years ago, using the double modulation tech-

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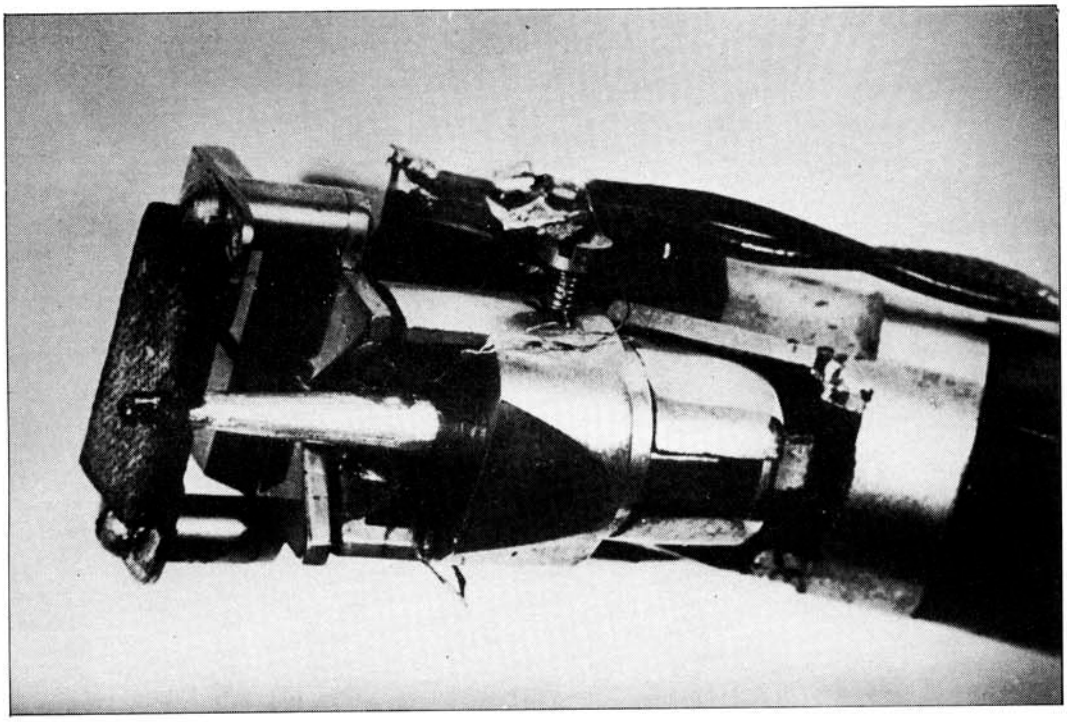

Blumlein's original stereo pickup

niques described in patent BP 394 325. Although these discs appear to be in safer keeping, EMI has done little to exploit their historical potential. Indeed getting hard fact information on what archive software exists in the EMI vaults, and its condition, is like squeezing blood from a stone. It all makes a sad and marked contrast with the attitude of Bell Labs who have been at pains to publicise their archival tributes.

The first stereo tests were made by Blumlein at Hayes. His assistants walked round a room and talked at the microphones as Blumlein altered the circuit configuration. These 'walking and talking' recordings have been occasionally played at lectures and demonstrations, but they have never been made widely available, even for historical interest. If you have heard a 'walking and talking' Blumlein recording, it was probably one that was cut on December 19, 1933.

Exactly one month later, on January 19, 1934, Blumlein took his stereo recording equipment to EMI's Abbey Road Studio One where Sir Thomas Beecham was making a commercial recording (in conventional mono) of Mozart's *Jupiter Symphony*. Sir Thomas Beecham, like Stokowski, was always interested in new audio techniques. It was Beecham for instance who, in 1936, made the first orchestral recording on magnetic tape, at the BASF concert hall in Ludwigshafen, Germany. During the Abbey Road *Jupiter* recording, Blumlein made several tests in stereo. Again it is hard to extract useful information from EMI, but it seems that these were cut in vertical/lateral form rather than 45/45. Before the recent Bell Labs re-issues and their 1932 stereo cuts these Blumlein-Beecham tests of 1934 had always been cited as the world's first orchestral stereo recordings. The main difference is that the Bell cuts were made using a double groove technique.

The Blumlein single groove cuts remained for nearly half a century closeted in the EMI vaults, along with the walking and talking tests and the decaying optical stereo film. But finally, amidst virtually no publicity, a snatch of a stereo test appeared on the one side of one disc in an 8-disc boxed set issued by EMI-World Records to commemorate the centenary of Sir Thomas Beecham. "At last," thought those of the audio world who cared, "a chance to hear original Blumlein stereo." But enthusiasm was short lived. The brief segments turned out to be a terrible disappointment. The Blumlein stereo sounds more like mono! The faint illusion of stereo that persists probably stems only from the fact that there is tonal imbalance between the left and right channels. Blumlein must be turning in his grave at the sound of his work as released to the public by his old employer nearly 50 years after the tests were recorded. Those who know what crossed pair stereo can sound like are sure there must be a far superior stereo image locked on the original discs held by EMI. The company promised to check the originals and comment on the issue, but despite reminders it never happened.

The Blumlein-Beecham issue sounds especially poor in comparison with the superb Bell Labs transfer. This is doubtless due to the fact that Bell Labs employed Arthur Keller, one of the engineers responsible for the original recordings, to supervise classification of the Bell archives and transfer of the 1931/32 winter season recordings on to modern LP disc format. EMI can of course not call on Blumlein for similar help. But is it really so difficult to transfer V/L recordings on to tape and from there on to modern 45/45 stereo LP format? Surely not.

All is not lost. Perhaps the publicity for the archival issues by Bell Labs will stir someone, somewhere inside Thorn-EMI to more positive action. Blumlein's work made EMI's involvement in the record business possible. At the last count, Sir Richard Cave, the boss of Thorn-EMI earned £96,961 a year. The least Thorn-EMI can now do is produce an archival disc record of Blumlein's pioneering work, shown to the best possible advantage. In this respect time is on Thorn-EMI's side. January 1984 marks the 50th anniversary of Blumlein's original tests with Sir Thomas Beecham.

In the early '30s when Blumlein in Britain and Bell Labs in America were working separately, and in ignorance of each other, on the same problem of reproducing stereo with loudspeakers rather than headphones, the time was most certainly *not* ripe for the introduction of any such system on a commercial scale. Both Britain and America were in the grips of a deep recession. Unemployment in the UK was around three million and in the USA around twelve million. Radio had taken over from the gramophone as the most popular medium. As Arthur Keller, who engineered the original '30s recordings of Stokowski and was recently re-employed for two years by Bell Labs to work on the re-issue of selected excerpts, recalls: "People had difficulty in raising the money for one loudspeaker, let alone two." Why then was Bell Labs, a research laboratory for a national telephone company, able and willing to devote so much time, attention and money to the development of such a commercially irrelevant system as high fidelity stereo recording? The simple short answer is that Bell Laboratories has a very wide research brief. Anything connected with sound communication, and now vision communication, is fair game for Bell's research interest. And there were good reasons for Bell to improve the quality of disc reproduction even in those bitterly depressed days. Curiously it all began with the cinema . . .

In the '20s the disc was still an imperfect medium. Records were pressed from shellac which was noisy and the modulation was horizontal, rather than vertical as had been proposed by Edison. Horizontal modulation is more difficult to track. Also groove spacing and playing time per side, becomes a direct function of modulation levels. But it's easier to generate high levels of sound if the groove is modulated 'laterally' because the stylus excursion can be made very large.

There were no magnetic tape recorders, and although the idea of recording sound optically on film had been proposed, it had not been developed into a workable system. So to provide a soundtrack for a film it was necessary to use discs, and these offered poor quality. In any case, Hollywood wasn't too interested in providing soundtracks for films, because most of the studio executives firmly believed in the long term future of silent pictures. But Bell Labs needed a sound film system for a special reason. The company used to recruit graduate engineers from universities and for this purpose made its own publicity films. These were screened with an accompanying talk by a Bell Labs employee.

In 1922 the Bell engineers tried synchronising their films with a talk pre-recorded on disc. In fact the synchronisation was very loose and there was no direct speech into the camera, simply a commentary. But two years later they achieved lip sync with a mechanical gear system linking a gramophone and film projector. The quality of reproduction was still poor because the disc was lateral

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cut and pressed from shellac. Quality also suffered because even 16in discs had to run at 33⅓ rev/min to give a reasonable playing time. But Bell saw the commercial potential of their sync system and demonstrated it to the movie industry. Only the Warner brothers were interested and the rest is more or less history. The system, called *Vitaphone*, was first used by Warner's to produce *Don Juan*, a musical sound film with an introduction spoken in lip sync from the screen. Then, the next year came *The Jazz Singer*. The discs used for *Don Juan* and *The Jazz Singer* were played by steel needles tracking at around 1lb and each needle lasted only one side. Dynamic range was around 30dB and bandwidth 4.5kHz.

That was 1927 and over the next three years the Bell engineers beavered away at improving the sound quality of disc recording. By the time they had succeeded, a practical optical sound film system had been developed. Essentially it's still in use today. But Bell's work on sound-film-discs laid the groundwork for improved gramophone sound. It also laid the groundwork for stereo reproduction or 'auditory perspective' as it was then called. Bell's work on recording led to research into the live transmission of high quality sound, in 3-channel stereo, across the country in subterranean telephone lines. In turn this generated more research into recording. In all this work the Bell engineers had a valuable ally in Leopold Stokowski who, like Sir Thomas Beecham in Britain, had a very open mind and keen interest in new sound technology.

In 1933 Stokowski's orchestra played at the Academy of Music in Philadelphia, while, over a hundred miles away, in Washington's Constitution Hall, Stokowski himself sat at the controls of a 'discrete' 3-channel sound reproduction system. Four meticulously equalised telephone lines connected the two locations. Three lines were used for the audio link, the fourth was kept as a spare. By using a suppressed high frequency carrier technique the Bell engineers were able to carry signals 150miles, with a frequency characteristic which was flat to within ±1dB from 40Hz to 15kHz, and a dynamic range of 80dB. The amplification system could in fact add an extra 10dB to the reproduced signal, so that an orchestra of 100 musicians in Philadelphia was made to sound like 1,000 in Washington. Incidentally no compander system was used at this time, even though companders were well known and available to Bell engineers. Three moving coil microphones picked up the sound of the orchestra and fed three loudspeaker banks through three separate phone channel links and amplifiers. In practice three microphones were spaced out between the conductor and orchestra with a fourth for solo voice pickup. When this spot mic was switched in, only the two side channels were used to pick up the orchestra. The spotted voice was transmitted and reproduced over the centre channel.

It's important here to remember that although Blumlein in Britain was working on a 2-loudspeaker system, with phase differences in the sound field converted into amplitude differences for the loudspeakers to re-create phase differences at the ears and so produce the illusion of a stereo spread, Bell engineers were committed to the 'wave front reconstruction' philosophy. If an infinite number of microphones were placed in front of a sound source, and connected to an infinite number of loudspeakers by an infinite number of cables, then the original wavefront could be reconstructed and full auditory perspective or true stereo reproduced. But this is obviously an impractical solution, and while Blumlein looked for a way of making two speakers spread a mix of sound, Bell's experiments were aimed at finding the minimum number of discrete reproduction channels which could provide a spread of sound without a hole in the middle. They found that three channels was the minimum. Hence the 3-channel link between Philadelphia and Washington.

Over the next decade Bell continually improved the system, and used it for live sound reinforcement, for instance at the Hollywood Bowl in California for orchestral concerts. There was an obvious incentive to try to record this 3-channel sound, but it was clearly impractical to achieve this with a disc record. So Bell developed a film recording system, with three channels of sound recorded optically down the centre of a length of 35mm film, and a fourth track recorded to control a compander operating on the three audio tracks. This was used, again with Stokowski's co-operation, for a concert of recorded sound staged at Carnegie Hall in 1940. Soon afterwards a modified system, developed by Disney Studios in co-operation with RCA, was used for *Fantasia*. This system has already been described in *Studio Sound* (August 1979), because the final 3-channel soundtrack, with single-channel compander control track, was derived from a 9-track optical master. It was thus arguably the first multitracked recording.

But long before Bell recorded multitrack sound optically on film, and even before the public demonstration of high quality live line transmission, Bell engineers had both improved the quality of disc recording and developed a 2-channel binaural stereo recording technique. Although this work was originally stimulated by the need to improve the quality of sound film disc recording, momentum carried the research and development on long after the cinema had lost interest in sound-on-disc recording. In all, Bell engineers made 6,000 test records during the period of three years from 1931 to 1934. Only around 700 of these originals now remain, because many have been discarded as valueless, lost, stolen or deliberately destroyed. And for the same reasons none of the original sound films or optical sound recordings remain since they were on nitrate stock like the EMI Blumlein material. Of the original master discs, still in the Bell archives, 128 were recorded with Stokowski during the 1931/32 season. It was from these recordings

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Arthur Keller with the special gramophone recently built to replay the original masters for dubbing on to modern format

Two early pick-ups—slightly heavier than their more recent companions

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An exhibition stand shows an example of the double groove technique used in early stereo recordings

that the two recent Bell Labs re-issues were produced.

In 1931 Bell rejected lateral cut modulation in favour of vertical cut, because they found it easier to track a hill-and-dale groove accurately. Shellac was discarded as a disc material and pressings made from a then-new material, vynilite. This had been produced by Union Carbide for moulding telephones. Traditionally wax disc masters had been rubbed with graphite, prior to electro-plating, to make them conductive. But Arthur Keller found that this roughened the surface and increased noise. So he and his colleague engineers built a high-vacuum, high-voltage, gold-sputtering machine which deposited a thin layer of pure gold on the wax disc surface. Because the discs were used only for tests, not commercial releases, the metal layer was simply stripped off and used as a stamper. To produce commercial quantities of disc record it is of course necessary to go through a 3-stage electroplating process, and produce master, mother and then stampers. But Bell didn't need commercial quantities and could use the metal master as a stamper.

Keller and his team used mainly 12in masters running at 33⅓ rev/min (16in discs had been necessary only for film use, where the playing time of a disc had to match that of a reel of film). All the discs were recorded with centre start, the stylus tracking out towards the outside. Because the modulation was vertical, rather than lateral, groove pitch could be kept fine.

By the winter season of 1931/32 the adoption of vertical cut modulation and the use of vinyl material for the pressings had brought about a marked improvement in audio quality. Dynamic range had been extended to 60dB and bandwidth to 10kHz. It's a revelation to compare the very boxy (30dB; 4.5kHz) sound of *Don Juan* or *The Jazz Singer* with the very respectable sound of the Stokowski recordings now re-issued, especially those made towards the end of the winter season. By this time the Bell engineers had cured some early problems, for instance of over-modulation, which marred the first cuts made in December 1931.

The recordings Stokowski made with Bell 50 years ago were kept a secret from the performing musicians. Only recently, when Arthur Keller lectured in Philadelphia and played some of the original recordings, did some old musicians in the audience learn that they had been recorded!

When Arthur Keller was re-employed by Bell Labs to sort through the old masters and arrange re-issues, recording engineer Ward Marston IV was also employed to help piece together the original material and dub from the original discs on to tape and then on to modern LP format. This proved to be a mammoth task. For one thing, because the tests had never been intended for commercial release, many of the recordings were incomplete. Also the early recordings, made in December 1931, were of far inferior quality to those made in the Spring of 1932. It proved impossible to get clean pressings from the gold sputtered masters so Keller and Marston had to devise a system of playing the masters themselves. These are negatives, so the turntable has to run backwards and the stylus track a ridge rather than a groove. They used Stanton forked styli, but needed a range of different shapes to cope with different cutting levels. This was the only way to cut down on pre- and post-echo where the originals had been recorded at high level. There was also a problem of keeping the stylus firmly on the master ridge, because the gold masters are less than perfectly flat. And some of them showed signs of flaking through age, mis-handling or bad storage.

All in all it's remarkable that the Bell re-issues sound as good as they do. The Weber *Invitation to the Dance* track is for instance a mix of incomplete takes from two quite different concerts recorded with different microphone placements. One piece of Wagner contains 20 splices. Different sections of material had to be tracked with four different-sized styli and then cut into a remarkable cohesive whole.

The 1932 stereo recordings were made by a double groove technique; one channel was recorded with one cutter head, starting from the centre of the disc, and the other channel was recorded with another cutter head, starting halfway out from the centre. According to Arthur Keller the 2-channel recording was intended to be replayed through headphones. Bell was aiming at wavefront reconstruction for speaker stereo using at least three channels. But it sounds remarkably good today, even when replayed through a conventional stereo pair of loudspeakers. Transferring the 2-track stereo on to tape, and then on to modern 45/45 stereo disc format, was a terrible headache. Ward Marston had hoped to lay his hands on one of the old double-groove players made by Emory Cook, but had to settle for two modern pickups lined up on a turntable plinth by trial and error. He attempted to synchronise them with an oscilloscope, but finally ended up dubbing the two separate channels on to two tapes and then syncing them by ear.

Release of the Bell Labs stereo recording made in March 1932, has inevitably stirred up controversy over who should be credited as the true and first inventor of stereo recording. At first sight Bell Labs were clearly first to record an orchestra in stereo, and they did this even before Blumlein had made his 'walking and talking' stereo tests at the EMI Laboratories in Hayes. To recapitulate on the bald facts: the first Bell-Stokowski stereo recording was made on March 12, 1932, the Blumlein 'walking and talking' tests were recorded at the EMI Laboratory in Hayes on December 19, 1933, and the first Blumlein-Beecham orchestral stereo recording was made at Abbey Road on January 19, 1934. But the Blumlein-Beecham recording was made with a *single groove cut* of two channels, whereas the Bell-Stokowski recordings of 1932 were made with *two quite separate grooves* cut on the same disc. To confuse the issue further, and add fuel to the fire of controversy, Arthur Keller and his colleague at Bell Labs, Irad Rafuse, developed and patented a *single groove* stereo recording system, virtually identical to the Blumlein system. So both Blumlein and Bell Labs proposed what is now standard practice, namely that two channels of sound should be cut in a single groove, at right angles to each other and at 45° to the disc surface. But whereas Blumlein lodged his British patent (BP 394 325) for a 45/45 cut on December 14, 1931, Keller and Rafuse didn't lodge their US patent (USP 2 114 471) until June 20, 1936. This delay was partly a result of a peculiarity in the US legal system and partly due to the low priority given to the idea by the Bell Labs legal department in those depressed times. In America a signed notebook can help date an invention, whereas in Britain an early filing at the Patent Office is more important. Arthur Keller has himself recently confirmed that because of the depression, the Bell Labs lawyers didn't get round to filing a patent application on the idea until long after he and his colleagues had built a system. Thanks to the American legal system, there was less incentive to hurry than there would have been in other countries.

It is now impossible to say with certainty who did what, first, and when. It's also singularly pointless. Clearly neither Bell Labs nor EMI knew much—if anything—of each other's work, and there was certainly no commercial incentive to be first with a workable stereo disc system. The British Beecham recordings, and the Stokowski recordings in America, were made only for experimental purposes. We should simply be glad that Bell Labs has invested money in the production of two re-issue albums, and be sorry there are unlikely to be any more. The Bell Labs management seems to think that enough's enough. But we should be even more sorry that there is as yet nothing of comparable significance from Thorn-EMI to honour the work of Alan Blumlein. Perhaps with the 50th anniversary of those historic Blumlein-Beecham recordings due in January 1984, Thorn-EMI can now be enthused or embarrassed into remedial action. ■