

THE WINSTON CHURCHILL MEMORIAL TRUST

CHURCHILL FELLOWSHIP 2002

LEVER AND PEDAL HARP CONSTRUCTION, REPAIR AND MAINTENANCE

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1. Acknowledgements

This report details the findings of a 2002 Churchill Fellowship visit to Europe, the United Kingdom and North America to investigate harp making and repair. More specifically, this included:

- Design of pedal and lever harps
- Use of woods and finishes
- Manufacture and Use of Strings
- Availability of different types of levers
- Regulation of pedal mechanisms

This trip and the very valuable experience and information gained would not have been possible without the generous assistance of the Winston Churchill Memorial Trust which enabled me to plan a comprehensive trip in the first place and then gave me the flexibility and means to extend my travels to meet extra people along the way.

It was also greatly enriched by the generosity of many members of the harp community in Europe, England Scotland, British Columbia and California, who welcomed me into their workshops and often into their homes as well and shared their skills and knowledge so generously.

My thanks too, to my family, Tony, Molly and Ned for their support and encouragement.

2. Executive Summary

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Fellowship objective:

To study harp construction, repair and maintenance in Europe, UK and North America

Fellowship highlights:

1. 8th World Harp Congress, Geneva - an eight day gathering of harp makers, suppliers, teachers, players, composers for seminars, masterclasses, exhibitions and concerts. Established many contacts in all categories.
2. David Harps, Ste Croix, Switzerland. I worked for three weeks with Gerard David and employees learning pedal harp construction and regulation.
3. Camac Harps, Mouzeil, France. I toured of one of the largest harp factories in the world.
4. Danielle Perrett, London, harpist, harp teacher Royal London College of Music, examiner Trinity College, London who introduced me to a number of people including; John Marson, harpist and composer; Alan Munson of Munson and Harbour, harp repairers; members of the UK Harp Association; Mike Parker, harp maker.
5. Ardival Harps, Inverness, Scotland. I met Bill Taylor who is President of the Historical Harps Association, a noted scholar of early harps and harp music and part of a small company making reproduction early harps.
6. Bow Brand Strings, Kings Lynne. I saw the manufacture from start to finish of gut and wire harp strings.
7. Pilgrim Harps, South Godstone, Surrey. This is a co-operative that makes a range of pedal and lever harps.
8. Tim Hampson, Bere Ferrars, Devon. Tim is a specialist in triple harps, clarsachs and replica early pedal harps.
9. Lori Papajohn, New Westminster, Vancouver, harpist, and Editor *BC Harps Newsletter*, put me in touch with Ron Wall of Winfield, BC and Laurie Neish, Ganges, BC. harp makers, both of whom I visited.
10. Robinson's Harp Shop, Mt Laguna, California. Here I met Susan Raimond, who for many years has cheerfully and skilfully answered questions about harp stringing and levers and promptly filled my orders. She put me in touch with Mike Malley of Lionwood Harps in nearby San Diego, whom I visited.
11. Sylvia Woods Harp Shop, Los Angeles. One of the largest harp retail stores in the world. I met Sylvia Woods, a noted harpist and arranger and attended a concert and workshop with William Jackson a Scottish folk harpist.

Findings:

- There is no one 'right' way to build a harp. A variety of factors go to make a good harp and include most importantly tone and volume. Weight, size, design, portability and cost are also important factors but will vary in importance from person to person. Australians have been very limited in opportunities to see, hear and play the variety of harps that are available in Europe and North America.
- Methods of lever harp making developed by myself have been confirmed as effective, economic and musically sound. At the same time, I have gained useful knowledge on how to improve further my techniques and I have been motivated to expand the range of harps that I make.
- Because of Australia's distance from other harp making centres and because of the position of the Australian dollar local harp makers have an advantage in terms of cost. This would be particularly so at the pedal harp end of the market if there were a local manufacturer. However, Australians seem unwilling to spend as much on harps as their European and North American counterparts.
- The opportunity to learn from harp makers around the world has enabled me to share Australian harp making achievements with the world community and thereby to increase the standing of my harp making colleagues with other harp makers around the world.
- The harp community in Australia (makers, players, teachers, audience), though growing, is relatively small and isolated and there is scope for both expansion and education. It has been, because of isolation from the rest of the harp world and isolation of groups within Australia, inward looking and somewhat conservative.
- The Harp Societies that already exist in South Australia, Victoria, New South Wales and Queensland are an obvious point at which to begin to promote growth and change, through seminars, newsletters, workshops. A number of overseas Societies are keen to be in touch, exchange news and information and possibly arrange joint activities which could raise levels of awareness and expertise.

3. Program

Geneva concerts, workshops, harpmakers' exhibitions	21 - 28 July	8th World Harp Congress
Sainte Croix, Switzerland pedal harp construction, regulation and repair	31 July - 21 August	David Harps
Mouzeil, France pedal and lever harp construction	26 August	Camac Harps
Veenendaal, Holland pedal and lever harp regulation	30 August - 1 September	de Veer-van Hattem Harps
Andelst, Holland maker of Paraguayan and Celtic harps, string maker	31 August	Hans den Brok
Oosterwolde Holland maker of Celtic harps	31 August	Hans van Lod
London suppliers of Salvi pedal and lever harps, hardware, strings and music	4 September	Hollywell Music
London harpist, harp teacher London College of Music, examiner Trinity College	5-7 September	Danielle Perrett
London Cristyn Williams and Catherine White in concert to celebrate the 70 th birthday of John Marson, harpist and composer	8 September	UK Harp Association
Inverness reproduction medieval harps, International Historical Harp Society, concert, "Poosies" including Patsy Seddon and Mary McMaster on wire, gut and electric harps	11-13 September	Ardival Harps
Kings Lynne manufacture of gut and wire strings	18 September	Bow Brand Strings
Filkins, Gloucester suppliers of Aoyama Harps, music and strings	19 September	Clive Morley Harps
London harpist and composer	22 September	John Marson

London	23 September	Mike Parker
specialist in early and Celtic harps		
South Godstone, Surrey	24 September	Pilgrim Harps
Pedal and lever harp construction		
London	25 September	Munson and Harbour
pedal harp repair and restoration		
Bere Ferrers, Devon	27 September	Tim Hampson
specialist in triple harps, clarsachs, replica early pedal harps		
Winfield, BC	4 October	Ron Wall
maker of lever harps		
Vancouver, BC	6 October	Elizabeth Volpe
Principal harpist, Vancouver Symphony Orchestra		
Salt Spring Island, BC	10 October	Laurie Neish
maker of lever harps		
New Westminister, BC	12 October	Lori Papajohn
harpist, Editor <i>BC Harps Newsletter</i>		
Mt Laguna, California	15 October	Robinson's Harp Shop
suppliers of music, plans and hardware for lever harps, makers of wrapped nylon strings. Susan Raimond, harpist and animal harp therapist		
San Diego	16 October	Mike Malley
maker of lever harps		
Los Angeles	19-20 October	Sylvia Woods Harp Shop
supplier of Lyon and Healy pedal and lever harps, Dusty Strings and Triplett lever harps, music, CDs, books and harp accessories. Concert by William Jackson, Scottish folk harpist. Workshop by William Jackson on ornamentation of traditional Scottish folk music		

4. Introduction

Background

Harpmaking in Australia has expanded considerably in the last ten years but even so there is only a handful of full time harpmakers. They are mostly separated from one another by considerable distances and generally have little opportunity to meet or even to see each other's work. While many are keen to meet others in the field and willing to exchange knowledge there are not huge opportunities for this. There are no large scale manufacturers who might offer training/learning situations for those wishing to enter the field or increase their expertise. Australian harpmakers work individually, producing a range of lever harps which differ in design, materials, construction techniques and tonal quality.

As a self taught harpmaker I have felt both the lack of available information and contact with others working in the field and have been very aware of the fact that the limits of my own knowledge have made it almost impossible for me to assess the quality of harps produced by both myself and others as well as the efficacy of my construction techniques and methods. Ultimately, the criteria for a good harp are the quality and volume of the sound it produces and the fact that it is built sufficiently strongly to withstand the stresses generated by the tension of the strings. In other words it sounds good and it doesn't break. For me, achieving this had been a matter of trial and error.

For a commercial harpmaker it is also necessary that the construction of a harp be cost effective and this can be difficult when the work is labour intensive and undertaken on a small scale.

The major aims of my Fellowship tour, therefore, were to discover and understand the various parameters, functions and requirements pertaining to design of harps of various kinds from lap harps to pedal harps, woods and finishes used, strings, and sharpening mechanisms - both levers and pedal mechanisms, and to ascertain by what methods the overall manufacture may be most efficiently and cost effectively carried out.

5. Harp Construction

5.1. Harp Design

The shape of a harp is determined to a large extent by the harmonic curve, that is, the relationship between the length, circumference and pitch of the strings. While there is a huge range of possibilities, the modern concert pedal harp is now taken as the norm and to a large extent, smaller levered and/or unlevered harps are built to reflect this norm. This has both advantages and disadvantages some of which are dealt with below.

As far as modern pedal harps are concerned there is really very little overall difference in design between major brands; size, shape, range and pitch are fairly standard to encompass the requirements of the classical music repertoire and what has come to be accepted as the 'norm' over the past hundred years or so. Each major manufacturer, and indeed smaller manufacturers who tend to build a single harp at a time, all have variations in their mechanisms but all work on the same basic principle. Camac has recently replaced pedal rods with cables which they claim reduces the possibility of breakage and makes re-alignment a simple task for even an untrained person rather than being a job for a technician.

Similarly there is a variety of methods of reinforcing both soundboard and soundbox and in transferring the strain of string tension from the vertical plane of the pillar to the horizontal plane of the base. This is not to say that there are no differences in completed harps from different manufacturers; several quite small differences in construction may well result in marked difference in volume and tone.

The method of giving sufficient strength to the overall frame of the harp varies but little, with a laminate always being used in the neck and hardwood of various types and thickness for the pillar. Camac has recently incorporated aluminium and carbon fibre into pillars to give strength without the weight of solid wood.

Both size and shape are much more variable in non-pedal harps as are methods of construction. There is a number of reasons for this which frequently have more to do with traditions or personal preferences and attitudes to harps and harp music than to actual requirements of successful harp building. Some people see the playing of classical music on a pedal harp as their major aim and therefore see non pedal harps as a cheaper and simpler instrument on which to begin playing. Others are more interested in folk or traditional music which requires neither the range, the volume nor the key changing abilities of a pedal harp or in instruments that are reproductions of historic harps.

The smaller size and fewer strings of a non pedal harp mean that the overall tension is less which in turn means that the strength required to maintain stability is less. A non pedal harp also does not require a straight pillar attached to a base into which the pedals must fit. The pillar can be directly attached to the sound box and may be curved which allows for a much greater range of possible shapes than in a pedal harp. Non pedal harps commonly range from 22 strings (sometimes even less in reproduction ancient harps) to 40 (beyond which manual changing of levers becomes difficult because of their distance from the hand) which also adds to the variety.

There is some geographic specificity in the most frequently occurring sizes. In Europe and Britain 34 strings are common - this number of strings giving sufficient range for a beginning to intermediate classical student. In North America both 30 and 36 strings are seen more often. The former gives a sufficient range for beginning classical students and is fine for many folk harpers while the latter gives an expanded bass to both. A further difference between North America and Europe is in the length of the bass strings and therefore in the overall height of the harp.

European design favours the type of Celtic neck which rises from the shoulder then straightens or even falls slightly towards the pillar while many North American makers use the also traditional curve that continues to rise towards the pillar end resulting in longer bass strings and greater overall height. Many of the smaller European harps have legs which give them much the same total height of the larger American harps but these can usually be detached for easy portability. This is perhaps influenced by the smaller size both of homes and cars in Europe and Britain.

The lesser overall strength required in non pedal harps leads to several methods of construction. The multi-laminated neck always used in a pedal harp is seen less often in the smaller harps, a three layer laminate of thicker wood or even a solid wood neck being more common. Pillars vary also from solid wood to two or three layer laminates. Provided there is sufficient strength to support string tension the method used is mostly a matter of choice.

Soundboxes, likewise, come in a variety of shapes. The concert harp is invariably made with a rounded sound box with considerable reinforcement which includes ribs of varying thickness down the front side edges. There may also be reinforcement within the box on either side of the sound holes. Three or more horizontal struts are also spaced vertically to spread the strain from the soundboard and front edges more generally through the entire box. These may be solid wood, laminated wood, metal or some other rigid material such as carbon fibre. They are most commonly fitted inside the soundbox, sometimes glued (if wood) sometimes screwed, or both. They may connect with the soundbox only at the front sides and centre back or be glued around the entire curve of the soundbox. Most commonly the soundbox is made as a single form but some manufacturers, particularly Horngacher in Germany, make two mirror image forms which are joined at the centre back. In this case the support struts are ornate metal pieces which are on the outside between the sound holes and may also be used for carrying/moving the harp.

Non pedal harps display a number of different styles of soundboxes. They may be round, square (actually trapezoid with the back usually being narrower than the soundboard and the two sides being equal) or of barrel stave construction. Medium sized non pedal harps generally have two or three internal wooden struts but smaller harps may have none at all. Makers of rounded or stave boxes usually argue that a curved shape gives better resonance but many square boxes do not seem to suffer at all from not being round. Square boxes are certainly quicker and easier to construct. Some argue further that the inside of the box should be sanded and sealed because a smooth, hard surface also increases resonance. There is also debate about size and shape of the sound holes amongst some makers but no particular size seems to give a 'best' volume.

Soundboards of pedal harps are always reinforced by smaller ribs on either side of the central rib. Some larger non pedal harps sometimes also have side ribs but most seem not to and the smallest harps need no more than the central rib. Such extra strengthening allows the soundboard to be made thinner which in turn allows greater vibration and therefore more volume and perhaps better tone. Walter Bresch in Vancouver continues the lower strings of his lever harps through the actual base of the harp allowing him to further reduce the thickness of the bottom section of his soundboards, a technique borrowed from the Spanish cross strung harp where the double row of strings puts greater than normal pressure on the soundboard.

5.2. Woods and Finishes

As with design I saw a huge variety in types of wood used for harps. Some makers swear by one particular type of wood as being the only one to give the sound that they desire. For instance, Hans den Brok in Holland uses only beech for his unusual harps which are Celtic in design but in sound very much influenced by Paraguayan tradition. He believes he cannot get the sound he wants with any other wood. Ardival in Scotland use only locally grown woods - sycamore and beech mostly. For them not only is the type of wood important but also its origin, less for the sound than for the fact that they are making reproductions of historic instruments and wish to use the materials that local makers would have used in the past. Other makers seem to use woods that are reasonably easy to source and that are not too expensive, including Canadian maple and walnut. Customer taste is also a strong influence.

Canadian maple is commonly used also in North America (though one harp maker told me he thought it too soft) along with black walnut and cherrywood. Exotic woods such as teak and various South American and Hawaiian hardwoods are also used. All makers seem happy with the woods they use and all are successfully making quality harps.

The question of what wood is best for soundboards is one that generates greater agreement. The majority of harp makers use spruce and maintain that nothing else works as well. But while spruce may be the best for the purpose it nevertheless does not guarantee either a good or a consistent sound even if all other factors are equal, which they never are. The method of construction of soundboards is basically the same from one maker to another but thickness varies considerably and many makers have slight variations which they consider improve either strength or sound quality; some use a veneer on the top surface for extra strength and/or for visual appearance.

Camac uses a thin layer of carbon fibre between the spruce and the veneer and also checks all the spruce by laser to ensure there are no variations in density which may affect vibration. Mike Malley in California checks to ensure that moisture content is as low as possible at the time of construction. Of all aspects of harp making this is the one that many makers are unwilling to discuss beyond a most general level, each keeping his own particular variations to himself.

Most makers would argue strongly that plywood boards are most definitely inferior (though certainly cheaper and easier to construct). A number of North American makers do use ply in some or all of their models, including Walter Bresch in Vancouver, Dusty Strings in Oregon and Triplett in California and I was impressed

with the quality of their sound. They all use nylon stringing which gives a different quality of sound anyway but it is not markedly different to the sound produced by nylon strings on a spruce board. Given that a spruce board with a veneer is in fact a laminate I cannot see the logic of a blanket disapproval of laminated boards. Problems of quality may arise when commercially produced laminates are used either through the type and/or quality of glue used or in uneven strength due to the pressing process. For this reason Dusty Strings has begun to manufacture its own laminate.

Lori Pappajohn, Celtic harpist with the group Winter Harp in Vancouver has several harps including a Bresch with a laminate soundboard and always uses it for recording because she says its sound is particularly pure and pleasing. Jill Whitman, the classical harpist with the group has a David concert harp which they also always use for recording because of the particular clarity and volume of the upper octaves. David harps have a veneered spruce soundboard but their harps are noted for the quality of the upper octaves. Producing such a sound at the top of the soundboard is a difficult task and one which few makers achieve in the way the David factory manages.

While all soundboards are sealed and finished on the top surface I met two makers who also finished the inside. Mike Malley who is most careful to ensure that the wood in his soundboards is dry during construction, then varnishes them as well as the inside of the soundbox to ensure that all moisture is kept out. Ron Wall in British Columbia also varnishes the inside of his soundboxes and soundboard backs.

The types of finish that I saw used vary almost as much as the wood. Two pack epoxies of several kinds, oil, traditional varnishes, shellac, modern rub on varnishes. Some were sprayed on, some brushed, others rubbed on with a cloth. While each maker was prepared to defend his own method as being either strongest, easiest or producing the best sound I was unable to find any differences that could be tied solely to the finish, except in final appearance which is basically a matter of taste and personal preference.

5.3. Strings

Modern harps may be strung with wire, nylon, gut or synthetic gut. A modern concert harp will have wrapped wire (wire on wire or wire on fibre) on the bass strings, gut on the middle octaves and probably nylon (though possibly gut) on the top octave. There is an accepted standard gauge for concert harp strings and they are available from a number of sources. Some harpmakers, such as David produce their own gut strings. Historic pedal harps such as Erards require a lighter gauge string because of their lighter construction and again there is an accepted standard.

Non pedal harps may be strung with nylon, gut or wire. The sound of each is quite distinctive and string type is generally chosen on the basis of the type of sound desired. For instance, *Poosies*, a four woman group in UK which combines harp, violin and voice, uses wire, gut and electric harp to give specific sounds in particular arrangements. Wire stringing is the least common as it requires a particular playing technique. It is used on reproduction ancient harps or for early or folk music. Its very distinctive sound makes it less suitable for a broader repertoire.

The major dichotomy is between gut and nylon stringing. The sound of each is different but there are other differences that are important. Nylon is considerably cheaper than gut; it is less affected by changes in humidity and temperature and thus less likely to break as often; when up to pitch, tension is far less than gut which means that a lighter, less strong frame is required. All these factors mean that nylon strung harps are cheaper to build and maintain which is a factor that weighs heavily with many customers. On the other hand the 'feel' of nylon strings is different and because they are under less tension, less strength is required to pull them. For many teachers and/or students to whom playing classical music on a pedal harp is the goal, or even the ideal, nylon strung harps are often seen as a cheap and not very satisfactory alternative to a gut strung harp. But for many players who are more interested in early or folk music, nylon strings may be the first choice specifically because of their distinctive sound. Hans den Brok in Holland uses nylon to get the thin, bright sound, reminiscent of Paraguayan harps, that he desires. In North America, where the folk tradition is perhaps more popular, there is a much greater proportion of nylon strung harps than in Europe.

Amongst non pedal harps strung with gut there is some variety. Many use the same gauge as the larger pedal harps and students who later move up to a pedal harp are already used to playing an instrument with the same sort of 'feel'. The larger manufacturers who produce both pedal and non pedal harps such as David, Salvi, Camac, Pilgrim etc use the same stringing and spacing on both types of their harps for this reason. Some makers use a lighter gauge (for instance, up to an octave higher than concert gauge) gut for non pedal harps which reduces the overall tension on the instrument. The question, it seems to me, is whether one wants to pretend that a small, non pedal harp is a pedal harp. It is not. And while a similar "feel" may make transition from one to the other slightly easier there is certainly no way that the sound will be the same. The smaller frame of a non pedal harp does not allow the same length of string on the bass as on a concert harp and the smaller soundboard and box will never produce the same volume or tone of the larger one. Lighter stringing however, on a smaller harp (all else being equal) may give a livelier tone.

I was surprised to find very few harpmakers or players either in Europe or North America were familiar with the French manufactured synthetic gut. This is, as the name suggests, a manmade fibre that is twisted in strands like a gut string rather than being a monofilament like nylon. It is less affected by humidity and temperature than gut which would be a great advantage in some parts of both continents and is slightly cheaper than gut. It feels and sounds like gut and can, indeed, be used amongst natural gut strings though my preference is to use one or other on any given harp.

Spacing, that is, the distance between strings, is another area in which there is immense variation from one manufacturer to another. Although there is a common belief that all concert harps use the same spacing, in fact, there is some variation from one brand of harp to another. Generally it is a small enough difference that it is hardly noticeable. On non pedal harps, however, the difference in spacing is much greater. It is generally the result of fitting as many strings as possible onto a smaller frame and some lap harps have very closely spaced strings. Provided they are not so close (especially the bass strings which vibrate over a greater area) that they touch and cause a 'buzz' and provided there is room for the fingers, the spacing does not affect the quality of sound of a harp. An adult with particularly thick fingers may well find a wider spacing more convenient and a small child may benefit from closer spacing.

Gut, synthetic gut, wrapped metal and nylon monofilament strings are readily obtainable in Australia. There is a local gut string manufacturer and a number of local dealers can supply other brands of gut as well as the other types. Nylon wrapped strings need to be individually made to the required length and gauge and so cannot be kept in stock by dealers. As far as I am aware nobody in Australia makes them. Robinson's Harp Shop in California supplies quality wrapped strings at a very reasonable price and fills orders very quickly. Unfortunately mail generally takes several weeks to arrive. As a harpmaker who frequently uses wrapped nylon strings it would be convenient for me to have a local supplier or to be able to make my own simply because of the time factor.

The actual making of wrapped strings is not a difficult process but requires a specialised wrapping machine. Whether there is sufficient demand in Australia to warrant outlay on such a machine is the question.

5.4. Sharping mechanisms

Sharping mechanisms serve to change the pitch of strings a semi-tone by changing the vibrating length. They are not essential and are a relatively modern invention. Paraguayan and other south American folk harps do not have any mechanisms and pitch is changed by holding the finger against the top or bottom of the string to shorten the vibrating length. Some players of reproduction early European harps also use this technique as do some players of more modern folk music. Alternatively, the harp may be tuned to the required key by tightening or loosening the strings before playing. This does not, however, allow for accidentals. Wire strung harps do not have mechanisms and one or both of the above techniques are used.

One of the first methods of mechanically changing pitch was with a flat blade attached to the neck which when turned pressed against the string to shorten the vibrating length. These are still seen on reproduction and some folk harps but the most common mechanisms used today are levers and pedal mechanisms.

5.4.1 pedal mechanisms

Pedal mechanisms permit key changes to be made with the foot leaving the hands free to continue playing. Such mechanisms have been developed over the past two hundred years in response to developments in western classical music. The modern concert harp has a double action mechanism which allows each string to be both sharpened and flattened, giving a huge choice of possible keys and unlimited accidentals while playing as this can be done with the pedals leaving the fingers free for playing. Single action harps only can flat each string and therefore offer a smaller choice of keys in which to play but do allow for unlimited changes while playing.

All modern mechanisms are constructed on the same principle as the early actions developed from the close of the eighteenth century by Erard. Each of the seven pedals, one for each note of the octave, activates a rod which runs through the centre of the pillar and is connected along the lower surface of the neck to a jointed arm which extends to each string of that note. These arms activate two (or in the case of the upper two octaves, one) discs with two metal forks which stand out at right angles. When the pedal is depressed or raised from its central 'at rest' position the upper or lower disc rotates causing the forks to securely hold the string by their opposing pressure thus

altering the vibrating length of the string and either raising or lowering it by a semitone. Thus depressing the A pedal, for instance, causes the vibrating length of every A string on the harp to be shortened and thus to be raised by a semitone.

Each manufacturer has made some modifications from the original Erard design to the way in which their own mechanism works but all use the same principle. For instance, Camac have recently replaced solid metal rods with the very strong metal wire that is used to move ailerons in aeroplanes. A large proportion of the cost of a pedal harp lies in the manufacture of the mechanism simply because they contain so many parts which must be precision made and which must work smoothly and silently over a long period.

Large harp manufacturers ('large' is a relative term - I use it to include businesses with from 6 to 60 workers) clearly have an economic advantage in that they have dedicated machinery, often computer controlled, and workers who can devote all their time to mechanism manufacture. But there is a surprising number of harpmakers, working alone, who construct their own mechanisms piece by piece. This is obviously less cost effective and more time consuming but they usually also offer something unique in the way of design and/or ornamentation so that their harps appeal to those buyers who want something a little different. They are also perhaps the type of person to whom large profit is less important than job satisfaction.

5.4.2. levers

Levers do exactly the same job as a pedal mechanism, that is they shorten the vibrating length of the string, raising it a semitone. Each string has its own lever attached to the neck below the bridge pin and these must be operated manually by lifting up (or occasionally down) a handle which means that if changes are required during playing one hand (usually, but not necessarily, the left hand) must stop playing momentarily to do so. For this reason many people look upon lever harps as instruments for beginning harpists, who, once they have mastered the basics will move upwards to a 'proper' or pedal harp.

There is certainly a limit to the music that can be played on a lever harp in comparison to a full sized pedal harp. But the ability to change key with the pedal is only one factor - number of strings as well as number of available keys also limit the musical possibilities. The possibilities of the lever harp, once lever changing technique is developed, are demonstrated by Dublin born Anne-Marie O'Farrell who plays lever harp at concert standard with a technique that is breathtaking to watch.

There is a variety of levers available. Some large harp manufacturers such as Salvi, Camac, Aoyama, and Pilgrim sell the levers that they have developed for their own harps; others, like David, make their own but use them only on their own harps; companies like Robinson and Loveland make levers only; and a number of individual harpmakers manufacture their own levers.

There are basically two kinds of lever action. First, lifting the handle either causes a fret pin (for instance Robinson) or a solid metal or plastic section attached to the handle (old Lyon and Healy) to lift the string outwards away from the neck and hold it in this position. In the fully lifted position the string may be also pressed against a stop pin or against some other portion of the lever holding it more firmly and preventing

buzzing (for instance, Truitt). A second method involves displacing the string with a cam handle. With Loveland levers the displacement is inward and the string is held tight against a stop pin. Salvi levers hold the string within a groove in the cam itself. Pilgrim levers (which are moved down rather than up to engage) displace backwards towards the shoulder of the harp. There is no second point of engagement, the string being held against the cam by its own tension.

Everyone has his/her own views about which type of lever is best. There are a number of factors to be considered.

1. Quality of sound. This is clearly important. Any lever will cause some diminution in the quality of sound but a lever that is badly designed or badly adjusted may allow/cause undue damping of tone or unwanted vibration. A lever that holds the string in some sort of pincer hold is less likely to do this but can do so if poorly fitted or adjusted.

2. Ease of movement. Lever movements often must be made in a fraction of a second and therefore the handles must be easy to see and identify (Fs are usually coloured blue or black and Cs red for this reason), comfortable and easy to grasp and smooth in their movement. It is an advantage to be able to move several levers at a time in some instances. There is incredible variety in levers for this reason - manufacturers make changes to their design according to what seems most desirable to them. Players are often very strongly influenced by the type of lever they first learn on and, having become used to them are unwilling to try anything else.

3. Cost. Levers are very labour intensive to make. Robinson's estimate that each of their levers is handled thirty times in the course of manufacture. Given that there are 34-36 on the 'average' lever harp they represent a considerable proportion of the cost of the harp. Robinson's levers are by far the most inexpensive, costing about A\$6 each. Loveland, which are most commonly used in Australia are about A\$15. All other commercially available levers that I saw are about A\$20. Robinson levers do cause some loss of tone but provided they are fitted and maintained properly are perfectly adequate for a beginner or a player who has less need for key changes. Given the huge difference in price between them and the next cheapest, Loveland, this may well be a serious consideration for some harp buyers. While Loveland do not affect tone as much they are to many people less visually pleasing, as their handles are black plastic and rather thick and stubby. Some players also complain that it is difficult to change more than one at a time and that the small space allowed for coloring blue or red for the Fs and Cs is too small to be seen easily. This latter problem can be overcome by painting a larger part of the handle or putting on plastic shrink tubing but does not improve the look. I saw Loveland levers with a brass coloured plastic handle which I thought looked nicer but I could not ascertain if they are easily available. I was also told that they can be ordered with longer handles but that, because they are plastic, the greater length leads to frequent breakage. Of the more expensive brands the quality of both sound and manufacture seems pretty much comparable. The major problem is giving Australian harp players the chance to see and try them so they can make their own choice.

6. Repair and Regulation

Most harp makers I visited are involved in repair and regulation of harps at some level, even if it is only in regard to instruments they have made themselves. Several lone workers claimed that repair of harps was one of the ways in which they gained much of their knowledge of harp making - there is nothing like demounting and disassembling a harp made by someone else for teaching you what to do or not to do in making your own.

Any harp, old or new, lever or pedal, may require repairs due to accidental damage. Old harps, of which there are many, particularly in Europe, may require replacement of soundboard or structural repairs to the frame. With levers harps this is relatively straightforward; with pedal harps it is more complicated. All the large pedal harp makers will repair their own harps and often other brands as well. But there are also specialist repairers such as Munson and Harbour in London who have a very high reputation for their work.

The need for repair of major damage is an obvious one: the need for regulation is often less apparent. In Australia where there are relatively few harps and even fewer skilled regulators, pedal harp regulation is too often something that happens rarely. In Europe where harps are played and heard more frequently more pedal harp owners seem to take for granted that periodic regulation is essential. Indeed, in Europe it seems far more common for owners also to have lever harps regulated regularly.

With pedal harps it is often the case that a fairly small fault or misalignment will cause a major sound problem and extend to each affected note in all the octaves. It is obvious that it needs attention. With a lever harp only one lever may cause a problem and then only in one of its two positions. It may not be recognised as an easily remedied problem. The situation may be ignored until a number of levers are in need of adjustment and causing major problems and even then it may be the harp as a whole or the brand of lever that is blamed. Cost is also a factor. Many owners cannot afford or are unwilling to pay the several hundred dollars for a pedal harp regulation and even the much smaller fee for lever harp regulation is often grudging.

In Australia it is a matter of education of harp owners that both pedal and lever harps need periodic checking and that rather than this being an unnecessary expense it may well save much greater future expense. This will remain a problem too as long as there are so few technicians for most makers have limited time to spend on regulation if they are to maintain the level of their harp making.

6. Conclusions and Recommendations

- There is no one ‘right’ way to build a harp. A variety of factors go to make a good harp and include most importantly tone and volume. Weight, size, design, portability and cost are also important factors but will vary in importance from person to person. Australians have been very limited in opportunities to see, hear and play the variety of harps that are available in Europe and North America.
- Methods of lever harp making developed by myself have been confirmed as effective, economic and musically sound. At the same time, I have gained useful knowledge on how to improve further my techniques and I have been motivated to expand the range of harps that I make.
- Because of Australia’s distance from other harp making centres and because of the position of the Australian dollar local harp makers have an advantage in terms of cost. This would be particularly so at the pedal harp end of the market if there were a local manufacturer. However, Australians seem unwilling to spend as much on harps as their European and North American counterparts.
- The opportunity to learn from harpmakers around the world has enabled me to share Australian harpmaking achievements with the world community and thereby to increase the standing of my harpmaking colleagues with other harpmakers around the world.
- The harp community in Australia (makers, players, teachers, audience), though growing, is relatively small and isolated and there is scope for both expansion and education, through seminars, concerts, newsletters, workshops etc. It has been, because of isolation from the rest of the harp world and isolation of groups within Australia, inward looking and somewhat conservative.
- The Harp Societies that already exist in South Australia, Victoria, New South Wales and Queensland are an obvious point at which to begin to promote growth and change. A number of overseas Societies are keen to be in touch, exchange news and information and possibly arrange joint activities which could raise levels of awareness and expertise. Makers, as well as players and teachers, must be a part of this process.