FSI-43
STEREO

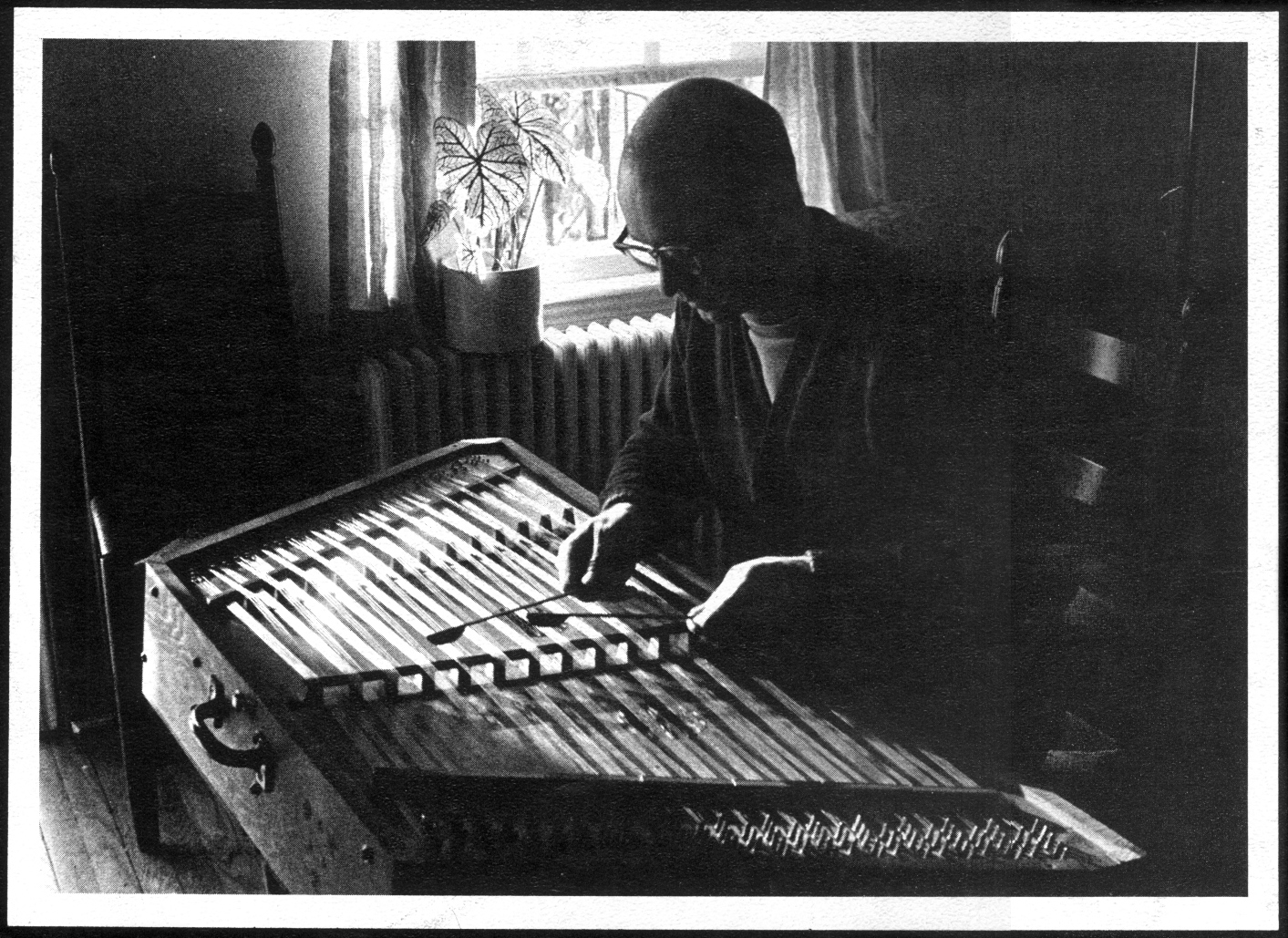
THE HAMMERED DULCIMER

— HOW TO MAKE IT AND PLAY IT —

(including illustrated book of instructions)

by

HOWARD W. MITCHELL



FOLK-LEGACY RECORDS, INC. SHARON, CONNECTICUT

FOLK-LEGACY RECORDS, INC. FSI-43

THE HAMMERED DULCIMER

by Howard W. Mitchell

Recorded by Sandy Paton

Contents of Record:

Side 1:

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cover photo: ANN MITCHELL

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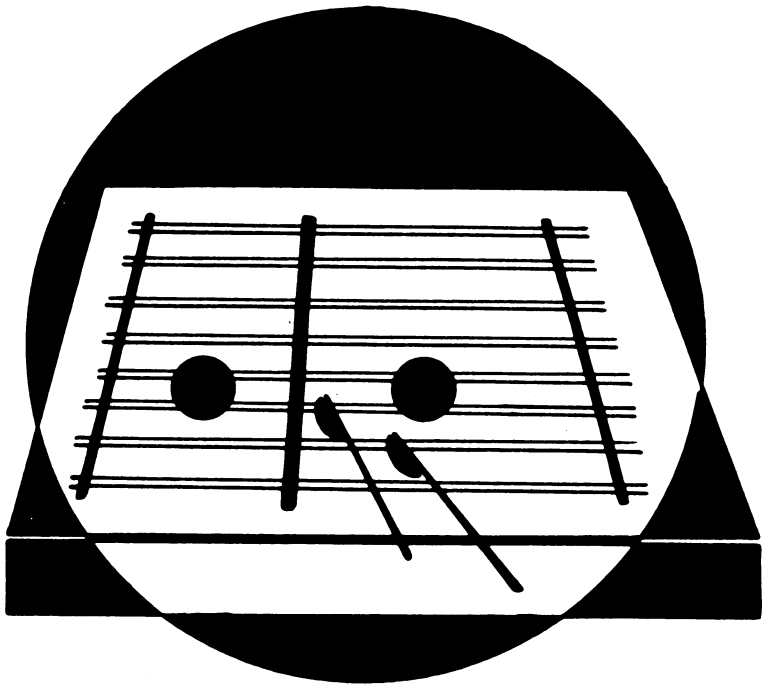

H. Mitchell

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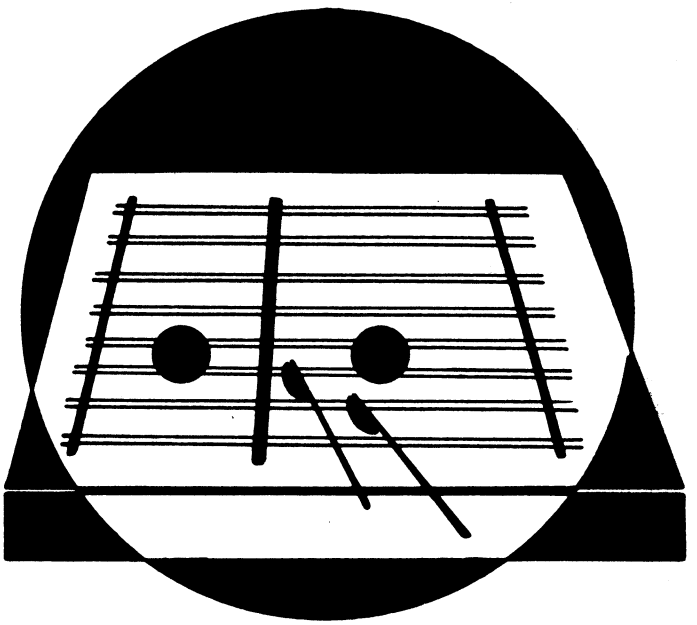

H. Mitchell

3rd printing: 1978

FOLK-LEGACY RECORDS, INC.

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PREFACE

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LEST YOU BE MISLED, I must advise that this is not a How-To-Do-It manual in the strictest sense. That is, I will not be presenting formalized and detailed dimensions, plans, and procedures for the making of a particular instrument. I will be presenting a summary account of the main whys and wherefores of designs I came up with when building my first twenty-one hammered dulcimers. This kind of format stems from my continued amazement at how useful it is to have some concept when planning an instrument, and how relatively useless this same concept may be for predicting the unique nature of the instrument which results.

THE ENTIRE PURPOSE of this manual is to present a few basic and useful ideas, along with the assurance that practically anything you do will probably be successful.

Howie Mitchell

December, 1971

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INTRODUCTION

During a small musical program my wife and I gave in New York in 1968, I was attempting to present my scanty knowledge of the ancestry of the hammered dulcimer. I made the comment that it is basically a box or a board, with several strings stretched across it and tuned to some sort of musical scale. I mentioned that it is related to the ancient psaltery, the main difference being that the psaltery is plucked, while the hammered dulcimer is struck with small mallets. I then prevailed upon Bob Beers (a marvelously able and well-known psaltery player) to add a bit more detail:

"They are actually, when you get down to it, one and the same. The instrument started back in early times, maybe three thousand years before Christ, and was at that time called the 'santir'. The Greeks, being a very original people, then took the instrument and developed it with tunings of their own, and with adding bridges to the instrument, they named it 'psaltery'. They then passed it back to the original people who played it (who were around in the area that is now Arabia, Turkey, Pakistan, Kasmir) and liking the name 'psaltery' very much, but not wishing to use exactly the Greek expression, they called the instrument a 'psanterim', with a p on the beginning of it."

Now they've completely done away with the p and they still play the instrument in the Near East, calling it a 'santur', and that's as much as I can tell you."

"Here they call it a hammered dulcimer."

Bob Beers.

New York City
Spring of 1968

*

* * *

My first opportunity to actually see and hear a hammered dulcimer being played came in August, 1966, at the first Beers Family Festival of Traditional Music and Arts, held in Petersburg, N.Y.. I had developed a mild interest in the instrument prior to that, from seeing antique dulcimers in various states of disrepair, and from hearing a few recordings of them being played. However, I was totally unprepared for the degree of fascination that came from watching the marvelously rhythmic and rather complex motions of the little cane-shaped hammers used to strike the strings, or from hearing the peculiar contrasts of harsh percussiveness and primitive sweetness in the voice of the instrument. There is no single conventional instrument which I can compare it to, though several persons have described it as being reminiscent of a harpsichord-like piano. It was a direct result of watching Russell Fluharty play at the Beers' FOX HOLLOW Festival that I became determined to try my hand at learning what I understand is a dying* art of hammer-dulcimerin'.

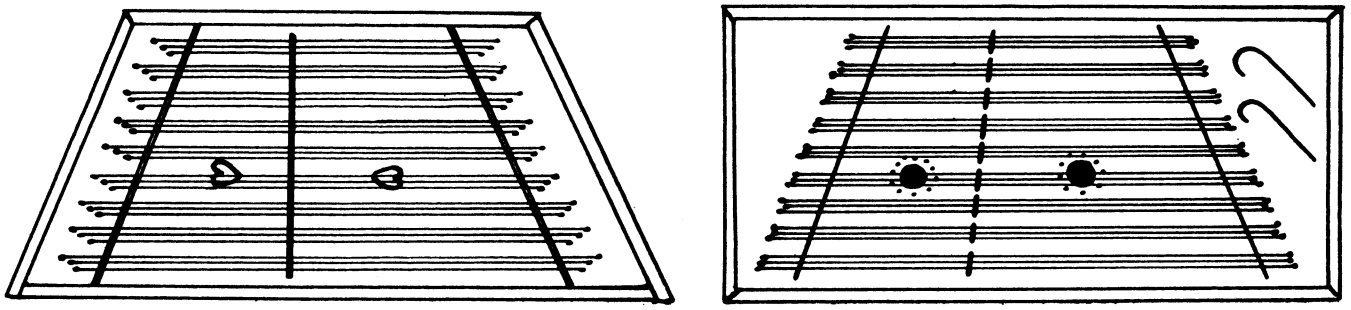


Figure 1: Typical simple hammered dulcimers (approx. 2' - 4' on longest side).

Although there is no set size or design for the hammered dulcimer, it usually consists of a flat rectangular or trapezoid shaped sound box, sturdily constructed, and having eight or more groups of strings graduated in length. All strings in a cluster are tuned in unison, and in a simple dulcimer the various courses pass over three bridges, resulting in two unequal-length vibrating portions for each course (see fig. 1).

Mr. Fluharty's dulcimer resembled the rectangular instrument represented above; the left and right-hand bridges being lengths of heavy wire, placed oblique to one-another, and set upon what looked like thin strips of wood molding. The remaining bridges were separate, wedge-shaped pieces of wood, placed

* (haw!)

point-upwards, and each capped with a nail. These latter bridges were located so as to be somewhat to the left of the mid-points of the strings passing over them. Russ used six strands of #7 steel music wire in each of his nine courses.

IT IS IMPORTANT to understand the simple and ingenious significance of placing the little wedge-shaped bridges off-center. For simplicity, let me describe a "thought experiment". Imagine a single string, stretched across three bridges A, B, and C, such that distance AB equals distance BC (see fig. 2).

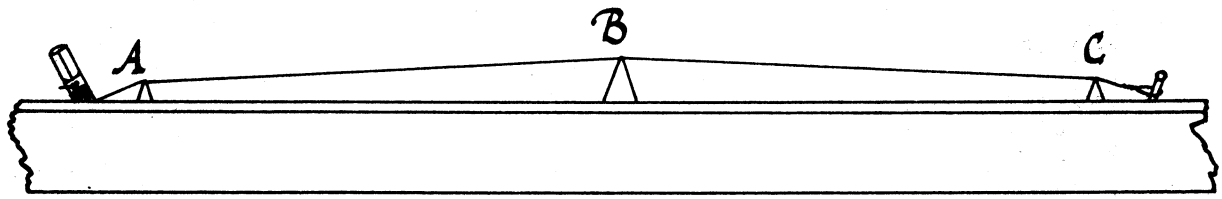


Figure 2.

Portions AB and BC would be free to vibrate, and assuming the string will easily slip across bridge B, the tightness of the wire will be approximately the same throughout its length. The result would be that portions AB and BC would vibrate alike, and one would hear the same musical pitch from each vibrating portion; that is, they would be in unison!

Now, imagine that bridge B is slid a short distance to the left, causing AB to be shorter than BC. If the bridge slips easily under the wire, the tightness of the wire should remain approximately the same throughout, but the pitch heard when AB is plucked would be higher than the pitch heard when BC is plucked ! Thus: TWO DIFFERENT MUSICAL NOTES FROM ONE STRING ! When one recalls that all dulcimer strings in a given cluster are tuned alike, then the above discussion of fig. 2 can be applied to a given course of strings (rather than to a single string).

Since an off-center treble bridge [that's the name given to the "in-between" bridge(s)] will result in each course giving two different pitches, it becomes of interest to decide what these two pitches should be for each course. Mr. Fluharty had his instrument set up so there was a musical fourth interval (i.e. do-fa) established between the right and left portion of each course of strings. Thus, when the right-hand portion was tuned to G, the left-hand portion automatically was tuned to C; when the right was A, the left was automatically D; when the right was B, the left was automatically E, and so on. Russell's tuning is shown diagrammatically in fig. 3.

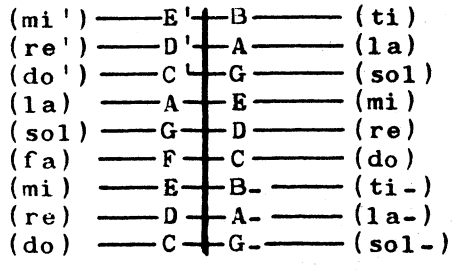


Figure 3.

I began designing my first hammered dulcimer immediately after returning home from the Beers' Festival. I had intended to make a rectangular soundbox, using some exquisite curly maple boards for the hitch-pin and tuning-pin blocks. These boards, however, were too narrow to fill in the upper corners of the rectangle (see fig. 1), and I decided to use the trapezoid shape instead. Since I have had some experience with mathematics, and purely because I like the visual appearance of many mathematical curves, I wanted to make the left and right bridges curved. From my work with fretted instruments, I knew that if a given string is tuned to yield "do" on the musical scale, then the notes re, mi, fa, sol, la, ti, and do' are obtained by using 8/9, 4/5, 3/4, 2/3, 3/5, 8/15, and 1/2 of the given string length, respectively. Starting with an arbitrary length for the left-hand portion of the longest string, I used the above proportions to determine the string lengths for the remaining left-hand portions of the dulcimer strings (see fig. 4).

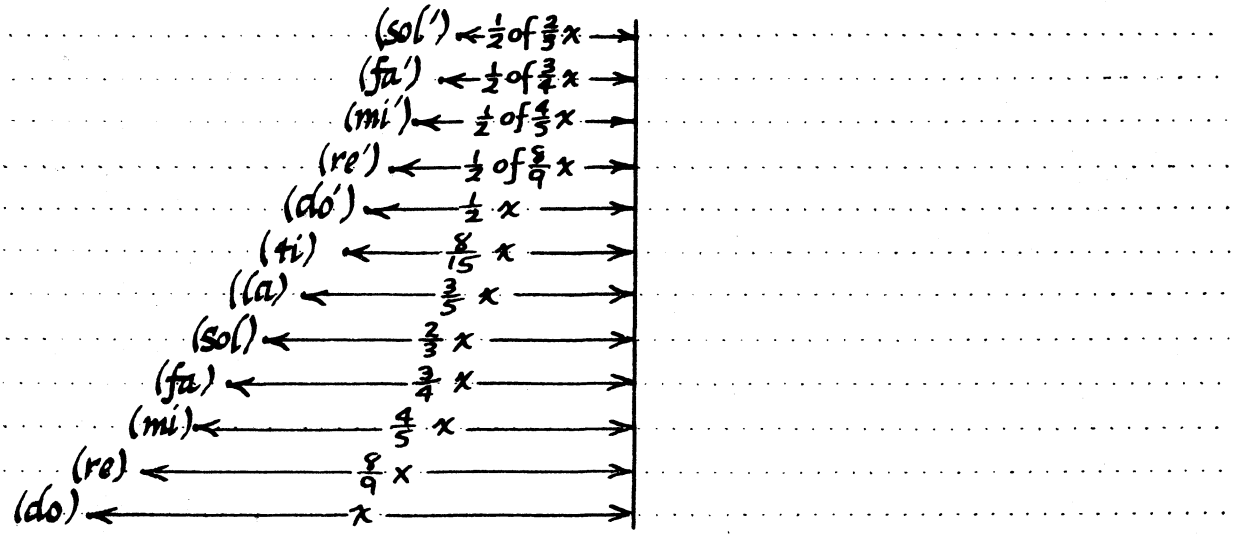


Figure 4.

The string lengths for the right-hand portions were next required, and thus more math. Knowing that the note "fa" is obtained by using 3/4 of a string originally tuned to "do", and knowing that the left-hand portions of the strings were to be a musical 4th interval higher in pitch than the corresponding right-hand portions, I concluded that the lengths shown in fig. 4 should, in each case, be 3/4 of the corresponding lengths to the right of the treble bridge. I then had to calculate answers to questions like the following:

X is 3/4 of what ?

8/9 X is 3/4 of what ?

4/5 X is 3/4 of what ?

As one might expect, when the calculated string lengths were laid out to the right of the treble bridge, another curved line of dots appeared. I eventually used a full-sized drawing of these curves as a guide for cutting a soundboard. I used 1/8 inch thick spruce for the soundboard, cut slightly larger but similar in shape to the surface between the curves.

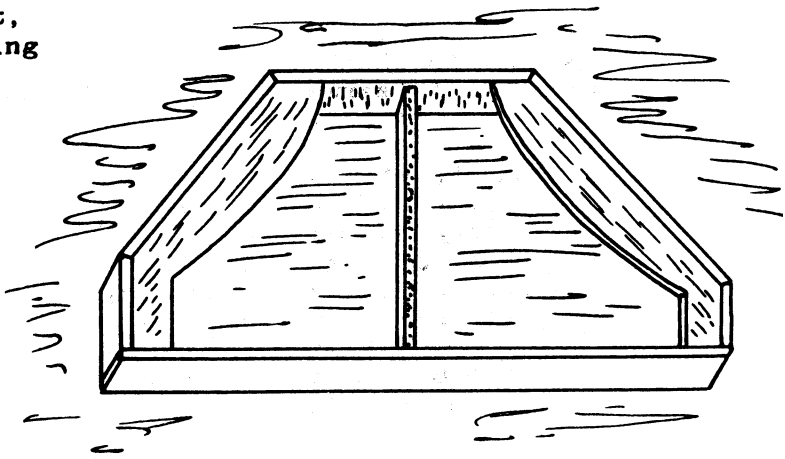


Figure 5.

To receive the soundboard, I constructed a sort-of trapezoid-shaped frame of 3/4 inch thick cherry wood, with a bottom of 3/16 inch common fir plywood. The hitch-pin and tuning-pin blocks were simply pieces of the 3/4 inch thick curly maple, cut to match the left and right insides of the trapezoid, and left and right curves of the soundboard. With the pin blocks installed, I had a sort of trapezoid-shaped box, with a soundboard-shaped hole in the top. To prevent the soundboard from sagging due to the eventual downward force of the strings upon the treble bridge, I placed a heavy brace in the open sound box, directly beneath the predicted location of the treble bridge (see fig. 5).

Since I had begun this design by assuming the treble bridge would be a straight line (see fig. 4) I felt at ease to construct it in the form of one long wedge-shaped piece of wood, capped with a corresponding length of heavy aluminum wire. The left and right hand bridges I made of walnut strips ($\overline{c}$ $\frac{1}{4}$ inch thick), steamed and bent to shape, and glued firmly to the soundboard along its curved edges. I lined the soundbox hole with narrow strips of wood, forming a sort of shelf upon which the soundboard could be glued. The soundboard (with right and left bridges attached) was then glued to this shelf and to the heavy treble bridge brace. I was then ready to put clear finish on the wood, drill holes for hitch and tuning pins, cut notches for strings across the left and right bridges, and then begin stringing the instrument.

The tension in hammered dulcimer strings is easily regulated and maintained by using some sort of metal friction pin at one end of each wire. The friction pin is forced into a slightly smaller-diameter hole, one end of the music wire is wrapped around the pin, the wire is tightened by twisting the pin in the wood, and there it remains securely held by friction. Although common wood screws make good tuning pins, I prefer commercially available <u>zither pins</u> (like the pins in an autoharp). Incidentally, a great pain-saver is the system of using one <u>double length</u> of wire for every "two strings". One end of the wire is attached to a tuning pin, and the wire is then strung across the instrument, looped around one (sometimes 2) hitch pin, and brought back again to a second tuning pin. The friction of the wire against the hitch pin(s) is so great that the

two halves of the wire can be tuned almost independent of each other ! I learned of this convenience just one day before stringing my first instrument.

My first hammered dulcimer had twelve courses of strings, with three strings per course. It was tuned higher than Mr. Fluharty's dulcimer, had a few more groups of strings, and one note (fa#) had appeared which does not belong to a common major scale (see fig. 6)!

12	(sol')	D	A	(re')
11	(fa')	C	G	(do')
10	(mi')	B	F#	(ti)
9	(re')	A	E	(la)
8	(do')	G	D	(sol)
7	(ti)	F#	C#	(fa#)
6	(la)	E	B	(mi)
5	(sol)	D	A	(re)
4	(fa)	C	G	(do)
3	(mi)	B	F#	(ti-)
2	(re)	A	E	(la-)
1	(do)	G	D	(sol-)

Figure 6.

It took me a week or so to become familiar with the very unfamiliar but logically sensible and practical arrangement of notes. Each of eight different tones (do through re', with the exception of fa) appeared in two different locations. Learning to play a melody became a sort of logistics problem for me, often involving a 4-way decision as to which hand to use to strike at which of two locations for the greatest efficiency of movement. This sort of decision I had to make for each note in a melody, and it was slow going at first (I use 96 notes in one run-through of the Irish Washerwoman !). Once I had decided on what appeared to be an efficient route of travel, I set about memorizing it, and repeating it over and over until my speed and accuracy were satisfactory.

It might be of interest to show the strike pattern I came up with for the Irish Washerwoman, though I doubt if it is of much practical use. You see, I am a Southpaw, and my dominant hand is left ! In my nomenclature, the melody progresses as you read downwards (fig. 7, next page). The symbols L and R stand for Left and Right hand, the numbers for the string groups (see fig. 6), and the symbols' positions to the right or left of the vertical line indicate striking right or left of the treble bridge. The nomenclature is awful to look at on first glance, but if you go slowly and carefully, referring to fig. 6, it does indicate accurately!

I should mention in passing that the melody line indicated is somewhat inaccurate, especially toward the end of the refrain (in second column). However, this is the way I learned. The words are recalled from one of my unforgettable visits with Dr. Asher Treat, of Dumont, N.J., who is responsible for my interest in the Appalachian dulcimer .... but, that's another story.

The unfamiliar sounds and appearance of the hammered dulcimer did much to carry me through an otherwise painful time of initial learning. Then too, the process of learning was intriguing for its own sake. At first I played almost every note deliberately and hesitatingly. A bit later I found that I was able to play short groups of 3 or 4 notes rapidly, before hesitating for the next group. Thus, learning seemed to involve increasing the number of notes in each grouping and reducing the times of hesitation until, after a week or so, the melody could be played all the way through without stopping.

L5		Th	L5	
R4		ere	R5	
L3		was	L8	
	R4	an	R7	
	L4	ol	L8	
	R1	la		R8
	L4	dy		L6
	R4	she		R8
L3		died	L8	
	R4	in	R7	
L3		Dun	L8	
R5		dee	R10	
L4		and	L9	
R3		from	R8	
L4		out	L7	
	R5	of		R8
	L5	her		L8
	R1	mo		R5
	L5	uth		L8
	R5	there		R8
L4		growed	L7	
	R5	a		R8
L4		fig	L7	
R6		tree	R9	
L5		now	L8	
R4		the	R7	
L3		peo	L6	
	R4	ple	R8-R8	
	L4	there	L5	
	R1	woul	R8-R8	
	L4	dn't	L4	
	R4	make	R8-R8	
L3		use	L3	
	R4	of	R5-R5	
L3		the	L4	
R5		fru	R3	
L4		it	L4	
R3		be		R5
L4		cause	L5	
R3		it	R4	
L4		grew	L3	
	R5	out		R4
L5		of		L4
R4		the		R4
L3		mouth		
	R4	of		
	L4	a		
	R4	brute		

Figure 7.

The first experience of being able to play the Irish Washerwoman fairly rapidly all the way through was one of the most curious sensations I can remember. By then my speed was perhaps 5-or-so notes per second, much too fast for me to be consciously aware of the details of each hammer blow. Along with this inability to follow motions consciously, I became aware of a sense of physical separation from the hands doing the playing. I would look down at these rapidly-moving hands, and would sheepishly have to remind myself that they were mine !

I have wondered quite a bit at this feeling of physical separateness, which was strongly noticeable off and on for the first month or two and then became less pronounced as I became used to the instrument. I suspect that my learning a new skill made me unusually aware of a common but marvelous mechanism of the mind, whose function is to learn and control repetitive, routine tasks. I imagine this mechanism is what makes it possible to speak, write, drive a car, play the piano, ride a bicycle, or perform any of the multitude of other muscular actions one is accustomed to doing without conscious thought. Thus, learning to play the hammered dulcimer probably does not make much demand upon any rare or unusual ability. It simply requires time and patience, combined with enough interest and wonderment to nullify the awful effects of discouraged impatience.

Several weeks after completing this first hammered dulcimer, I noticed the soundboard beginning to warp and pull up at a couple of locations around the edge. At the same time, I was beginning to want more notes of lower pitch. I therefore decided to unstring the instrument, remove the soundboard, add bridges for bass strings, and reattach the soundboard. Fortunately, it was not tightly stuck to the treble brace. While in the midst of this refurbishing, I became curious as to the effect of removing the treble brace. This I did, afterwards replacing the soundboard temporarily and restringing the instrument.

Without a brace, the treble bridge sagged somewhat when the strings were retightened, making tuning difficult. The loudness of the instrument was increased, but the thump of the hammers at impact was was also louder, to an unpleasant degree. I therefore unstrung the instrument once more, removed the soundboard, replaced the treble brace, and repositioned the left and right bridges further in from the edges of the soundboard. By replacing the brace, I hoped to once again deaden the percussive thump of the hammers. By moving the left and right bridges in from the edges of the soundboard, I hoped to enable the strings to transmit their motion to a less rigid (and thus more "live") part of the soundboard. Fearing that the downward pressure of the strings would now be too great upon the left and right bridges in their new positions, I decided to pass the strings through small holes drilled through the bridges and deliberately out-of-line to the main parts of the strings (see fig. 8c). This out-of-lineness was to provide firm (rather than rattling) contact between the strings and the wood of the bridge.

Figure 8a:

SIDE VIEW through bridge in original position.

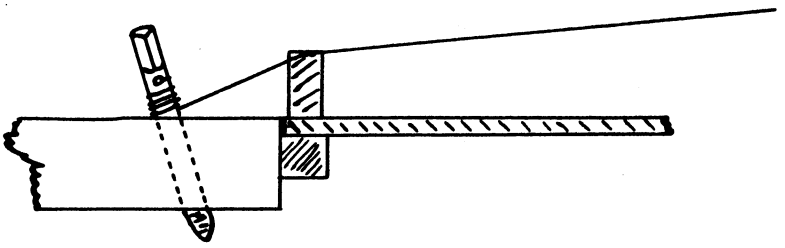


Figure 8b:

SIDE VIEW through bridge in new position.

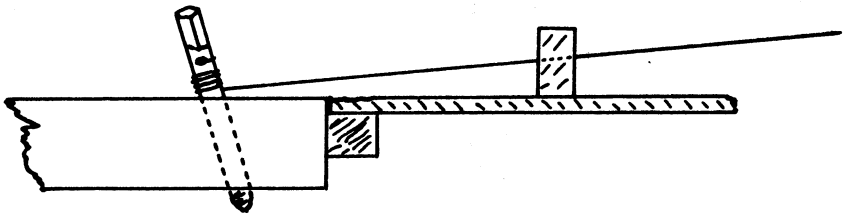
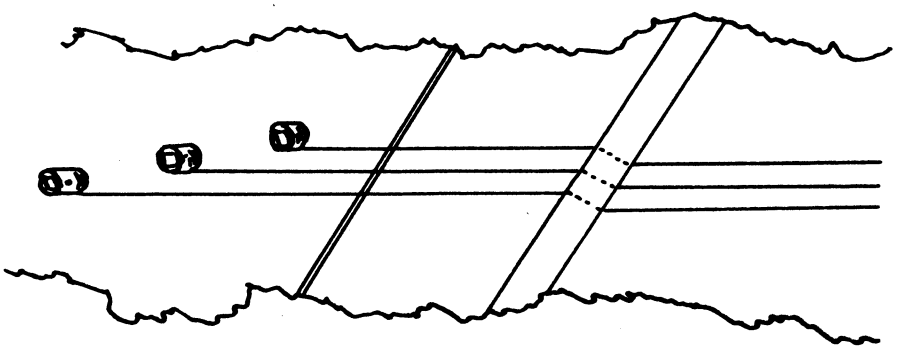


Figure 8c:

TOP VIEW of bridge in new position, showing zig-zag course of strings.



In order to coax a relatively low-pitched tone from a musical string, its vibrating length must be relatively great. For hammered dulcimers, this means using strings whose vibrating lengths are comparable to the full width of the soundboard. This is achieved traditionally through an ingenious idea of cutting holes in the treble bridge (or making it in separate pieces; one for each course). The bass strings pass over their own bridge(s), placed near the right margin of the soundboard. They then angle downwards to the left, passing through the holes cut for them in the treble bridge and thence to the left-hand bridge and on to the tuning pins. In effect, this is not unlike what happens as the warp threads pass through the heddles of a weaving loom. Near the middle of the instrument, all treble strings are relatively far above the soundboard, while the bass strings are comparatively low in position. Near the bass bridge, the reverse is true, making it all but impossible to strike both bass and treble strings at the same time at either of these two locations (see fig. 9). Obviously, the bass bridge needs its own set of holes for the treble strings (or: it can be made in separate pieces; one for each course).

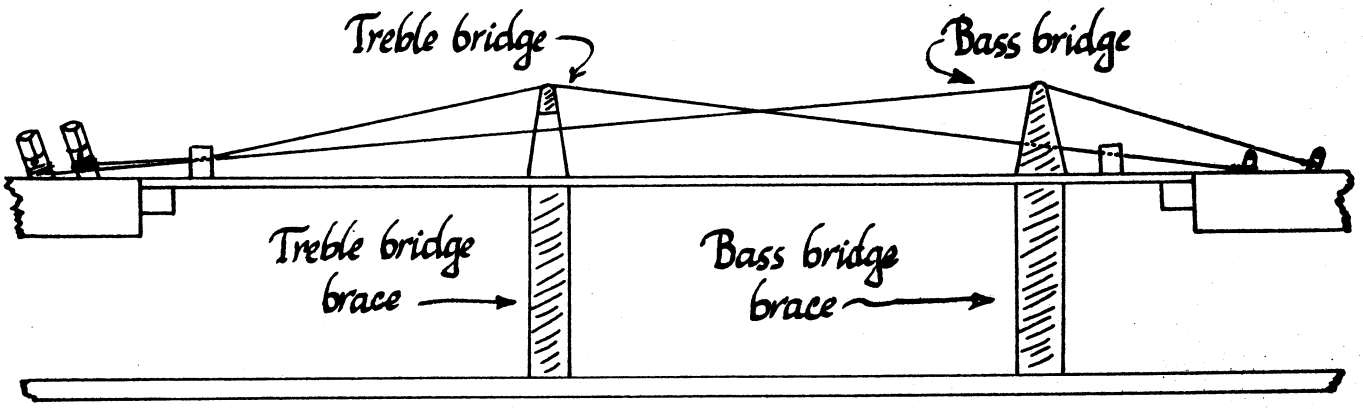


Figure 9.

When dulcimer #1 had been put back together with its new set of bass strings, Ann and I immediately discovered that it was superbly arranged for duet-playing. The strike points for the bass strings were near the right edge of the soundboard, making them playable without overly crowding and confusing the person struggling to play the treble strings. The sound of bass and treble strings combined was far more interesting than either set by themselves, and our random errors tended to nullify each other. The instrument was tuned as shown in fig. 10; six pairs of bass strings had been added.

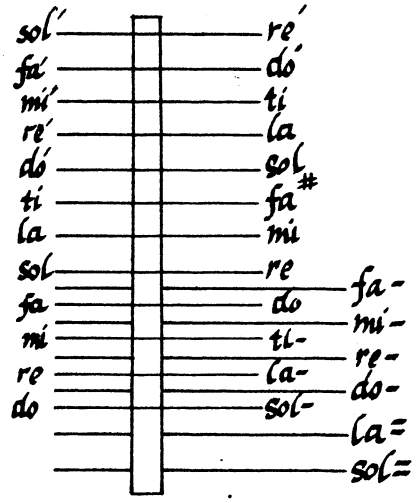


Figure 10.

Dulcimer #1 had been provided with its own set of 3 detachable legs, making it approximately table height and therefore easy to play while sitting in a chair. The instrument was heavy and clumsy to carry unprotected, so I built a wooden case for it. The case was roughly the same shape as the instrument, had a space for legs and hammers and other collectivia, and the whole inside was lined with elegant green quilted material. Ann found me two handsome embroidered straps for lowering and raising the instrument in and out of its case. The dulcimer and other items fit perfectly, the instrument and the lifting straps and the green quilting made a delightful sight, and the lid closed smoothly and latched without a hitch. I then discovered to my dismay that the combined weight exceeded all my expectations; the case responded as if it had been securely bolted to the floor.

This experience with a weight problem caused me to design dulcimer #2 with the idea that it should be its own case. I first made a completely closed trapezoid-shaped box, then cut off the top. This gave me a trapezoid-shaped frame-and-bottom assembly, with a perfectly matched lid. The instrument was designed and built somewhat like #1, except that THE LEFT AND RIGHT BRIDGES WERE STRAIGHT, rather than curved. By cutting a small rectangular door in its back, I was able to stow its legs inside the soundbox.

The decision to make the side bridges straight greatly simplified that part of the work. I quickly found that the degree of obliqueness of these bridges is not particularly critical, for steel music wire will emit usable tones over a wide range of tensions. THE SIMPLICITY OF CONSTRUCTION MORE THAN MADE UP FOR THE LACK OF CURVES !

I deliberately used pine for the pin blocks of #2 to see if the lower friction available from soft wood would still hold the strings up to tension. It wouldn't; the tuning pins would partly unwind as soon as the tuning wrench was removed. I counteracted this trouble, however, by removing the tuning pins and lining each hole with a coating of ELMER'S GLUE-ALL. The hitch pins then became a problem, for they tended to pull slightly through the wood at high string tensions. The instrument was fine at moderate string tensions.

A day or so after dulcimer #2 had been tuned, I noticed that the soundboard had sagged a bit. This didn't impair the tone at all, but I could feel it advertising its maker's incompetence. I eventually concluded that the combined string tension was bending the oblique sides inward, bowing the soundboard downward. The use of a crosswise brace in subsequent instruments seemed to take care of this particular problem (see fig. 11).

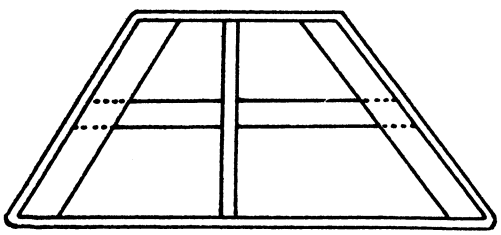


Figure 11.

Dulcimers #2, #3, and #4 were similar to each other, except for using hard wood for the pin blocks in the latter two. The specific details of these instruments are now hazy in my mind, but I do remember that I was attempting somehow to improve the efficiency of the soundbox. The traditional use of 3 or 4 strings per course (sometimes 5 or 6) implied to me that those soundboxes were poorly designed. I thus committed myself

to using only a pair of strings per course for these instruments, and tried to make the soundbox more responsive. This committment appealed to me all the more in that it meant fewer holes to drill!

Dulcimer #5 was the first one I made "on order". It was for an excellent musician and friend of mine, Eddie Trickett, and I felt that something Elegant was required. From my previous experiences with plucked dulcimers, I was confident that intuition and conventional do's and don'ts (especially the don'ts) were not always applicable to homemade instruments. I therefore decided to make the soundboard of Ed's instrument from a sheet of 1/8 inch thick curly maple. "As everyone with even a grain of common sense should know," maple is much too hard, too dense, and too stiff and non-resonant to be a good soundboard wood. Quite frankly, I selected the maple because of its beauty, and because I was extremely curious to hear what an instrument having a "poor" soundboard would sound like.

The visual appearance of dulcimer #5 exceeded my hopes for Elegance. Its voice, however, was immediately disappointing, for it was muted and lacked power and responsiveness. I must have suffered over this for at least an hour before I began to realize that the instrument had a marvelously delicate, subtle, bell-like quality which I had never before heard or even thought of. By the time I had delivered the instrument to its new owner (the next day), I was very much wishing I had a similar instrument for my own. It is interesting to note that I have felt this same sort of initial disappointment toward every newly-completed instrument I have made since then. With two exceptions, this feeling has evaporated after a short time and been replaced with fascinated partial-satisfaction.

It must have been fairly soon after this that I had one of my recurring fits of being tired of school work (I am a science teacher, or at least that's what people say). Realizing I had some paperwork to do after lunch, I left school after lunch and dropped by the Library of Congress Folksong Archive. There, my friend Joe Hickerson provided me with most of his sparse file on hammered dulcimers, and I spent a couple marvelous hours alternately reading and remembering where I wasn't. I returned home with a renewed lease on life, with a curiosity about the invariable references to a 5th interval (i.e. do-sol) placement of the treble bridge, and with the following tangible evidence of my peregrination:

Thomas Mann - Ortonville, Iowa (dulc. player)
Anglo-Am Folk Songs & Ballad Series (record)

Hammered dulc: F. Bryan
History: Bas-relief cathedral porch - Spain 1184
China 1800 yang ch'in (foreign zither)
Tuning: single bridge - 5th interval! 2/3 : 1/3

hammers - cane + knob - rawhide or felt-covered (corset stay!)
Recommend #13 piano wire for all strings!
Usually "C" instruments!
Record: AAFS-41B - Album IX

Charles F. Bryan
Peabody College
Nashville, Tenn.

"SING OUT" - Sachett
Ellis County, Kansas

German-Russian immigrants
→ Russia → U.S.
1760's 1870's

C 3' on largest side

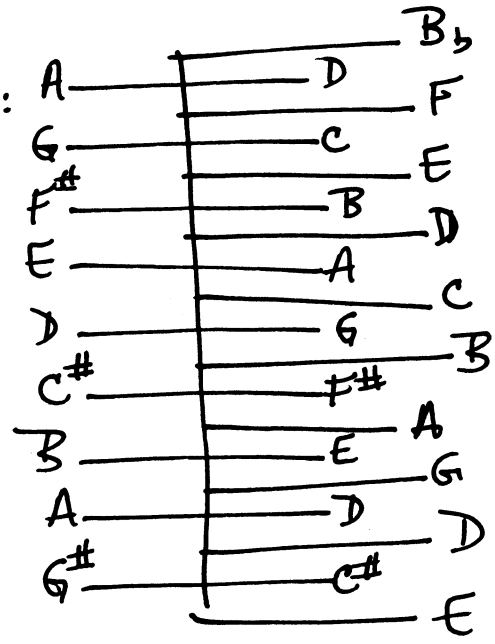
17-21 courses #8 or #9 piano wire
Treble bridge - 8 courses of strings
9 courses of bass strings,
Right treble: octave from F to F'
Hammers - ridges

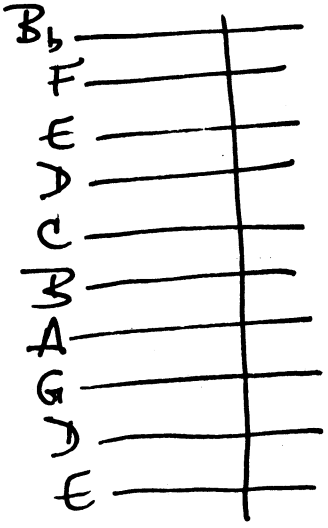
held between index & middle finger.

G, D, A, C (m3)
A, D, G, C, F
C, F, B♭, E♭

Sachett: International Folk. Mus. Counc.
Vol XIV - 1962
"hammer dulcimer playing is a dying art."

Sachett:



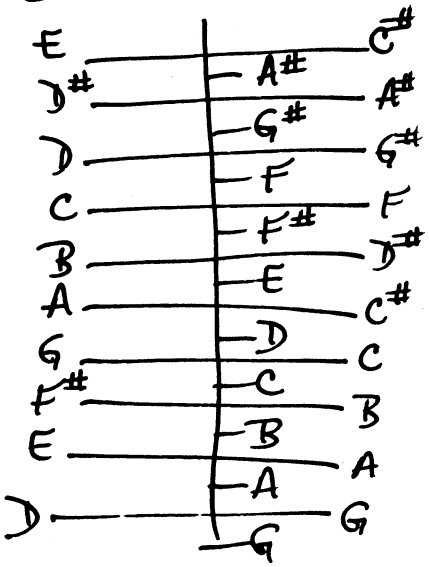


(bass)

(Peter Pfeiffer tuning)

"Violins & Other Stringed Instruments & How to Make Them" (1914)

Dulcimer: soundboard: pine, sequoia, or cedar



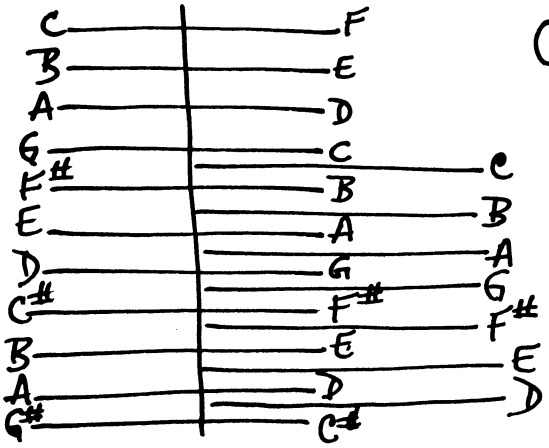
highly detailed & "impossible".

(chromatic)

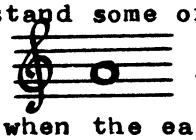
English Country Music Record #1

Publish.: Bob Davenport & Reg Hall
7 Duppas Ave.
Croydon CR0 4BX
United Kingdom

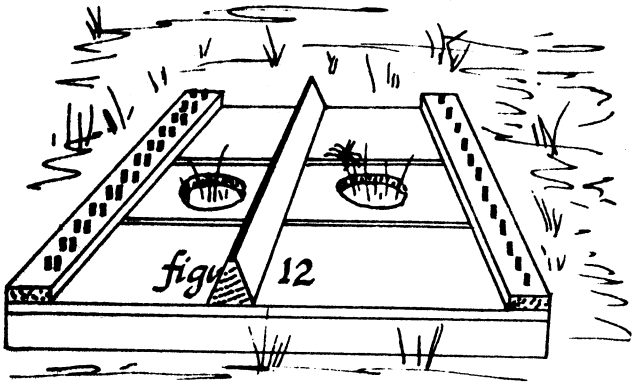
Billy Cooper: dulc.



Compleat System fo the Dulcimer
C. Haight – c 1845

I have had approximately 20 years' experience plunking upon such instruments as guitar, banjo, ukulele, autoharp, plucked dulcimer, and mouth bow, but I have had very little formal musical training. I understand some of the significance of the systems which use "A" or  as names for the auditory sense impression perceived when the ear is stimulated regularly at a rate of 26,400 times per minute. I can give some illusion of musical literacy by speaking of whole notes, half notes, quarter notes, quarter tones, three-quarter-time-with-accented-third-beat, Mixolydian, Aeolian, and Phrygian scales, mean-tone and equal-tempered systems, just-intonation and Pythagorean tuning, syntonic comma, augmented sevenths, and half-gone fifths. Nevertheless, the tuning systems shown in my Library of Congress scribblings seemed mostly a confusion of letters and lines. The beauty and simplicity of what was being represented totally escaped under a cloud of symbols. The generalization: "Hammered dulcimers are usually C or G instruments" I interpreted simply to mean that these instruments are usually tuned to yield only the C and/or G major scales. I already knew that the C major scale is represented without sharps or flats (i.e. C major = C, D, E, F, G, A, B, C', etc.). Ann told me that the scale of G major has only <u>one</u> sharp (i.e. F#). Thus: G major is G, A, B, C, D, E, F#, G', etc.. I felt that the presence of other sharps and flats in the tuning systems meant that there were a few "accidentals" here-and-there to play with, so as to dress up the one or two available playing keys.

My sixth hammered dulcimer was my first experience building a fifth-interval instrument. I was prepared by the above generalization to perceive the two major scales, with extra dress-up notes, and I wasn't disappointed in that respect. It was also confusing to me, in comparison to the fourth-interval instruments, and I saw no particular advantage to having the same notes sprinkled about differently (NOTE: The 12 course, 4th interval arrangement gives C <u>and</u> G major scales, if the left-hand portions of the strings are tuned to C major !). There were fewer double locations where a particular pitch could be found, and the choices I did have would often require me to cross my arms while playing. The instrument was handsome and had excellent tone and power, but I seldom felt at ease with it, and I finally sold it to a person who wasn't so conditioned against it. I no longer recall how it was tuned, but I am sure it was similar to systems I used later on.



Dulcimers #7 and #8 were what Ann calls my "black sheep" dulcimers. I was interested in finding out how important the soundbox and soundboard are in the production of sound. These dulcimers were made just as deficient in soundboxiness as I could make them. Number 7 (fig. 12 shows it ready for stringing) consisted mainly of three 3/4" thick redwood boards laid flat and parallel to each other, cut in a trapezoid shape, and held together by two glued-on oblique pin blocks of birch scraps. A couple 2"x 2" strips were attached underneath, one at each of

the two parallel edges, to act as stiffeners. Black sheep #8 was made similarly, but was provided with a soundboard of 1/8" thick mahogany paneling. This soundboard was cut trapezoid-shaped, and rested upon the inner edges of the pin blocks and upon a spacer attached to the redwood boards about where the treble bridge would be.

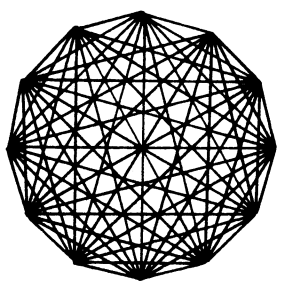
The tone of dulcimer #7 was subdued and bell-like and quite similar in quality to #5. The strings tended to ring for a long time after being struck, and provided a sustained echo for the melody being played. Its appearance was, of course, neither awesome nor threatening, and children were fascinated by it. It emitted a pleasant tinkle when explored by even the most untutored of hands, and absolutely could not be forced to give out a loud or harsh sound. I would guess it was also nearly indestructable.

Dulcimer #8 was, by contrast, loud, harsh, unpleasant, nerve-wracking, and aggressively ugly in every respect, and I felt embarassed when I finally gave it away.

Dulcimers #1 and #6 had been made with 1/8" spruce soundboards, the others having soundboards of materials such as 1/8" 3-ply mahogany paneling, 1/8" prima vera, 1/8" 3-ply maple, and nothing. I like the appearance of spruce, partly due to its associations with musical instruments. However, spruce (like many other woods) presents a problem when used in thin sheets of relatively great expanse. It continually changes size cross-grain as the relative humidity changes. If it is attached to a sturdy frame, it tends to swell and hump up during damp weather, and shrink and pull apart during dry spells (particularly during winter).

I began dulcimer #9 with the idea of trying to reduce this humping and cracking. I intended to glue strips of spruce to the underneath surface of the soundboard, with their grain running more-or-less perpendicular to the grain of the soundboard. When I was ready to cut the spruce to fit the frame of #9, I found that my longest piece was about 4 inches too short.

Rather than wait for a new supply of spruce, I selected a piece of common 1/4" fir plywood, sprayed it a handsome russet color (using "KRYLON RUST-MAGIC, No. 1317, Activated with GL-358"), and used that as soundboard. I was hoping to discover that cheap-and-common every-day-plywood would be serviceable for a musical instrument. It was fine, yielding a tone similar to that of the black-sheep dulcimer #7, but louder. The <u>color</u> was unexpectedly pleasing, and I suddenly hit on the idea of decorating the soundboard by forming equilateral-polygon thread patterns across the sound holes. I used yellow silk thread strung between escutcheon-pin vertices, and it looked like a delicate geometric web of thin brass wire.



By this time, I felt knowledgeable enough to attempt what I had wanted to do almost from the very start, and that was to make a hammered dulcimer for Russell Fluharty. My new supply of 1/8" spruce had arrived, and I built the slat-braced-soundboard instrument which I had originally planned as #9. This instrument (#10) was entirely satisfactory in tone and appearance, and Ann and I had the pleasure of delivering it shortly thereafter to Russell, who lives in Mannington, West Virginia. He is a warm-hearted, humorously good-natured and gentle person, and made us welcome with his long-ago stories of how he bagged a raccoon and his first hammered dulcimer the same evening, how he would play mandolin music with the old-time medicine shows which passed through now and then, and how he met his wife-to-be during one of these shows. He and his grandson Jerry Taylor are excellent musicians, and often play at fairs and festivals throughout the Eastern United States (He and Jerry Taylor call themselves the "IMAGES", and present a most tasteful program of the Old and the New, using the 100-year-old dulcimer, banjo, mandolin, roller organ, plucked dulcimer, and electric guitar.).

MARVELOUS: During the revising of this page, the Apollo 11 astronauts Neil Armstrong and Ed Aldrin set foot on the moon!
H.W.M. 7/20/'69

Russ played his dulcimer for me again, and I was newly impressed with its rich, 100-year-old voice. I was also startled to see how inaccurately I had remembered it, for I had assumed it was strung with twelve groups of four strings, rather than with nine groups of (mostly) six strings each. Russell felt that one important ingredient of the instrument's tone was the presence of many strings within a cluster, tuned almost (but never quite) in unison. I was reminded of how much a beginner I was in the craft, and I saw clearly the visual beauty of numerous closely-spaced strings. When I returned home I had a whole new set of ideas.

I immediately tuned #9 down from G to C major (on the left; see fig. 6 on pg. 5), and added two more strings per course for its twelve treble groups (originally 12 pairs of strings). The improvement was striking (sorry about the pun), for although the instrument wasn't much louder, it was "richer", and the individual tones had more "power" when struck. This led me to design #11 to also have 12 groups of four strings each, along with about 10 bass pairs, and a 1/8" slat-braced spruce soundboard. It turned out to have an exceptional voice, and I was able to use it for playing with the Allemande-Lefters square-dance group at their monthly affairs.

Our square-dance band uses piano, guitar, banjo, and lead* fiddle as its standard instruments, with the fiddler usually playing in the keys of A, D, G, or C major. Dulcimer #11, however, was playable only in C and G major, and I began to think about how to get the other two scales. I tried attaching small brass hinges to

* I know what you're thinking.

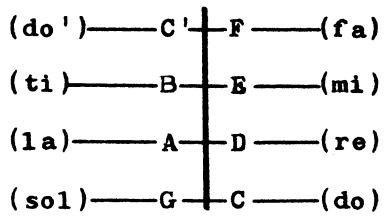
the soundboard, directly beneath the strings and near some of the outer bridges. Each hinge was placed so that when it was turned up against its string group, the pitch of that group would be raised one half-tone. In this way, I was able to get sharps on F, C, and G, and thus change to the desired keys by flipping hinges. Although this system beat retuning the instrument with a tuning wrench, it still required a verse or two's worth of time to find and flip the necessary hinges. Thus, I was now in the running, but still somewhat disadvantaged.

It was at this point that I began to think back to the first "Festival of American Folklife" put on by the Smithsonian Institution in July, 1967. One of the highlights for me during this festival was the Ray Baca Orchestra of Fayetteville, Texas. This is a popular "family polka band" which got started when Ray's father organized a Czech band in 1892. Mr. Ray Baca plays a hammered dulcimer, made by his father over 70 years ago. The orchestra uses dulcimer, string bass, piano, trumpet, saxophone, trombone, drums, clarinet, and bass horn, and theirs is some of the most cheerful polka and waltz music I have ever heard. They play in several different keys, sometimes switching key in the middle of a number, and THE DULCIMER KEEPS UP WITHOUT A MOMENT'S HESITATION.

Mr. Baca's dulcimer has about 12 courses each of treble and bass strings (4 strings per course throughout) and is tuned with a musical fifth interval (do-sol) across the treble bridge. I began to wonder how in the world he could tune it to be so versatile. I have one of their records*, and I spent an evening listening for key changes. Using a chromatic pitch-pipe, I concluded that the dulcimer could at least play in the keys of C, D, F, G, and B_b major.

Then, quite by accident, I realized that when they shifted keys in a song, they usually shifted in jumps of a fourth interval (i.e. do-fa). Sort of as a mental exercise, I began fiddling with the key letters C, D, F, G, and B_b, to see if I could put them all in an order of consecutive 4th intervals. I succeeded in this when I placed the letters in the sequence: D, G, C, F, and B_b.

How I arrived at the next connection I may never know, but I somehow combined the 4th interval idea with the fact that a complete major scale can be played using only four dulcimer courses tuned as follows (note the 5th interval across the bridge !):



(Figure 13)

* ("Polkas and Waltzes by Gil Baca". KERMIT RECORDS #KB-1200; 3771 Childress; Houston, Texas; zip 77005)

I became curious to see what would happen if the note F were considered to be "do" in a new major scale beginning with the 4th string and using the next three above. My pitch pipe helped me determine that these notes would be named as shown to the right:

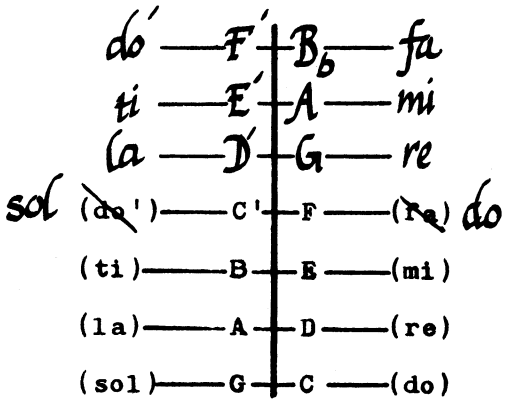


Figure 14.

The new letters appearing to the left of the treble bridge line were a great surprise, for they were not only part of the F major scale, but were also part of the C major scale extended !

If this same process is continued, beginning with B_b as "do", the new major scale in B_b should appear, at the same time serving to extend the preceeding F major scale ! Rather than beginning with C, however, let me construct a series of scales with D as the starting point, for this is the first of a series of 4th intervals derived from the Ray Baca record (see pg. 16). Using a chromatic pitch pipe to help name the notes, I come out with the following array:

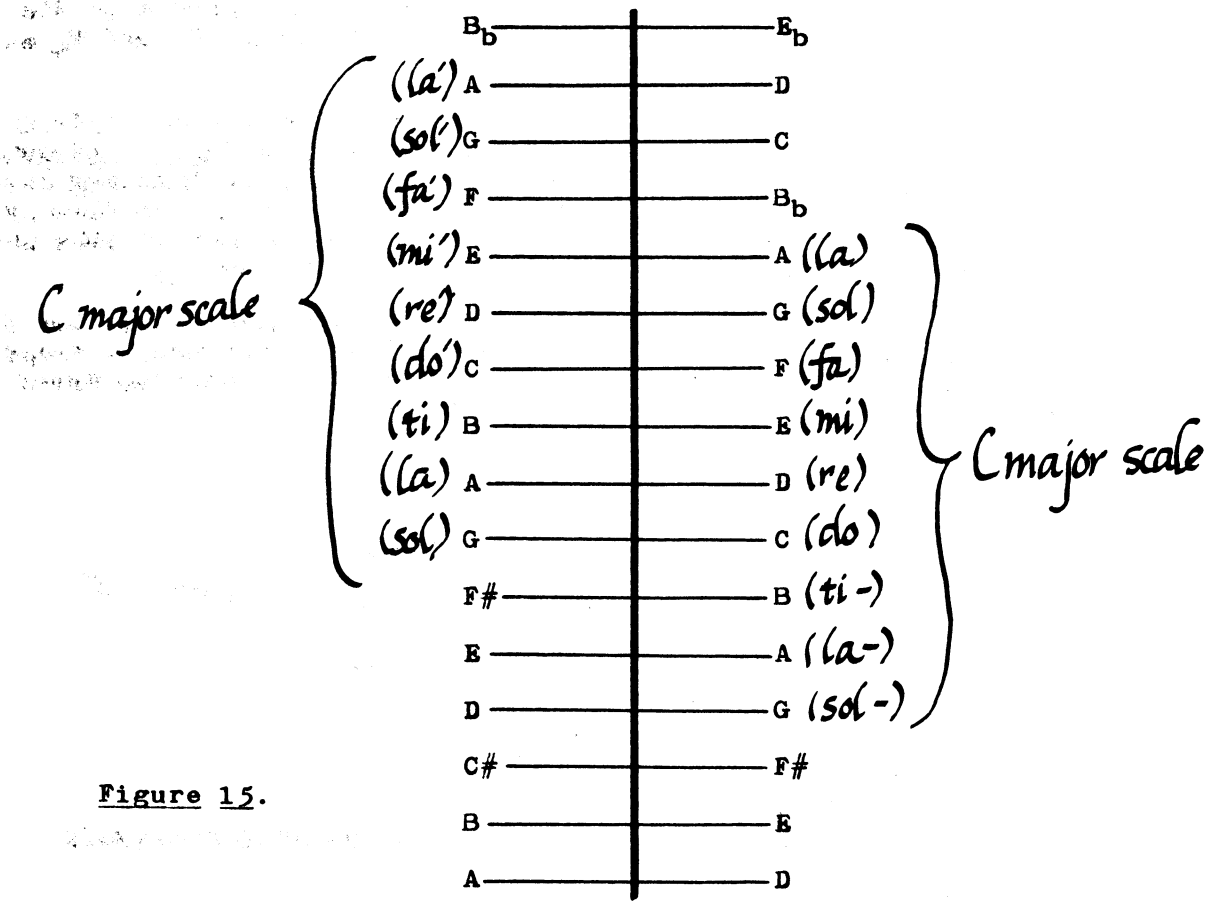


Figure 15.

There are two aspects of this array (fig. 15) which I find most remarkable. One is the wide range of notes available in a given major scale (particularly G, C, and F major). The other is the strange (perhaps coincidental?) similarity between portions of this diagram and the Peter Pfeiffer and C. Haight tunings on page 12.

It would follow that the Peter Pfeiffer and the C. Haight tunings contain more than just the C or G major scales; I believe they make available the scales of D, G, C, and perhaps a bit of A major. To help you spot this, let me list the sequence of tones making up each of these major scales:

D major scale: D, E, F#, G, A, B, C#, D'

G major scale: G, A, B, C, D, E, F#, G'

C major scale: C, D, E, F, G, A, B, C'

A major scale: A, B, C#, D, E, F#, G#, A'

Realizing that this "5th interval, do every fa" tuning seemed promising, I began designing dulcimer #12 to play in the four "square dance keys" of D, G, C, and A major. After a few false starts, I saw that A, D, G, and C is a sequence of consecutive 4th intervals. I therefore saw that I should begin constructing my scales with that of A major. Bob Beers had previously recommended that I begin a scale on the second course of strings, tuning the right-hand part of the first course to "ti" instead of "do". On paper, this is what it comes out to be:

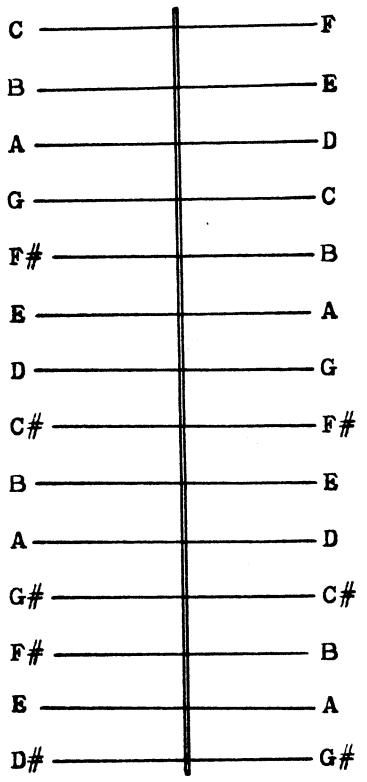
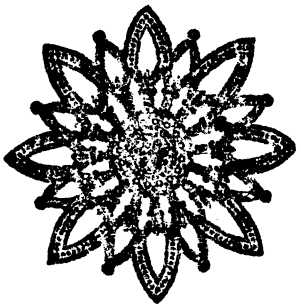


Figure 16.

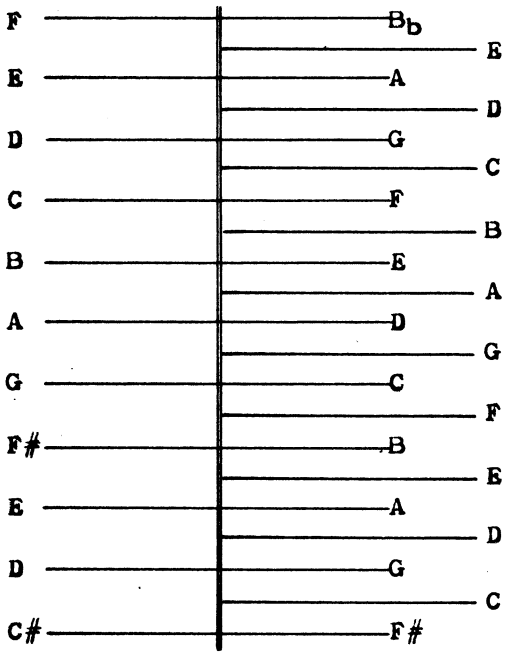
To build a dulcimer with such an apparent confusion of notes was unthinkable, particularly when I had also planned to provide it with numerous bass strings ! I decided to stop work on #12 and go on to #13, which I felt should be a simpler "pilot model". It would also give me a chance to use some handsome gold Christmas decals which Ann had recently brought me.

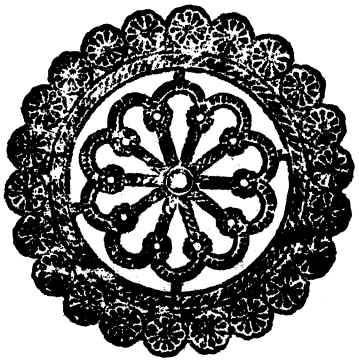


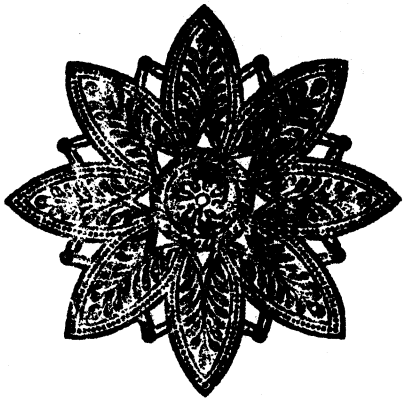
Before building my "pilot model #13", I wanted to hear some more of the dulcimer, as played traditionally. My subsequent visit to a local record store resulted in my first acquaintance with the Persian hammered dulcimer, known as a santur (Record: MUSIC OF IRAN, Santur Recital; Nasser Rastegar-Nejad; Lyrichord LL135). The music was strange and unfamiliar, but the voice of the instrument had a peculiar, ringing harshness which I did like from the very beginning.

The photograph on the record jacket showed a smallish black trapezoid-shaped instrument with 20 courses of 4 strings each. It's hard to tell from the picture, but I'd guess nine or ten of these courses pass over nine or ten separate little "chessmen" which collectively serve as the treble bridge. The remaining (bass) strings pass over another row of "chessmen" placed near the right of the instrument. The tuning and hitch pins are placed in the oblique sides of the instrument, rather than in the top margins.

I liked the compactness gained by placing the string pins in the sides of the instrument. I was also convinced that a black soundbox would look elegant with the gold decals. I therefore planned for a black trapezoid-shaped instrument, having all string pins placed in the oblique sides, and strings tuned as shown below:







Construction of the soundbox for my gold decal dulcimer went smoothly, and I realized I'd have it completed long before the square-dance dulcimer. It seemed illogical to finish #13 before beginning #12, and I therefore exchanged their numbers, making #12 the "pilot model" and #13 the square-dance-dulcimer-to-be. The following is a top view of the black dulcimer (now #12) after a few strings had been added. You'll have to use your imagination to fill in the "Rust-Magic" colored bridges (capped with aluminum wire), the black background, and the gold decals set in red-rimmed holes.

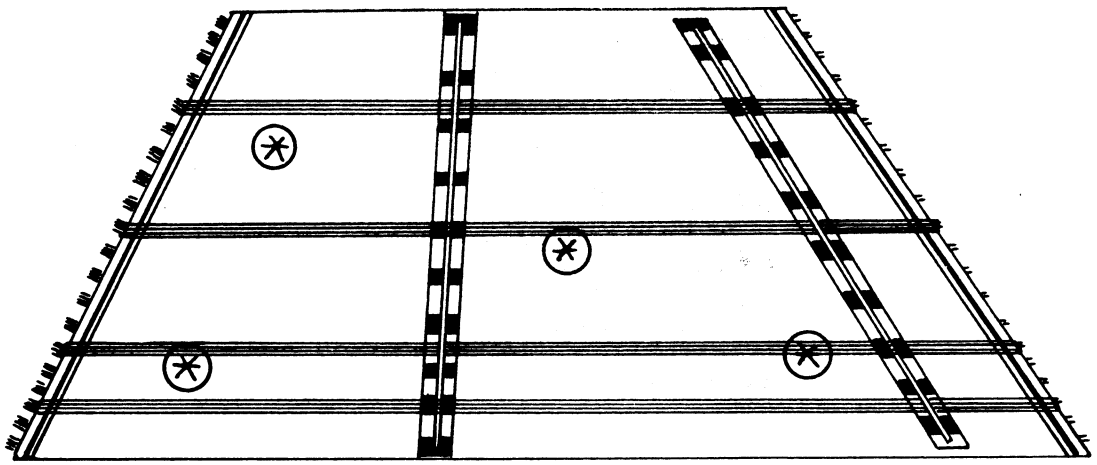


Figure 17. (Top view of partly strung dulcimer ~~#13~~ #12.)

As I added strings to #12 I began to hear ominous crackling sounds, and when stringing was about half complete both side bridges crumpled sideways. I had underestimated the enormous force developed where the strings make an almost right-angle bend around these bridges.. I repositioned the side bridges about 2" in from the left and right edges, and was then able to tune the instrument in spite of grievous sagging. All final pitches were somewhat lower than intended, for as soon as I'd tune a set of strings the bridges and top would sag further, relaxing and lowering the pitch of strings previously tuned. In spite of all these difficulties, the tone was promising and I experienced the hoped-for versatility; I could shift keys in the twinkling of an eye by simply playing on different sets of strings !

I resumed work on the "square dance dulcimer" (now #13) by deciding on the number of bass courses to be added and how they'd be tuned. I finally committed myself to using 14 treble courses (5 strings per course), tuned as shown on the following page. I planned for 13 bass courses (3 strings per course), tuned a fifth interval below its higher-pitched treble neighbor. Although this tuning scheme was still frightfully complex in appearance, it was no longer overwhelming, thanks to good old ~~#13~~ #12.

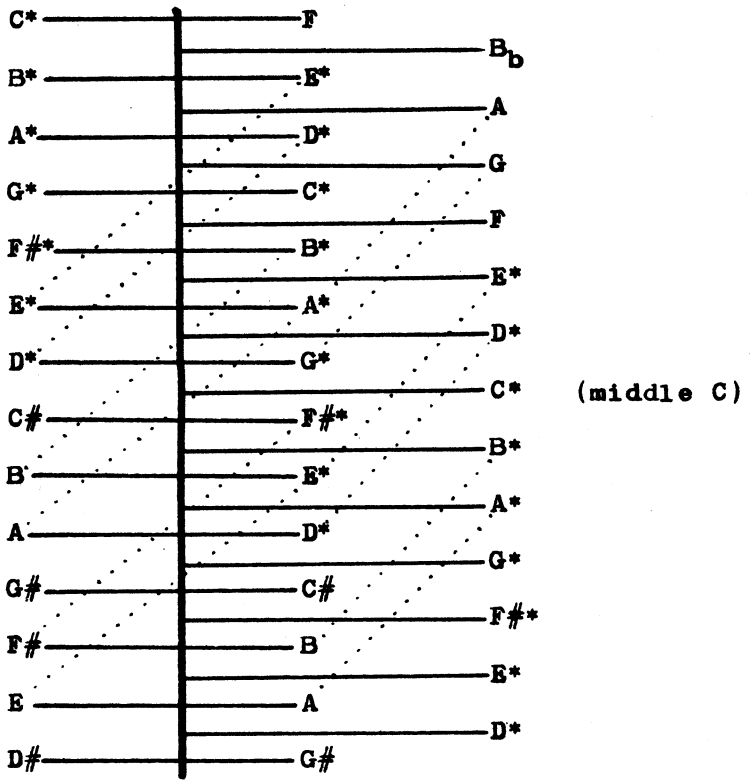
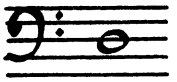


Figure 18.

(Tuning scheme for dulcimer #13. Note the enormous range of tones available to a given major scale; tones belonging to the G major scale are marked with an asterisk (*). Strings tuned to the same pitch are joined by dotted lines. Lowest note (bass D) is  ; highest note (top left) is 2 octaves above middle C. Note that this is the same as fig. 16, except for the bass strings.)

To assure the necessary voice power for dulcimer #13, I had first decided to use more strings per course. Believing that longer and tighter strings give clearer and more decisive tones, I decided to also use greater string lengths. This immediately brought up the question as to what maximum string lengths could be used without risking string breakage. I made a very simple device from a scrap of two-by-four (see fig. 19, next page) to help answer the string lengths question.

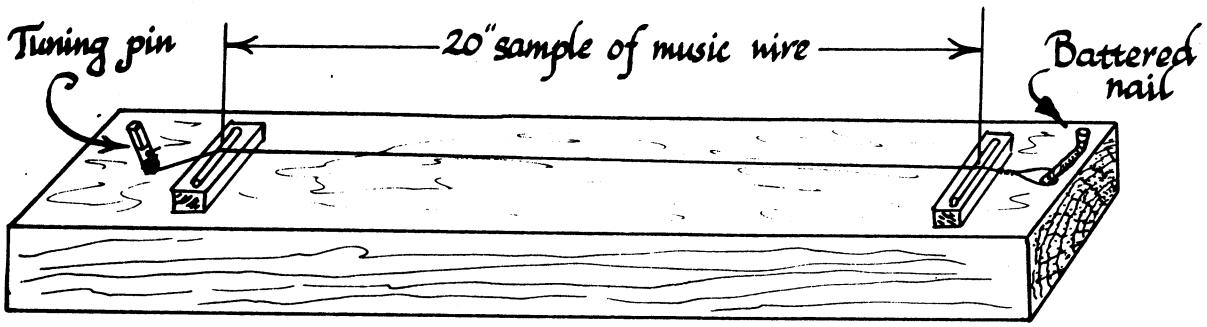


Figure 19.

My procedure for testing strings was simply to attach a sample of wire and alternately pluck and tighten the wire until it broke. I used a pitch pipe to help me name the highest musical tone emitted by the wire before it broke. I began by testing three samples of #1 Steel Music Wire (.010" dia.); each failed with a "snap" after reaching a pitch between C and C# above middle C. I then tested three samples of #2 wire (.011" dia.); they broke with a slightly louder "SNAP" at about the same pitch as the #1 wire. With growing amazement, I also heard samples of #3 and #4 wire (.012" and .013" dia.) break at a maximum pitch between C and C# above middle C. I stopped testing with #8 wire (.020" dia.) for by then a sample would break with a loud "BANG" and would WHACK loudly against the wall. In every case, THE HIGHEST PITCH ATTAINED WAS SOMEWHERE BETWEEN C AND C# ABOVE MIDDLE C ! (You physicists might have fun figuring <u>that</u> one out.)

Beginning with the fact that a 20" length of steel music wire will break when tuned to about C above middle C, the maximum string lengths for a series of given notes can be calculated. For example:

1) If 20" of steel wire breaks at C above middle C, then <u>40" of the same wire should break when tuned to middle C</u> (You know: double the length and drop one octave in pitch.)

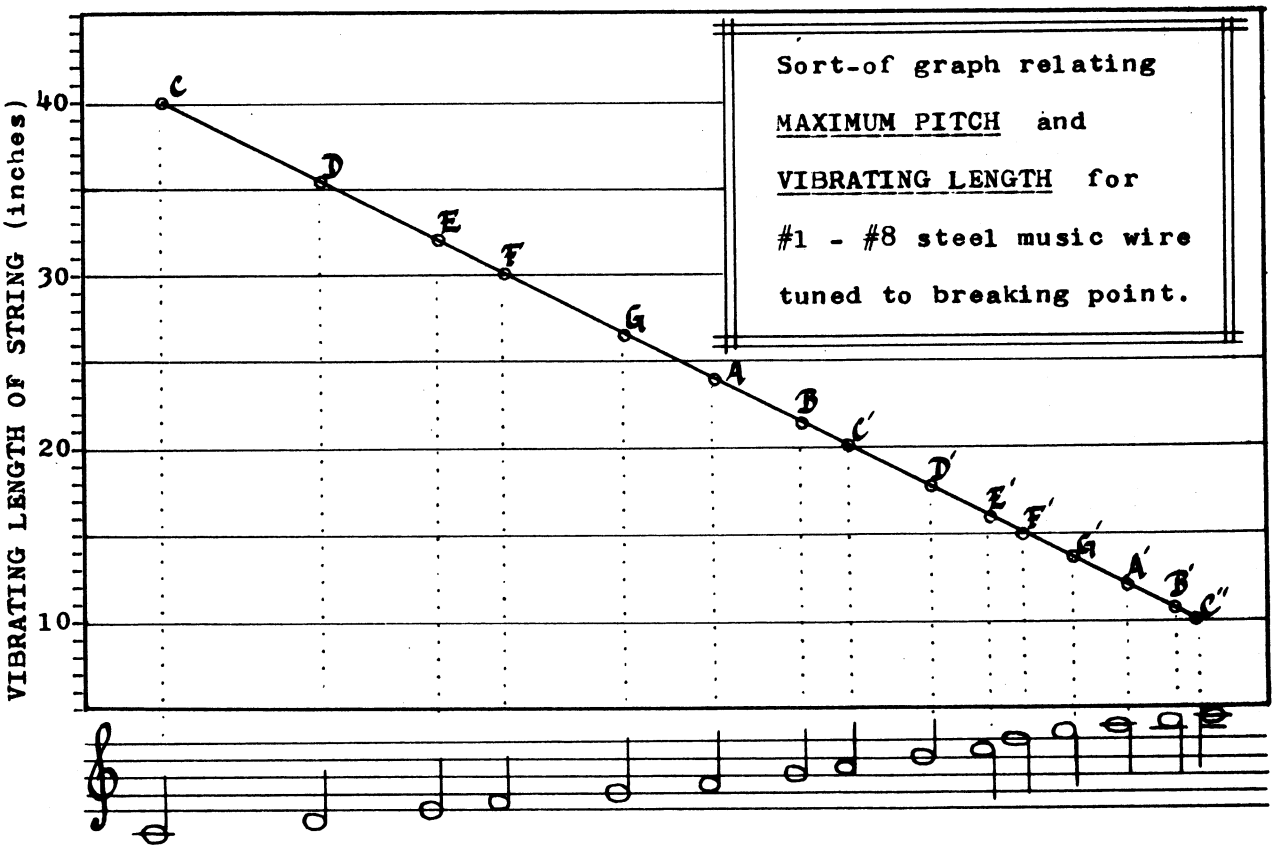
2) <u>D</u> will be "re" if <u>C</u> is "do". "Re" is obtainable by using about 8/9 of the vibrating length of a string whose pitch is called "do". Thus, a string which is 8/9 of 40" (about $35\frac{1}{2}$") should break when tuned to D above middle C !

3) <u>E</u> will be "mi" if <u>C</u> is "do". Using the string ratio for "mi" (pg. 3), a string which is 4/5 of 40" (i.e. 32") should break at E above middle C.

4) Similarly, a string 3/4 of 40" should break at F;
a string 2/3 of 40" should break at G;
a string 3/5 of 40" should break at H;
and-so-on.....(see ratios on page 3).

By using the string ratios on page 3, and reasoning similar to that just shown (bottom of pg. 22), I calculated the maximum string lengths for tones ranging from middle C to the C which is two octaves above middle C. By presenting this information in a sort-of graph, I could tell at a glance how long a given string could be without breaking when tuned to a given pitch (see below).

Figure 20:



I used a graph similar to the above to begin a full-size drawing for dulcimer #13. By knowing the specific pitch intended for each string I could quickly determine its maximum length. I found it convenient to place marks representing the maximum string lengths, and within these limits add lines representing the left and right-hand bridges. To be safe, I arbitrarily used no more than 2/3 to 3/4 of the maximum vibrating length allowable according to the graph. Figure 21 (next page) gives an impression of the early appearance of the layout for #13 (except the layout was full size). Obviously, the lower-pitched strings could be nowhere near their maximum allowable lengths !

Incidentally, it was easy to establish the maximum width of the instrument; it couldn't be much more than 4 feet across and still fit in my Volkswagen !

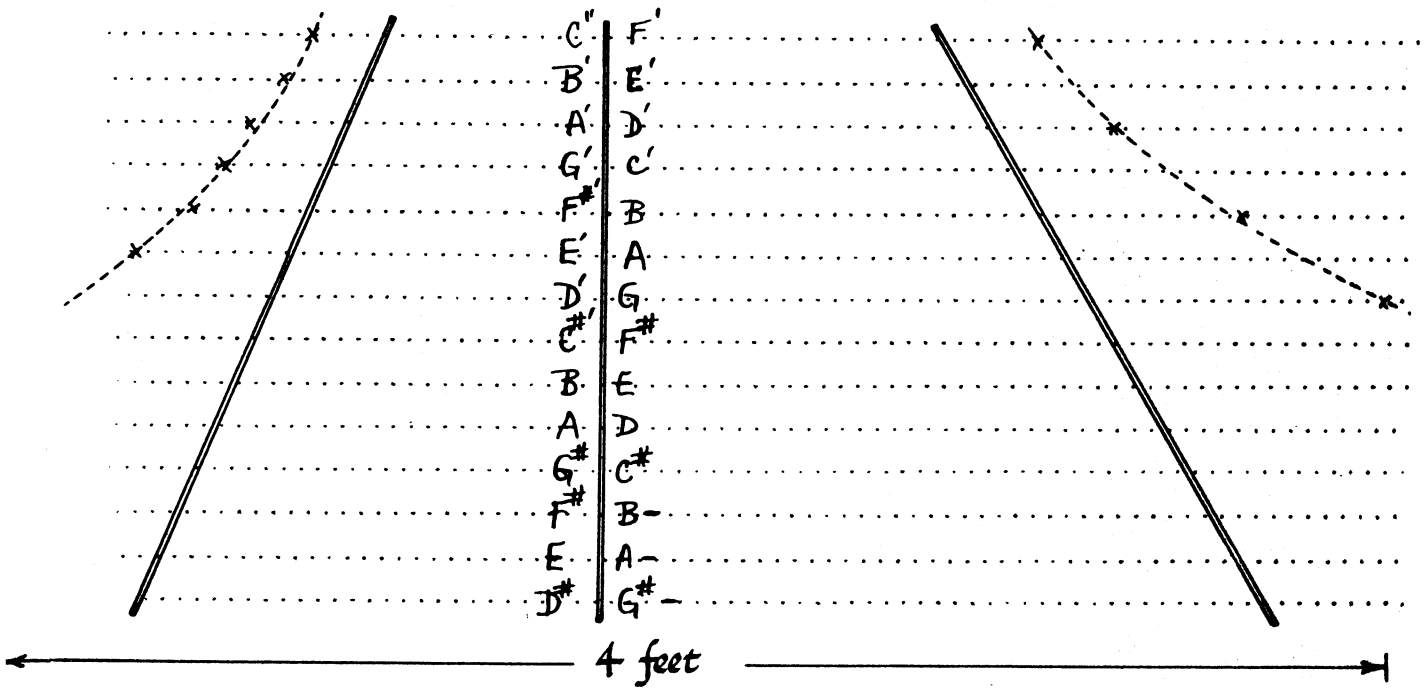


Figure 21: First stage of layout for dulcimer #13. Original was full-size.

Once I'd made the somewhat arbitrary committments to string lengths, left and right bridge locations, and maximum size of instrument, the specific outlines of soundboard, pin blocks, and frame followed naturally (see fig. 22). It continually intrigues me how this simple act of going from the general (e.g. fig. 18) to the specific (e.g. fig. 22) brings with it such a feeling of relief. The enigmatic phantom implied by fig. 18 immediately dissolves into a long line of relatively unimposing problems which politely present themselves for solution, one at a time !

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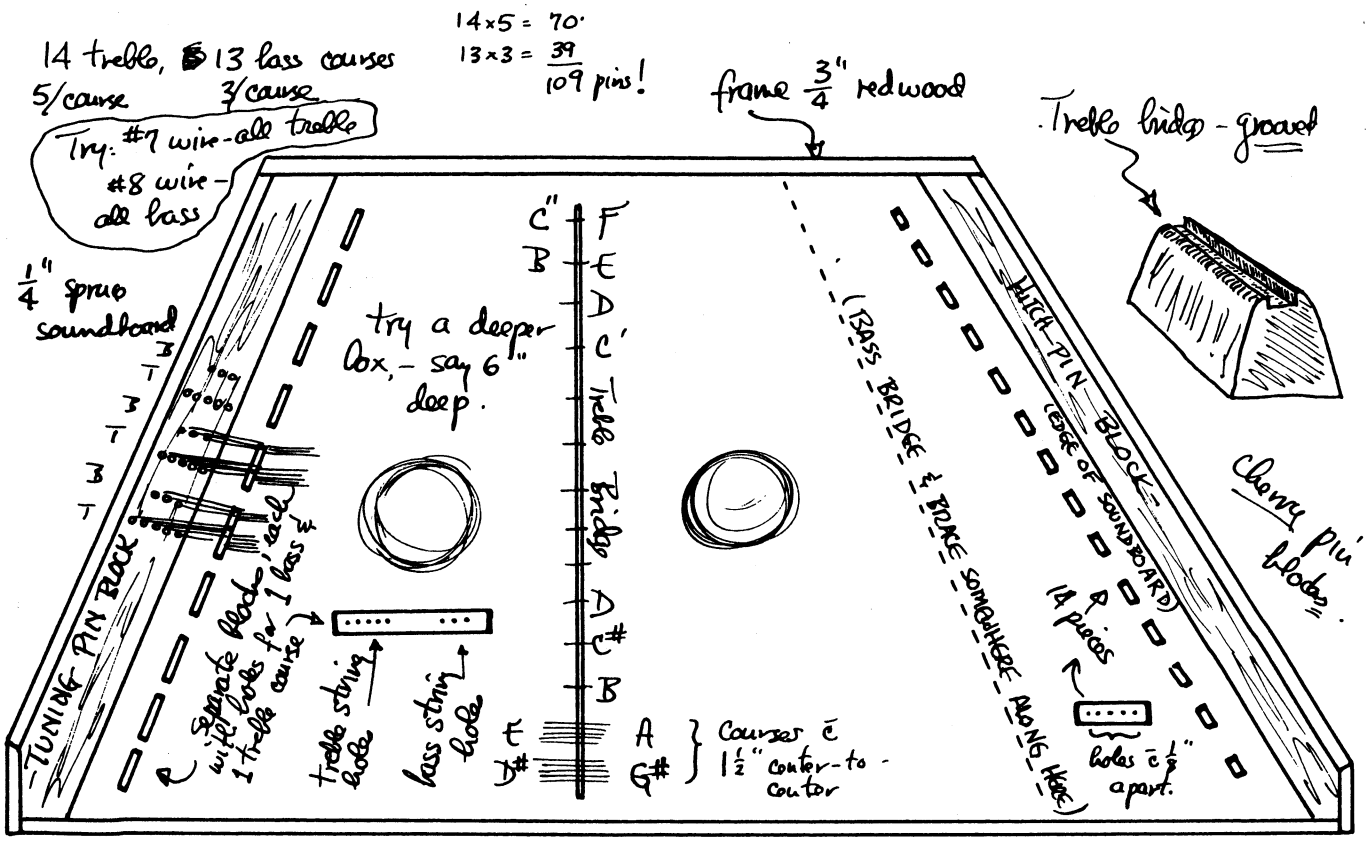


Figure 22: Later stage of layout for dulcimer #13. To help reduce confusion, guide lines shown in fig. 21 (normally drawn in lightly) are not shown here.

I have yet to find a dulcimer design which I prefer above all others. As a rule, when I begin designing an instrument, I am invaded with ideas to be tried, and questions to be answered. The particular ideas and questions which appeal to me at the time of planning largely control what the instrument will be, and show up as a host of scribbles and thumb nail sketches on the layout (see above). For example, the following questions caused me to design #13 with a 1/4" thick spruce soundboard, a deeper box (6" instead of 4"), separate blocks for the oblique bridges, a grooved treble bridge, etc..

1) Will a 1/4" thick spruce soundboard serve as well as the thinner (1/8") soundboard ? If so, won't the added stiffness of the thicker wood prevent buckling without my having to stiffen it with slats (see pg. 14) ?

2) Will a deeper soundbox give the noticeably richer, deeper tone that many persons tend to predict ?

3) If the left and right bridges are made of separate little blocks (glued on to the soundboard), won't this reduce the stiffening effect of a one-strip bridge, and result in a louder tone ?

4) Will an instrument sound O.K. if approximately the same size wire is used throughout?(previously I'd used thinner wires for the higher registers).

5) If I place the bass bridge somewhat nearer the treble bridge, won't it be easier to accurately strike the bass strings ?

(NOTE: Previous to this, I had been placing the bass bridge close to the right edge of the soundboard)

6) I've had a lot of trouble with one side of a treble course ringing when the other side is struck (annoying, and sounds like a telephone ringing far away). If I make the treble bridge grooved, thus having two points of support for each string passing over it, mightn't this isolate one string portion from the other and reduce the number of times I try to answer the phone ?

7) Will I be able to shift keys in the twinkling of an eye ?

** * **

This is the way I felt about the above questions in July, 1969 (approximately 1½ years after completing #13):

1) Soundboard is quite satisfactory, with not a sign of buckling or cracking.

2) NO NOTICEABLE DIFFERENCE in tone, that can be ascribed to the deeper box. The instrument is much bulkier and thus harder to manage. I prefer thinner instruments.

3) NO APPRECIABLE DIFFERENCE that I am aware of. The blocks tend to pull off the wood, due to the twisting effect of the strings (strings "zig-zag" through holes drilled in the blocks, much like shown in fig. 8c).

4) Voice seems to bo more uniform throughout than in earlier instruments using several wire sizes (previously, I'd assumed that thinner wires were necessary in the upper registers to prevent string breakage, and often used 3 or 4 different sizes in the treble strings!).

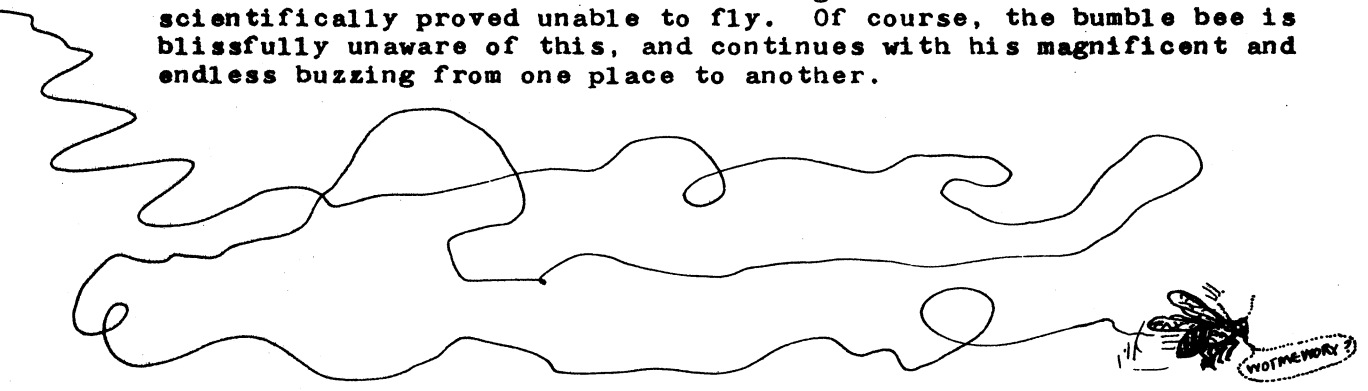
5) I can play faster and more accurately, and it feels easier with the bass strike points nearby.

6) COMPLETE SUCCESS ! In addition, when the strings are temporarily supported on a single heavy wire placed in the groove, the ringing effect returns noticeably.

7) Again complete success ! As a matter of fact, I have noticed parts of two additional major scales I had not originally planned for. I intended to get A, D, G, and C major. I ended up with those, and bits of E and F major in addition ! As discussed previously, I change scales by playing on different portions of the instrument.

** * **

Throughout much of my work with hammered dulcimers, I have been continually amazed at how many "sensible" rules of instrument making are so difficult to confirm. This gives a marvelous sense of freedom when designing an instrument, since I feel that even if I use ideas somewhat contradictory to what I (or someone else) have believed, the resulting instrument will probably not be adversely affected. It all reminds me of hearing how the bumble bee has been scientifically proved unable to fly. Of course, the bumble bee is blissfully unaware of this, and continues with his magnificent and endless buzzing from one place to another.



As one more example in which curiosity provides its own answers as to instrument design, here is a short discussion of dulcimer #14, in question-and-answer form. Incidentally, #14 was my first attempt at making a rectangular instrument.

1) Thus far, the soundboards have been attached by being glued onto a sort of shelf lining the soundbox hole. Mightn't the soundboard be made more compliant near the outer bridges by scalloping its oblique edges and attaching it only here-and-there, between the scallops? (See *'s in fig. 23).

2) If the left and right bridges are made of separate little blocks (see fig. 23), mightn't this allow the soundboard to be even more compliant than it would be if the bridges are single, relatively stiff strips ? (This is the same as question #3, pg. 26, but remember that now the soundboard will be <u>scalloped</u>.)

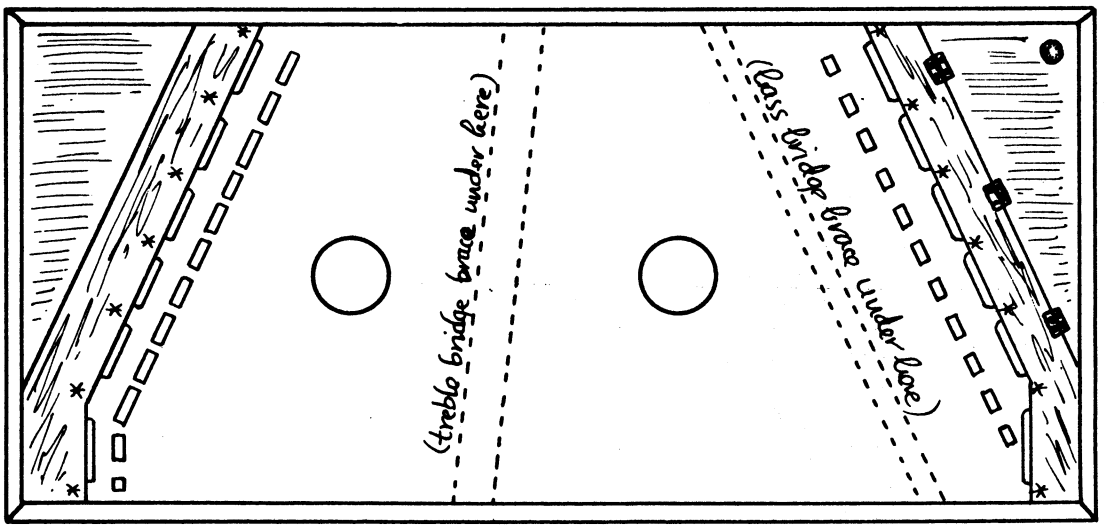


Figure 23: Top view of dulcimer #14, just before addition of hitch pins, tuning pins, strings, bass bridge, and treble bridge.

3) If the ideas of scallops and separate little blocks are combined on one instrument, mightn't there be a noticeable increase in loudness and richness of tone (whatever that is) ?

4) If the maximum string length chart (see fig. 20, pg. 23) is used to plan an instrument which is as long as possible, mightn't the extra size of the soundbox (combined with the extra tightness of the strings and more compliant soundboard) make an instrument having spectacular tone?

5) If the bass and treble bridge braces are made VERY HEAVY, won't the hammer thumps be almost non-existant, with the string tones coming primarily from the outer edges of the soundboard ?

** * **

This is the way I tended to answer the above questions, approximately 1¼ years after completing the instrument:

1) & 2) Immediately after the soundboard had been installed I gave it my customary knuckle-thump test, which is probably more satisfying than it is useful in predicting the instrument's tone. Even so, I was immediately gratified to hear a surprisingly loud and ripe-sounding response to knocking the scalloped soundboard along its scalloped edges (an unscalloped soundboard sounds relatively "dead" when thumped closer than about 1½" from its edge).

3), 4), & 5) I was quite pleased with the instrument's tone after the treble strings had been placed and tuned, though it didn't sound as "rich and resonant" as I would have expected, according to my knuckle-thumping. When I began adding the bass strings, I felt I needed even greater length and tightness than I had planned for, and I therefore finally placed the bass bridge slightly to the right of the internal brace (i.e. slightly to the right of the dotted lines for bass brace, fig. 23). I figured that this sidewise displacement would result in some hammer-thumping coming through (bass bridge was now resting on an unbraced portion of the soundboard), but I hoped it wouldn't be excessive.

After all stringing was done, I was amazed at the superior tone of the bass strings ! Even in instances where a bass string's pitch was identical to a treble string's pitch, the bass string "sounded better". In addition, the presence of some hammer-thumping seemed to improve the musical effect, rather than detracting from it. Although the tone of the treble strings was good, they sounded somewhat harsh, thin and metallic in comparison to the "mellow resonance" of the bass strings. It was as if I had two separate and distinct instruments on the same soundbox !

At first I was at a loss as to how to explore this difference in tone. Then, almost by accident, I remembered the curious muting effect produced when a heavy and dense object (e.g. a rock or a chunk of metal) is placed against a vibrating bridge. I decided to press a piece of iron against each bridge at each end of each set of strings (while the strings vibrated) to determine where the bridges were vibrating and where they were not*.

As I had expected, I heard no appreciable muting at any position along the treble bridge, and moderate muting for all bridges at the extremities of all treble strings. The surprise came when I began to test the bass bridges. In some cases it was the left bridge that vibrated, in others only the right bridge was active, and in several instances both left and right bass bridges would vibrate ! This indicated that a certain amount of "give" in the bracing might be desirable.

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* I made the assumption that if the instrument's loudness decreased when the chunk of iron was touched to a given location, then that given location had been vibrating before the iron was applied. Conversely, if no noticeable diminution of loudness was detected, then I felt it safe to assume that the wood in that location had not been vibrating appreciably.

I had scarcely begun to get acquainted with #14 before its right-hand treble bridge blocks began to split and twist off of the soundboard (see fig. 24). Each block had been made by sandwiching a piece of $\frac{1}{4}$" thick spruce (soft and weak!) between two 1/8" thick pieces of rosewood (poor adherence with some glues). I suppose my zig-zagging strings imposed too severe a shear and twisting stress on the combination of weak and hard-to-glue woods.

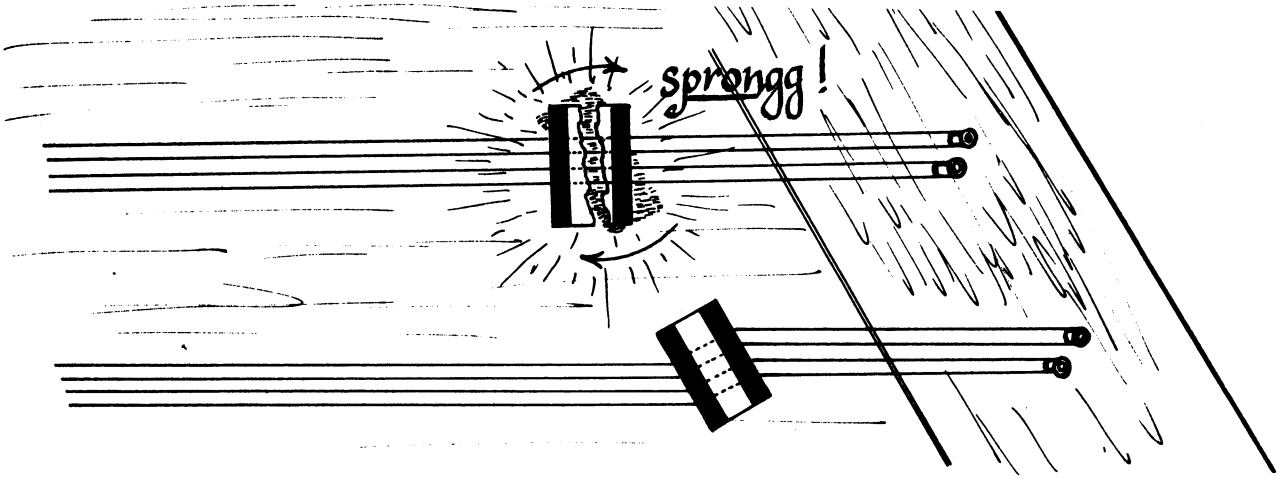

Figure 24: View of a broken treble bridge block on #14. Bass strings & bridge not shown.

I repaired #14 by making longer blocks, each of which carried two treble courses. I replaced the spruce with cherry wood. The instrument has held up reasonably well since then, although a bridge block will pop off now-and-then. Incidentally, when restringing #14, I replaced half of each treble course with one size heavier wire (thus: each treble course has two strands of #7 steel, and two strands of #8 steel). The tone of the treble strings was much improved, and there's no longer the impression of "two separate instruments", as described on page 29.

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It was a miserable experience to have constructed 13 hammered dulcimers with a fair degree of success and to then witness #14 crumble away. It was about then (April 26, 1968) that Ann took me to one of several World Craft Fair programs put on by the U.S. Department of Commerce. The first part of the afternoon program was a presentation of Korean music, by Dr. W.C. Wang of the Korean Embassy. His marvelously warm and gently humorous discussion of Korean musical scales, music, and musical instruments cheered me completely. One after another, he demonstrated an ancient harmonica, a koto, a 1000-year-old ceramic "sweet potato", a Chinese end-blown flute, and finally a very small hammered dulcimer ! Apparently the hammered dulcimer is well-known in Korea, and as Dr. Wang played

for us I was astounded at its fine tone (the instrument was only about $2\frac{1}{2}$' long on its longest side, and trapezoid-shaped). I could hardly wait to get back home and begin designing my first baby Hackbratt, having bass and treble braces made light to provide a certain amount of "give" (as suggested by the behavior of the bass bridges of #14).

I designed #15 with a 5th interval across the treble bridge. It is about 3' long on its longest side and has 11 treble and 10 bass courses (3 and 2 strings per course, respectively). Both left and right-hand bridges are single strips of walnut (approx. $\frac{1}{4}$" square in cross-section), glued onto the 1/8" thick spruce soundboard after the zig-zag holes for strings had been drilled. The instrument is strung with #6 and #7 steel music wire, for treble and bass strings, respectively.

I tuned #15 as shown below in fig. 25 (thus allowing A, D, G, and bits of C and E major as playing keys). Although the added "give" made it somewhat troublesome to get into tune the first time, it holds in tune reasonably well. The tone is quite good throughout, except for a few of the lowest bass notes (they're on the verge of sounding metallic and muddy due to being almost too slack). There is a slight tendency for the soundboard to hump up during damp weather, and I am all the more in favor of using thicker wood for the soundboards.

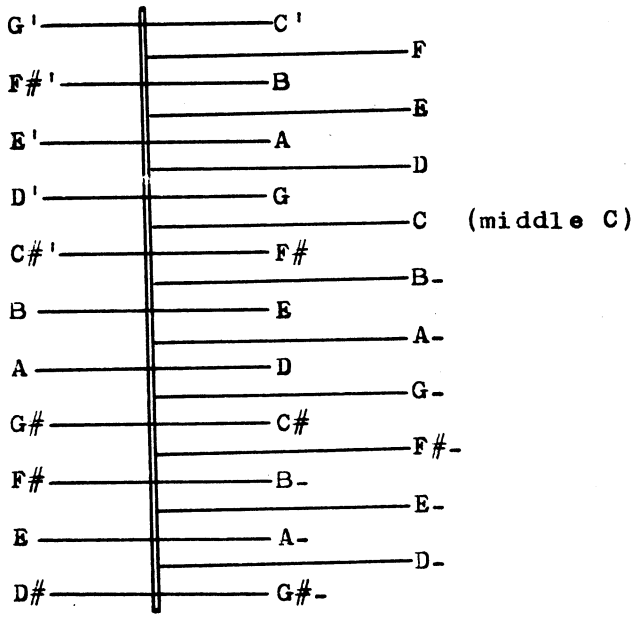

Figure 25.

(Note that this is similar to the tuning scheme for dulcimer #13. The strings on #15 were shorter, however, and were all noticeably slacker.)

During this period of designing, building, and experimenting with 5th interval instruments, I went through a somewhat agonizing interval of unlearning and relearning. My developing proficiency on 4th interval instruments seemed a great handicap at first, for my hands would insist on rapidly striking at familiar locations, rather than at the new locations required by the new tuning system. The contrast between playing rapidly (on a 4th interval dulcimer) and making horrendous mistakes rapidly (on a 5th interval dulcimer) would frequently drive me to the limits of my endurance. I had to remember that the home tone ("do") was displaced from the first course left to the second, fifth, eighth, or eleventh course right. Where I had only one accidental to deal with (fa# on the 4th interval instrument), I now had several (e.g. two fa#'s, a ti_b, a la#, etc., on the 5th interval instrument).

I can think of two main influences which enabled me to keep working at hammer dulcimering at this stage, rather than calling it quits. One was the excellent fiddle music which Bob Beach (of the Allemande-Lefters) plays month after month. I was determined to refine my skills enough to be able to keep up with him, switch keys rapidly as he does, and perhaps even extemporize on the melodies during all the confusion of joyful dancing, joke-telling, and general Delight. My first few attempts at playing along required some of the most exhausting effort I've ever experienced. Two or three hoedowns were all I could manage in an evening, and I felt as if I'd been on an all-day-hike. Later, I began to be able to accommodate four or five tunes, and even get in a few licks at harmony. It was marvelous to detect a slight but definite improvement at each dance. Eventually, after 1½ years' solid experience with 5th interval dulcimers, I could keep up with nearly all melodies, extemporize on many, occasionally play faster than Bob*, and feel only slightly but comfortably weary after 3 hours. The next milestone will come when I am able to swap jokes with Joe Winn (the guitarist, banjoist, cellist; mnemonics, card and magic trick expert, artist, and historian of the band), and at the same time play the dulcimer without looking at it !

The second influence was a most delightful recording by a hammered dulcimer expert whose name is Chet Parker. Available on Folkways Records (THE HAMMER DULCIMER PLAYED BY CHET PARKER; Folkways FA-2381), this is a cheerful collection of reels, hoedowns, quadrills, hornpipes, and miscellaneous Old Time Favorites, played on a 12-course hammered dulcimer made by Chet in 1904. It is rickey-tickey music at its unpretentious best, and after listening to it for a while, I began unexpectedly to be able to duplicate some of his simpler decorated runs. I am gradually aiming at playing some of the more difficult pieces which he plays so effortlessly.

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* (Not recommended, unless I need to finish first.)

Dulcimer #16 was an attempt to improve on #13 by using a scalloped soundboard, bass and treble braces lightened by boring holes through them, single-strip end bridges (rather than blocks which keep popping off), and brass and phosphor bronze wire for many of the bass strings. The brass and phosphor bronze idea came from talking to Scott Odell, of the Smithsonian Institution (Old Instruments section). Apparently, it is common practice to use brass or bronze strings in the bass register of harpsichords. The greater flexibility of this wire permits it to be tuned to lower pitches without sounding mushy and non-musical. Both spring brass and phosphor bronze wire are much weaker than steel music wire (20" samples broke consistently at middle C, rather than one octave above; see pp. 21-23), and I had to tune my bass strings one octave below nearby treble portions, rather than a 5th interval below (see pp. 20-21). Once more, the lightened braces resulted in some sagging and difficulty of tuning. However, the overall tone was excellent, with exceptionally rich bass notes (lowest note was A, bottom space of bass clef). The new bass tuning was somewhat confusing to me, and I tended to prefer playing on #13 for that reason. Shortly after completion, #16 developed some annoying buzzes in its side bridges, and soon showed signs of breaking apart due to humidity changes.

Dulcimer #16 was in the middle of a'building when our first son John was born (August 5, 1968), and when September teaching resumed, my dulcimer-building energy became dormant. It wasn't until the following July, during the Smithsonian's Folklife Festival, that I had much definite idea of doing more dulcimer building. What was the cause of this renewed interest ? I met Chet Parker !

It began during an afternoon*hammered dulcimer workshop program, M.C.'d by Mike Seeger. Mike spotted me among the numerous fascinated persons in the audience, and thinking I already knew Chet, invited me up on the platform with him. Then Chet invited me to try plunking on his dulcimer, warning me that "it might be tuned a bit different from what you're used to." Through these two persons' encouragement I was put at ease, and when I tentatively tried a few notes, I found that it was the 5th interval tuning I was used to (based on D, G, and C major scales, using 12 courses of 4 strings each)! It was a most curious and profound experience to be in public view while meeting Chet for the first time, and to then play on his dulcimer. I was able to play "The Old Spinning Wheel" (learned from his record) all the way through without a mistake. Somehow, his dulcimer and hammers seemed livelier than mine and almost played by themselves.

Very early the next morning, I awoke with the odd idea that I'd like to make an approximate duplicate of Chet's dulcimer and show it to him before he left the Festival for home. By breakfast time this idea seemed rather foolish, but I decided to give it a try, and after I'd drawn a rough layout of the instrument I was having such fun that all hesitation vanished.

* (Tuesday, July 2)

Since time was short (Chet would be leaving on July 5), I planned my Parker model dulcimer around available wood. This consisted of some of Ann's 3/4" shelf wood, some two-by-three's awaiting placement in a small half-bathroom we're finishing, a couple $\frac{1}{4}$" poplar boards, and some strips of window screen molding. Fearing that zither pins wouldn't hold in the soft two-by-three's, I made a quick trip to a nearby piano repair shop, and they generously gave me a couple hundred used piano pins (ordinarily thrown away). By the evening of July 3 I had the frame and back glued and nailed together, the soundboard installed, and the rough instrument darkened with Danish walnut stain. The next day was spent drilling holes for the hitch pins, making a primitive bridge, etc., and by that evening (July 4) the instrument was strung, in tune, and playable ! Total working time was about 11 hours.

I deliberately restricted myself to a design which would require as few specialized tools and techniques as possible. Thus, this work needed only a hand saw, hammer, yardstick, brace & bit (for sound holes*), piano T-wrench, and an electric drill. The appearance of the dulcimer at several stages of construction is shown below. Finished dulcimer is represented in fig. 27, next page.

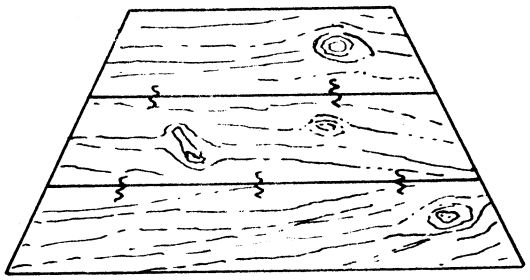

Figure 26a: Shelf wood boards marked and cut to trapezoid shape, glue applied, and temporarily held together with corrugated metal fasteners.

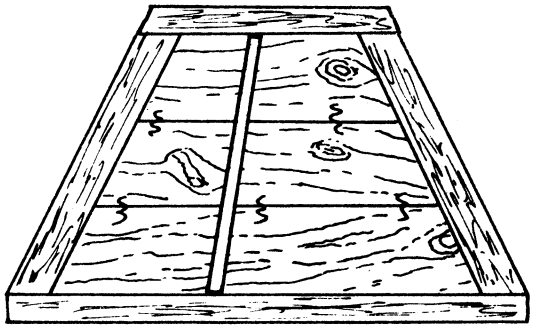

Figure 26b: Two-by-three's cut and attached to oblique edges with glue and nails. Two more pieces cut, glued, and nailed to parallel edges. Treble brace added.

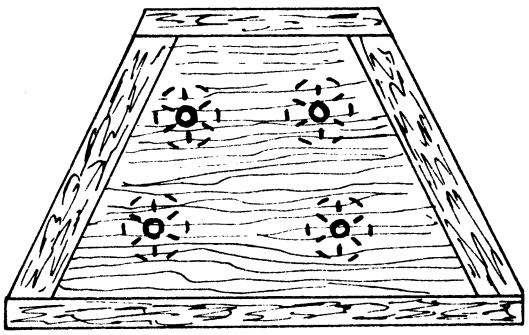

Figure 26c: Soundboard cut to shape and glued and nailed into place. Stain and soundhole decorations applied.

(In my opinion, sound holes are unnecessary for tone. I add them purely as decoration)

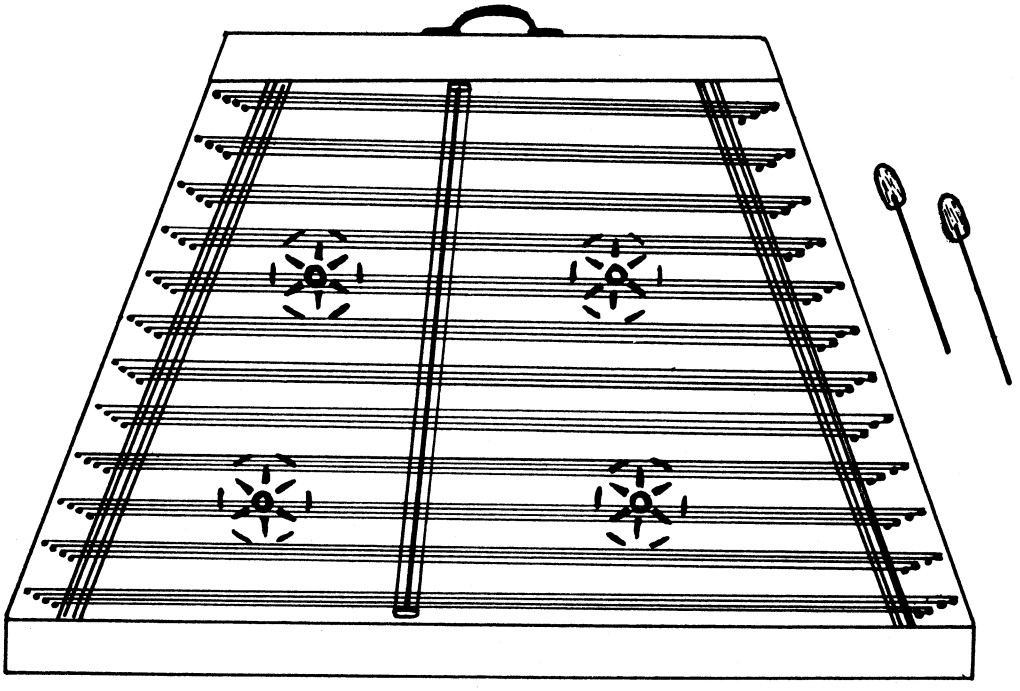

Figure 27: Parker model dulcimer (#17) completed. Hammers are leather-covered slotted wooden knobs, glued to the ends of thin 6" wood strips. Side bridges were made by attaching window-screen molding to the oblique edges of the soundboard, and capping with heavy wire. Strings are #9 steel (.022" dia.).

Newly-strung dulcimers tend to go out of tune in a short time, and this one was no exception. However, I was able to get it back in tune long enough to take it to Chet at the Smithsonian. He grinned and immediately played a gloriously complicated series of medleys, with almost no misses. We then discovered that my dulcimer could be tuned easily to his, and he encouraged me to try to "second" him, duet-fashion. That became one of those rare, magical times when everything seemed to work to perfection; I could follow his lead with no trouble whatsoever, and played harmony to several of the simpler tunes I'd learned from his recording. I think the Festival visitors encouraged us both to greater efforts, and it wasn't long before Chet was alternately telling jokes and stories, playing and singing silly songs, and showing me new ways of playing harmony. I remember that whole day with very special delight.

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Dulcimer #18 was designed and built shortly after #17, and had a soundbox essentially the same as that of #17 in every respect. The treble strings were the same, but I then added 10 courses of bass strings (3 strings per course). It became (and still is) my favorite General-Purpose-Rough-&-Ready-Knock-About & Carry-Anywhere dulcimer. It is considerably more complicated in appearance, as may be seen in the photograph below:

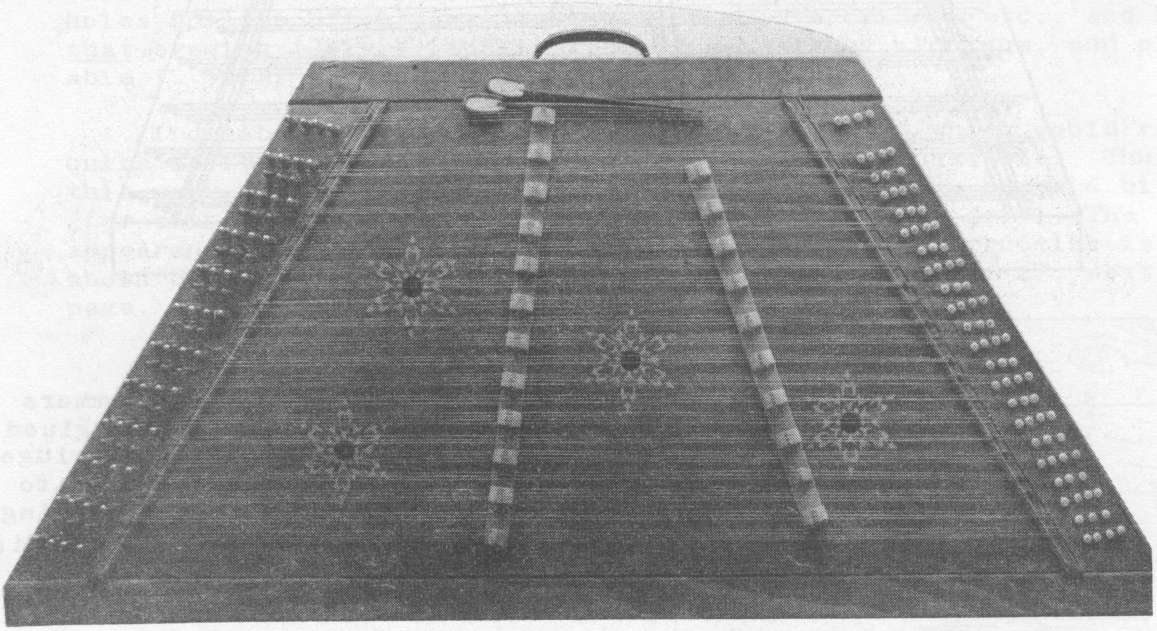


Figure 28: Hammered dulcimer #18 (like #17, but with ten bass courses added). Construction time approximately 14 hours.

The bass and treble bridges were made with great ease and convenience by shaping a stick to the proper cross-section, cutting it in little pieces, and gluing these pieces onto two straight wood strips.

At about this time, I began to realize that the use of wood capped (rather than wire-capped) bridges gave a less harsh sound, and instruments #19 and #20 verified this. The results were the same as the grooved treble bridge (see pg. 25 and point 6 on pg. 26), but with much less effort required.

Dulcimer #21 was patterned after #18, but was made deliberately handsome by using oak pin blocks, mahogany veneer soundboard ($\frac{1}{4}$" thick) and cherry boards along the perimeter of the trapezoid. In #21 I also discovered that bass string pairs (rather than triplets) were quite adequate for balanced sound.

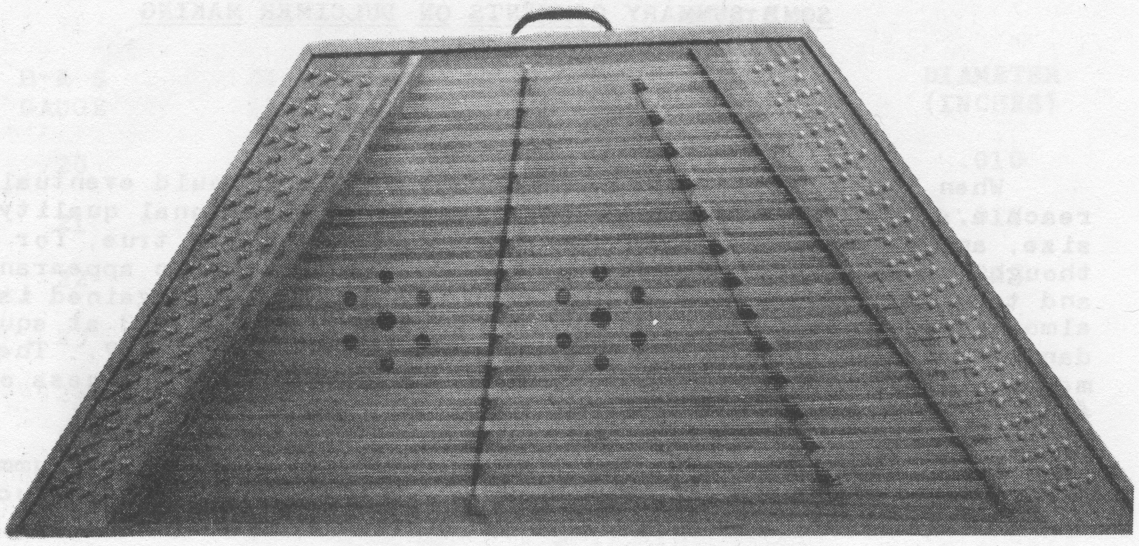


Figure 29: Hammered dulcimer #21 (My wife, Ann, calls it a "Fancy Chet Parker #2 Model."). Distance between outer bridges varies from about 34" at bottom of instrument to about 12" near the top. There's nothing critical in these dimensions, of course, but this will give an idea of size. Basic playing keys are D, G, C, and F major, with a touch of A major.

This completes my account of experimental work done in building my first 21 hammered dulcimers. The point made in lines 8-13 of the Preface still holds true much of the time, even though experience is increasing my ability to predict.

A source of continued amazement in all this has been the way instruments can vary greatly in appearance and voice without affecting their relative aesthetic value. An instrument which lacks in one aspect tends to make up for it in another. I get the impression that one would really have to work hard to develop a poor instrument ! In other words, there seems to be no magic varnish and no special advantage (beyond preference) to using only well-seasoned yub-yub wood from headboards stored in attics for a minimum of 25 years.

It is a truly remarkable experience to begin with an interest, then get ideas, make plans, haul in a pile of lumber and hardware, and gradually transform rough material and uncertainties into a musical instrument.

So, what are you waiting for ?

SOME SUMMARY COMMENTS ON DULCIMER MAKING

** * **

When I began making dulcimers, I imagined I would eventually reach a single "preferred" design, having optimum tonal quality, size, and appearance. I no longer feel that this is true, for although the details of construction affect the specific appearance and tone of an instrument, the relative satisfaction gained is almost indeterminate. The pleasure I've had playing #13 at square dances compares favorably with the fun that came from #17. The mellow tone of #14 is a joy, but so is the metallic harshness of #12.

This being the case, I'd like to close this manual by summarizing my present ideas concerning dulcimer design and construction.

1) TUNING PINS AND WIRE:

According to my experiences, you may have to order music wire and tuning pins through a local piano repair shop. They are certainly helpful if you're interested in obtaining used piano tuning pins; I've gotten good bargains sometimes, as used pins are too nice to throw away, and too marred to use again for official repair.

I have been ordering directly from the following companies, and have been impressed with their speed of service and congeniality:

for wire:	for zither pins and some wire:
MALIN & CO.	TUNERS SUPPLY CO.
5400 SMITH ROAD	94 WHEATLAND STREET
BROOK PARK, OHIO	SOMERVILLE, MASS.
44142	02145
(prices on request)	(write for information)

I have, of course, tried phosphor bronze and spring brass wire on instruments, but consider them somewhat risky to use due to their relative weakness. They are quite handsome in coloration, and are useful where low tones must be coaxed from a relatively short or slack wire. These materials tend to break at about 1 octave below steel music wire for the same vibrating length. That is, phosphor bronze and spring brass break at about middle C for a 20" vibrating length (see pg. 23).

AN ABBREVIATED TABLE OF GAUGE NUMBERS AND WIRE DIAMETERS:

B & S GAUGE	DIAMETER (INCHES)
20	.0319
21	.0284
22	.0253
23	.0225
24	.0201
25	.0179
26	.0159

NOTE: This gauge system used with spring brass and phosphor bronze wire.

AMERICAN STANDARD GAUGE NO.	DIAMETER (INCHES)
1	.010
2	.011
3	.012
4	.013
5	.014
6	.016
7	.018
8	.020
9	.022
10	.024
11	.026
12	.029

NOTE: This gauge system used with spring steel music wire.

2) DESIGNING THE INSTRUMENT:

When I began designing hammered dulcimers, I had some difficulty visualizing what the instruments would look like. My solution was to make full-sized top views, showing the major wood pieces as they fit together (for example, see pp. 24-25). I rapidly discovered that I could mark and fit my wood pieces quite well by just using the drawing itself for reference. I rarely used actual length measure (i.e. "inches") but simply placed raw material upon the paper and marked it from the actual drawing. This proved to be such a fast and accurate system for me that I have never abandoned it. The main difference now is that my working drawings are much less detailed, showing only minimum lines for marking the wood.

Instrument shape and size will be influenced mainly by the number and lengths of the strings used. I hope I have made it clear that this is all fairly arbitrary, for strings behave well over a rather wide range of tightnesses and pitches. I've had good results making the shorter strings about 2/3 to 3/4 of their breaking length, and the longer strings as long as is practical (longer, tighter strings give generally brighter tones). I have been able to tune the steel strings down to about $1\frac{1}{2}$ octaves below their breaking pitches before they begin to sound unusably mushy and buzzy.

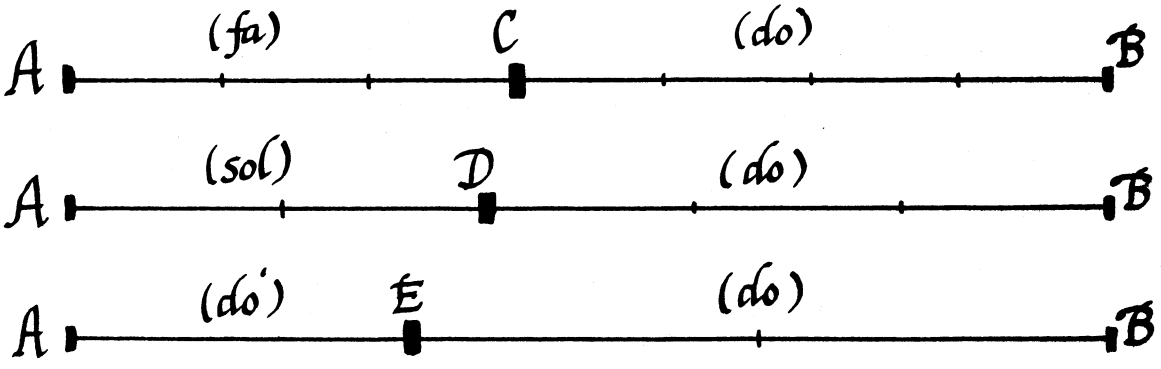
Be sure to include one or more <u>cross</u> braces ! The combined pull between the slanted sides can be enormous, and unbraced wood will slowly (sometimes not so slowly !) distort inwards.

A summary remark I might make about precise and specific lengths and sizes is: HAW !

3) INTERNAL BRIDGE BRACES:

Since the treble bridge <u>brace</u> should come more-or-less under the treble bridge, you'll need to estimate where to place this support. This will involve a little knowledge of vibrating string ratios and relative pitches. This can be determined experimentally just by sliding a bridge under a string until the desired interval is obtained.

For example, suppose a "do-fa" interval is desired. If a third bridge is slid back or forth until one portion of the string gives "fa" when the other gives "do", the relative lengths of the portions will be in the ratio of about 3:4 (see below). Similarly, a "do-sol" interval will occur when the relative lengths are in a ratio of about 2:3 (see below). An octave interval (as on the Persian santur) will occur when the relative lengths are in a 1:2 ratio (see below).



(<u>Figure 30</u>)

In figure 30, please note that:

AC = 3/7 of AB !

AD = 2/5 of AB !!

AE = 1/3 of AB !!!

The bass bridge (and brace) is ordinarily placed near the right-hand bridge. The exact location is not critical, but the strings do have to be long enough to produce the desired low notes. In the tuning arrangement I prefer (e.g. see pg. 21), the bass notes tend to be 1 octave below their left-hand treble string neighbors. I have had good results simply making the bass strings about double the length of their left-hand treble string neighbors.

I have occasionally designed instruments having bass strings tuned 1 octave below their right-hand treble string neighbors. In these instances the doubling of lengths is a more complicated problem. I've been simply placing the bass bridge close to the right-hand bridge, and using heavier, slacker wire (e.g. #21 or #22 spring brass or phosphor bronze). I have occasionally seen wound strings used, in similar cases where low pitches are desired from relatively short vibrating lengths. I haven't yet tried this, but I bet it would be really effective !

There's nothing much to the actual construction of the braces themselves. I just put in a sturdy board (like: ½" cherry) which firmly contacts the bottom and the soundboard of the instrument. It could be called a partition, with no holes or spaces included to lighten it or make it vibrate better. "Just put it in and get on with it" is the keynote here. If you'd prefer to lighten it and bore holes, that will work well, too.

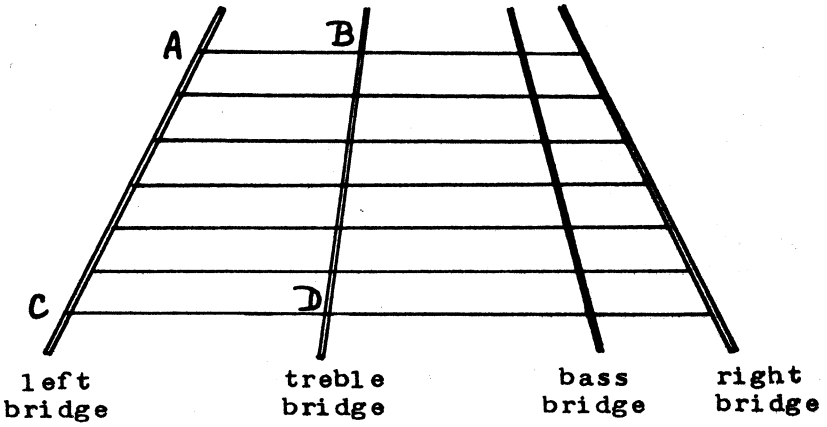
Get the idea ?

4) A FEW WORDS ABOUT BRIDGE BUILDING:

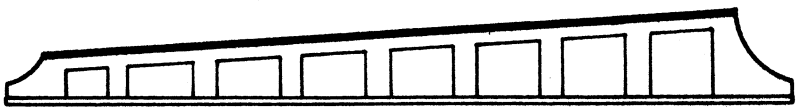
Most hammered dulcimers I've seen have treble bridges which are around 1-1½ inches high throughout. This causes the shorter strings to rise at a steeper angle than the longer strings. I personally like to make my treble bridge slanted, so that the strings rise at a more-or-less constant angle. I have settled on using a 10% grade for the left-hand portions of the treble strings. In other words, that's 1" of rise for every 10" of vibrating length.

For example, consider the instrument represented on the next page (figure 31):

Figure 31:



In the above figure, let's say distance AB is 7" and CD is 13". I'd design my treble bridge to make the strings at B about 0.7" higher than at A, and the strings at D about 1.3" higher than at C.



I used to have quite a bit of trouble deciding accurately how tall to make the bass bridge. The bass strings must be elevated properly to go through the treble bridge holes without coming too close to the wood. This was all hard to visualize, especially with the bass bridge at an angle to the treble bridge. I solved the difficulty by drawing <u>side</u> views (full size) of the longest and the shortest treble strings. I'd then just draw in the bass string (aimed properly through its treble bridge hole), and take the correct height <u>directly</u> from the drawing. You can get an idea how this worked by looking back at figure 9 on page 8.

5) STRINGING AND TUNING THE INSTRUMENT:

An obvious way of attaching the wires to the hitch pins is to make a loop on one end of each wire, and drop the loops over the hitch pins (see below, fig. 32 a). An easier and quicker method is to attach one end of a wire to a tuning pin, carry the wire across the instrument and around one or two hitch pins, then back again to the next tuning pin (see fig. 32 b & c).

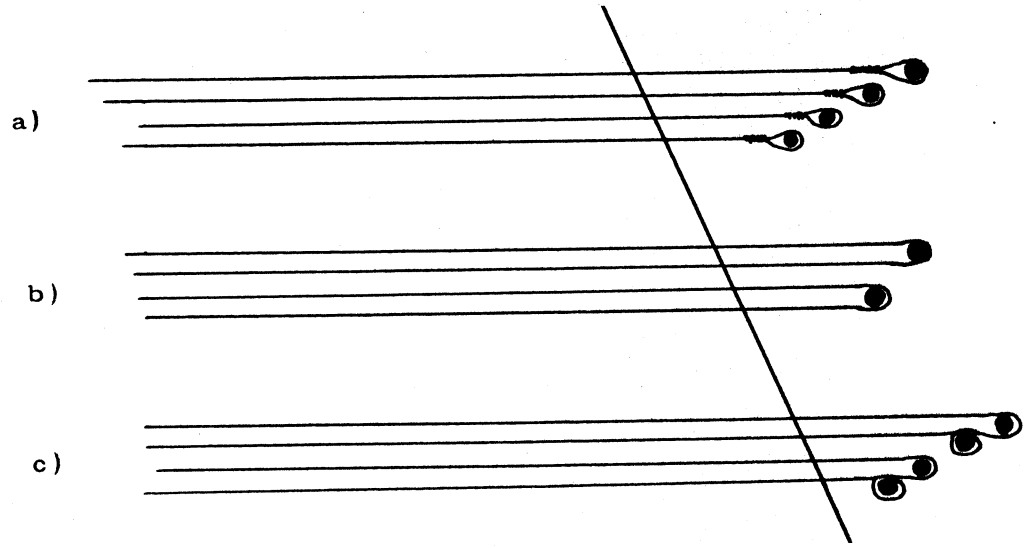


Figure 32:

I begin stringing with the first or second course and then I slip the treble bridge underneath. I tune the strings to moderate tension, and in unison with each other. I then pluck the longer and shorter portions, moving the treble bridge sideways until I hear the desired interval (e.g. do-fa or do-sol) across the bridge. This procedure is repeated with one of the short courses and with three or four courses in between. At this point, the position of the treble bridge is approximately correct throughout. I then add the remaining treble strings and rough tune them all to the intended pitches.

The instrument is next tuned more accurately. First I tune one of the long courses accurately to a pitch pipe, and then work upwards through the strings, keeping unisons and octaves accurate, and major chords (e.g. do-mi-sol, do-fa-la, re-sol-ti) sweet.

During this fine-tuning process, slight inaccuracies of treble bridge position may show up. This is recognized by difficulties in keeping all octaves, unisons, and major chords matched. If, for example, pitches to the left of the treble bridge tend to be sharp, then the bridge should be tapped slightly (1/16" or so) to the right. (See why ?)

6) SOME PLAYING METHODS TO TRY:

a) Once the dulcimer is struck, its undamped strings tend to ring for a fairly long time. The effect is very much like that of playing on a piano while holding down the damper pedal. Just playing a one-line melody will result in a marvelous background of sound accompanying the tune. This is the simplest method of deliberate playing that I can think of.

b) The plucked dulcimer, the hurdy-gurdy, and the bagpipe are examples of instruments using a primitive but effective method of harmony accompaniment. In each case, the melody is played against a sustained tone of constant pitch. This effect can be approximated with the hammered dulcimer by simply striking the "do" or the "sol" quite frequently as the melody is played.

One can become more fancy by striking the "do" every time a "one chord" (do-mi-sol) is needed, by striking the "fa" when a "four chord" (fa-la-do) is called for, and by striking the "sol" every time a "five chord" (sol-ti-re-fa) is needed.

c) The arpeggio (e.g. do-mi-sol-mi-do-mi-sol-mi-do-etc.) can be mixed with advantage into hammered dulcimer playing. The tune "Go Tell Aunt Rhody" is given below as an example.

(NOTE: Circled notes are the tune itself; others are the arpeggio fill-in. Underlined tones are below do in pitch. Do-prime (i.e. do') is one octave above do.)

(MI) DO DO SOL (MI) SOL (RE) SOL (DO) SOL MI SOL (DO) SOL MI SOL
(RE) SOL FA SOL (RE) SOL (FA) SOL (MI) SOL (RE) SOL (DO) SOL MI SOL
(SOL) MI DO MI (SOL) MI (FA) RE (MI) SOL MI SOL (DO) SOL (DO) SOL
(RE) SOL (DO) SOL (RE) SOL (MI) SOL (DO) MI SOL MI DO' .

For those who prefer "going by the numbers", here is the same tune, with 1,2,3,4,5,6,7,8 substituted for do,re,mi, fa,sol,la,ti,do', respectively. Tones below do are underlined.

(3) 1 1 5 (3) 5 (2) 5 (1) 5 3 5 (1) 3 5 3 (2) 5 4 5 (2) 5 (4) 5 (3) 5 (2) 5 (1)
5 3 5 (5) 3 1 3 (5) 3 (4) 2 (3) 5 3 5 (1) 5 (1) 5 (2) 5 (1) 5 (2) 5 (3) 5
(1) 3 5 3 8 .

(con'd.)

6) c) continued:

For further practice, here is a little arpeggio exercise composed for this manual. Strike the notes in a steady rhythm, aiming eventually for about 5 strikes per second.

DULCIMER ARPEGGIO EXERCISE

A { MI RE DO SOL MI SOL DO RE MI DO RE LA FA LA RE MI FA RE
  { TI SOL FA SOL TI DO RE TI DO SOL MI SOL DO (rest)

(Repeat A)----------

B { MI FA SOL MI DO RE MI FA SOL MI FA RE TI DO RE MI FA RE
  { MI DO LA TI DO RE MI DO RE TI SOL TI RE (rest)

(Repeat B, substituting DO for last RE)----------

(Continue with A and B as long as desired)

ARPEGGIO EXERCISE (by the numbers):

A { 3 2 1 5 3 5 1 2 3 1 2 6 4 6 2 3 4 2 7 5 4 5 7 1 2 7 1
  { 5 3 5 1 (rest)

(Repeat A)----------

B { 3 4 5 3 1 2 3 4 5 3 4 2 7 1 2 3 4 2 3 1 6 7 1 2 3 1
  { 2 7 5 7 2 (rest)

(Repeat B, substituting 1 for last 2)----------

(Continue with A and B as long as desired)

d) The tremolo method is the closest one can get to a sustained tone on the dulcimer. One simply selects a melody note and a harmony note, strikes them rapidly and alternately, then moves on to the next melody and harmony note. This works well for slow tunes and for accompanying some slow singing. It sounds easy, but it may take a while to develop a good, steady control of rhythm and loudness.

A short tremolo can be coaxed from a single hammer by holding it fairly loosely at the tip of its handle. Short tremolos make good decorations during fast tunes, and are fun to execute.

6) PLAYING METHODS, con'd.:

e) The hammered dulcimer can be easily transformed into a psaltery, with its characteristic delicate, shimmery sound.* One simply plucks the strings with the fingers.

Some psample psaltery psounds have been included on the accompanying record. If you like the effect, I recommend that you listen to the exquisite psaltery music of the Beers Family (on Columbia, Prestige International, and Folkways records).

f) The hammered dulcimer is large enough to be playable by two persons, duet style. This is often inspiring, sometimes hilarious, and will get bass strings into good use quite rapidly.

Although many people play the hammered dulcimer from the long side, it can be played just as well from the short side. It's a matter of getting used to note positions from that particular location. This fact might make it possible for people to play duets without getting in each others' way as much (assuming that is desirable).

g) That's about all the major playing techniques I can describe at the present time. One can get different effects, of course, by changing the hardness and the weight of the hammer heads and by varying the flexibility of the hammer shafts.

The whole purpose of this PLAYING METHODS section (as well as much of the record) is to provide some useful points of departure and areas of exploration. Begin with familiar tunes, fool around on the instrument, and develop new ideas which occur in the process. There are records which can be played along with (Country Music records are marvelous for this!), music books of all sorts, people who know tunes already, and others who can translate written music. With the present renewed interest in traditional and homemade instrumental music, contact and assistance should be readily obtained in that subject.

There is no attempt here to "teach the hammered dulcimer" in the usual sense. I think of this instrument as something to have fun with, rather than to use for developing spectacular proficiency. One day, you may suddenly discover that you are surprisingly good anyway.

* (For psaltery playing, I have generally been more pleased with instruments having relatively light backs (e.g. 3/8" plywood) and fairly long, low-pitched strings.)

7) OTHER SYSTEMS OF TUNING THE DULCIMER:

a) A Persian Santur which I have has the treble bridges placed to give an octave across these bridges. When received, the instrument was tuned in a regular major (diatonic) scale. Its bass strings were 1 octave below neighboring right-hand portions of the treble strings. (See fig. 33 a)

b) Steve Addiss described an instrument in his possession which is apparently chromatic, with a half tone across the bridge, and the RIGHT HAND TREBLE PORTIONS SHORTER THAN THE LEFT. Strings are tuned with a whole tone between courses (see fig. 33 b), except for a few places.

c) The tuning system presented in "Violins and Other Stringed Instruments and How to Make Them" (P. Hasluck, ed.; David McKay, Pub.; 1914) is chromatic, requiring separate treble bridges and a variety of intervals across them. (See fig. 33 c)

d) Two similar chromatic tunings may be compared in figs. 33 d and 33 e. Figure 33 d shows a "modern tuning" used by Mr. W. Cooper of Hingham, Norfolk; fig. 33 e shows the tuning system used by Peter Harvard of Ipswitch. (Information source: "The Dulcimer" by John Leach; in The Consort, no. 25, 1968-69 Annual Journal of the Dolmetsch Foundation; pp. 394-395)

Figure 33 a:

E'''	E''	
		E'
D'''	D''	
		D'
C'''	C''	
		C'
B''	B'	
		B
A''	A'	
		A
G''	G'	
		G
F''	F'	
		F
E''	E'	
		E
D''	D'	
		D
C''	C'	
		C

Figure 33 b:

C#	D
B	C
A#	B
G#	A
F#	G
F	F#
D#	E
C#	D
B	C
A	B_b
G	G#
E	F
D	E_b
C	C#
A#	B
G#	A

Figure 33 c:

E	C#	
		A#
D#	A#	
		G#
D	G#	
		F
C	F	
		F#
B	D#	
		E
A	C#	
		D
G	C	
		C
F#	B	
		B
E	A	
		A
D	G	
		G

7) OTHER SYSTEMS, con'd.:

Figure 33 d:

G#	C#	B_b
F	B_b	G#
E_b	G#	F
C	F	F#
B	E_b	E
A	C#	D
G	C	C
F#	B	B
E	A	A
D	G	G

Figure 33 e:

G	D#	C
F#	C#	B_b
E	B_b	G#
D	G#	F
C	F	F#
B	D#	E
A	C#	D
G	C	C
F#	B	B
E	A	A
D	G	G

Eight further examples of tunings are available in the Consort article. They serve to illustrate the wide variety of tunings possible which are actually in use. Give me ten years or so, and perhaps I can make some further recommendations !

8) FIRST AID FOR THE DULCIMER:

Occasionally a newly finished dulcimer will exhibit annoying buzzes, or will not tune accurately, or will sound weak and/or mushy in some locations. Before you resign yourself to building a new instrument, there are a few things you might try:

a) As a rule, buzzes are caused by two closely adjacent parts of the instrument which vibrate against each other when a string is sounded. The bottom of the treble bridge can be warped enough to bob up-and-down against the soundboard, or a string can be loosely in contact with one of the side bridges. The shape of the point of contact between a string and the treble bridge is somewhat critical, and can also result in a buzz (particularly if the bridge is metal-capped).

8) FIRST AID, con'd.:

These buzzes are hard to locate by ear, but if the string causing the buzz is struck while you press on different locations which might be involved, you will usually be able to locate the faulty area (the buzz will stop when you press there). If it's the treble bridge, you might try working a small amount of glue into the trouble spot; if it's a string, it may be cured by simply stapling the string down against the side bridge it buzzes against.

The points of contact on the treble bridge should be smoothly convex; a buzzing string can sometimes be helped by slightly reshaping the contact point (or groove) on the treble bridge.

I once traced a buzz to a pair of pliers resting on the same table as my dulcimer !

b) If the instrument doesn't tune accurately throughout, the treble bridge may have to be moved slightly sideways. It is tapped small amounts (e.g. 1/16") away from the treble side which tends to be sharp.

During tuning, the treble strings may tend to stick slightly on the treble bridge. You may have to tune the portion away from the tuning pins first, then readjust slightly for the near portion of the same string.

c) The first few strings to be placed on a dulcimer tend to sound unimpressively weak. This condition disappears usually after more strings have been added and the treble bridge is pressed more firmly against the soundboard.

Weak sound can be improved by tuning existing wires to higher pitches, or by using heavier wires (one can even mix wire sizes in a given course, with good results).

A mushy, metallic "thunk" is usually associated with strings which are too loose (or: too short for the intended pitch). Raise their pitches a tone or so, and they should sound fine.

*

* * *

*

9) BIBLIOGRAPHY ON THE HAMMERED DULCIMER:

The Library of Congress has furnished practically all the material I've read on the hammered dulcimer. They will send a current bibliography of available material on request.

Write to: Archive of Folksong
c/o Library of Congress
Washington, D.C.
20540

Ask for: Bibliography on Hammered and Plucked Dulcimers (compiled by Joe Hickerson).

10) PARTIAL DISCOGRAPHY ON THE HAMMERED DULCIMER:

a) "PLAY AND DANCE SONGS AND TUNES": Library of Congress album AFS-L9. Includes several selections by Thomas Mann, dulcimer player (recorded in Ortonville, Iowa in 1937). $4.95 ppd. from MUSIC DIVISION, LIBRARY OF CONGRESS.

b) "THE HAMMERED DULCIMER PLAYED BY CHET PARKER": Folkways album FA-2381.

c) "POLKAS AND WALTZES by Gil Baca": Kermit Records; 3771 Childress; Houston, Texas 77005 (stereo)

d) "RAY BACA'S POLKA BAND": Baca Records, above address.

e) "SARA GREY with Ed Trickett": Includes 2 fine dulcimer and banjo duets in stereo. Folk-Legacy album FSI-38.

f) "TRADITIONAL MUSIC AT NEWPORT 1964 Part 1": Includes 2 selections on hammered dulcimer (one is a duet between Chet Parker and Elgia Hickok). Vanguard VRS-9182.

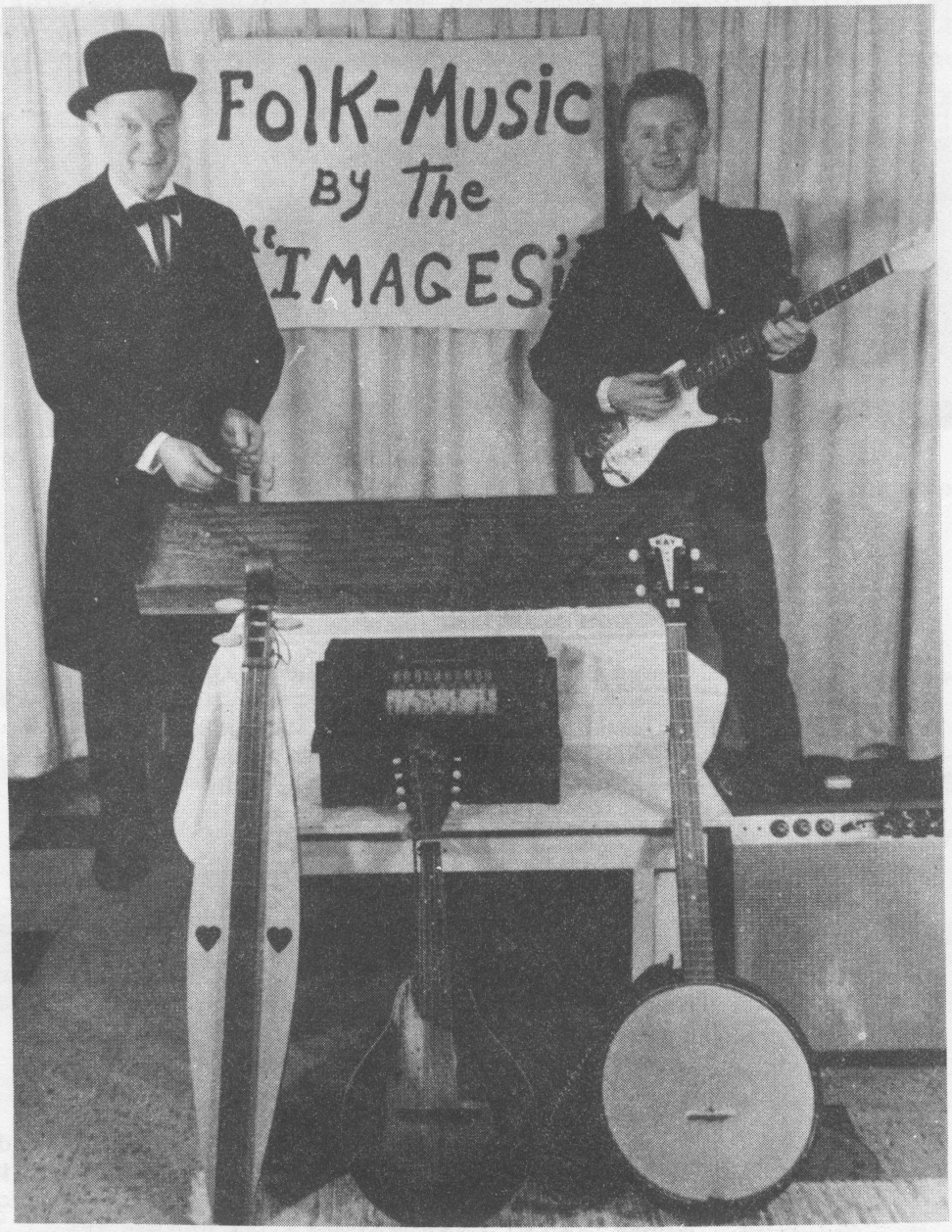
g) "ALL AROUND THE MOUNTAIN": Bluegrass music, including 2 selections on the hammered dulcimer. Available from The Sweet Corn; 1335 Blakeslee; Kalamazoo, Michigan 49001 $5.00 ppd..

h) "5 DAYS SINGING": A new two-album release in the Golden Ring tradition by Folk-Legacy. Includes several selections with hammered dulcimer. (stereo)

i) "MUSIC OF IRAN Santur Recital": Persian hammered dulcimer music, by Nasser Rastegar-Nejad. Lyrichord LL-135.

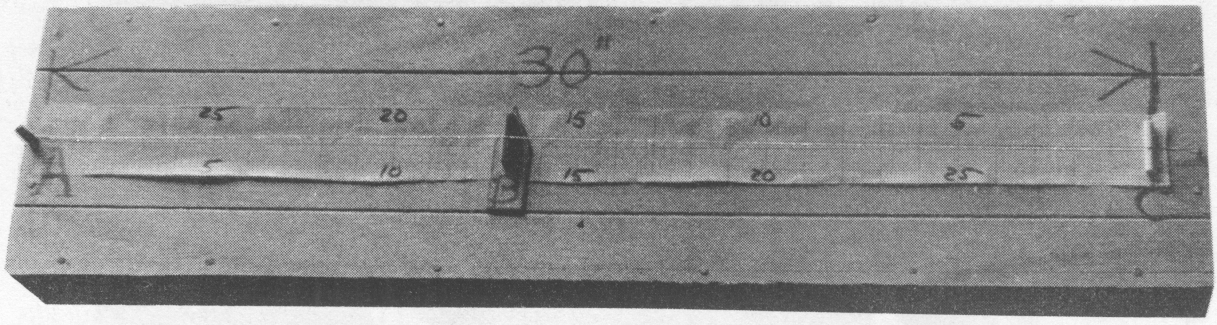
j) "CYMBALOM IN HI-FI": Hungarian chromatic hammered dulcimer (cymbalom) featuring Janos Hosszu and ensemble including a second cymbalom, a piano, viola, cello, and double bass. Period Records RL-1912.

NOTES ON THE RECORDING ACCOMPANYING THIS MANUAL



SIDE I: Band 1: My interest in the hammered dulcimer began when I both saw and heard it being played. I feel that it's appropriate to begin this record with at least a sample of the sound I heard. This is a short recording of Russell Fluharty, made recently at his home in Mannington, West Virginia. The photo above shows Russell with his grandson, Jerry Taylor.

SIDE I: Band 2: On page 2, I describe a "thought experiment" as an introduction to the feature of getting two tones from one string. Band two gives a further demonstration of this, using a crude one-string box and sliding bridge, as shown below.



Band 3: Sample of some typical sounds you'll hear when you go to tune a hammered dulcimer (dulcimer #16 used in this demonstration).

Band 4: Hammered dulcimer strings ring for quite a while after they've been struck. When a simple, single-line melody is played, it generates its own sort-of echo background. This is demonstrated in the beginnings of two musical selections:

Abide With Me

Saint Martin's

For musical interest, the two selections develop into more complex forms, involving guitar accompaniment and dulcimer harmony accompaniment to the voice. Music for St. Martin's is on the next page.

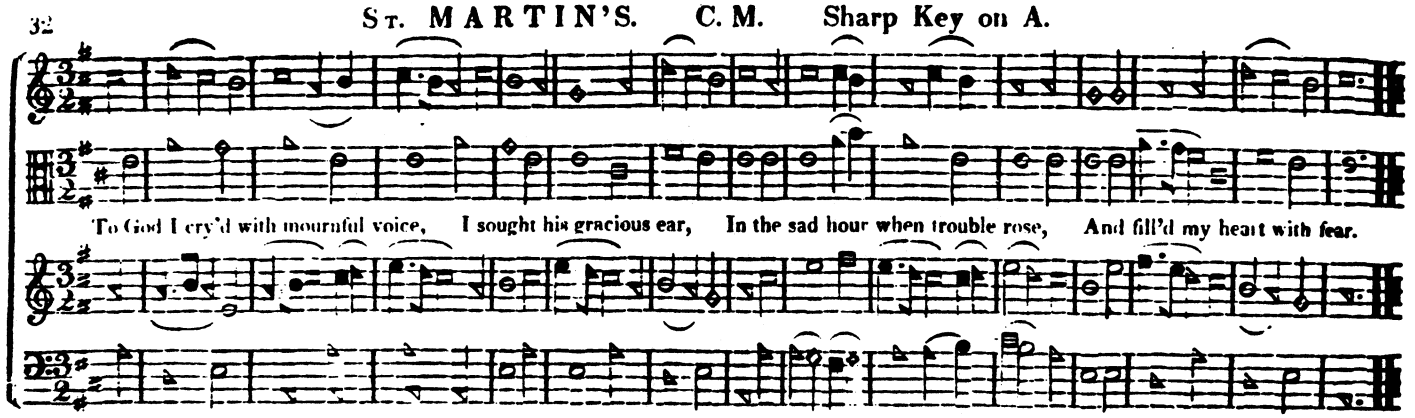
Abide With Me is played on dulcimer #18, made from cheap plywood, extra pine shelf wood, and two-by-threes from an indoor bathroom we added to our upstairs. Saint Martin's is played on dulcimer #21 (the "Fancy Chet Parker Two Model").

Band 5: This is an illustration of the drone method, described in b, pg. 44.

Sweet Betsy from Pike (simple drone)

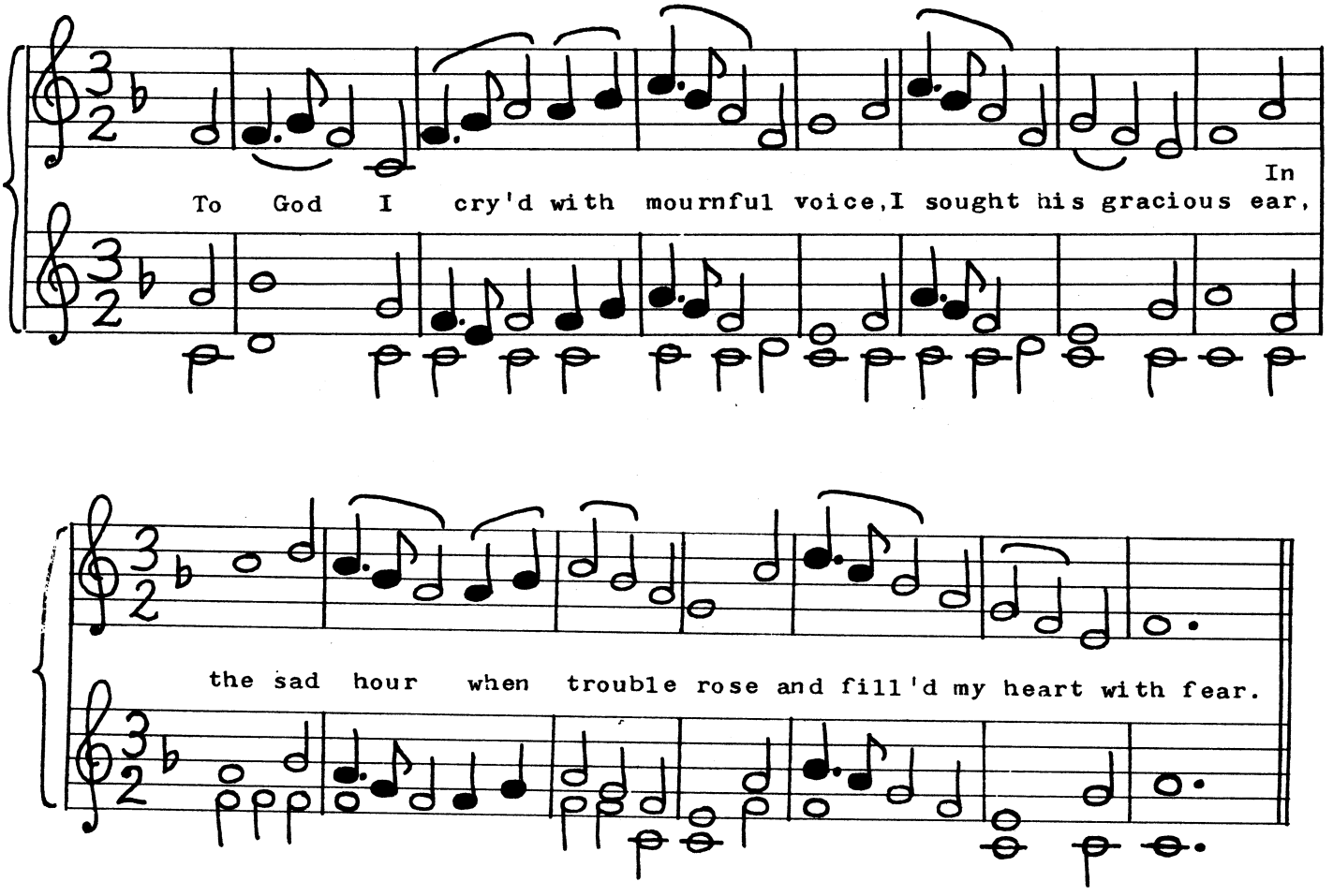
What a Friend We Have in Jesus (fancier)

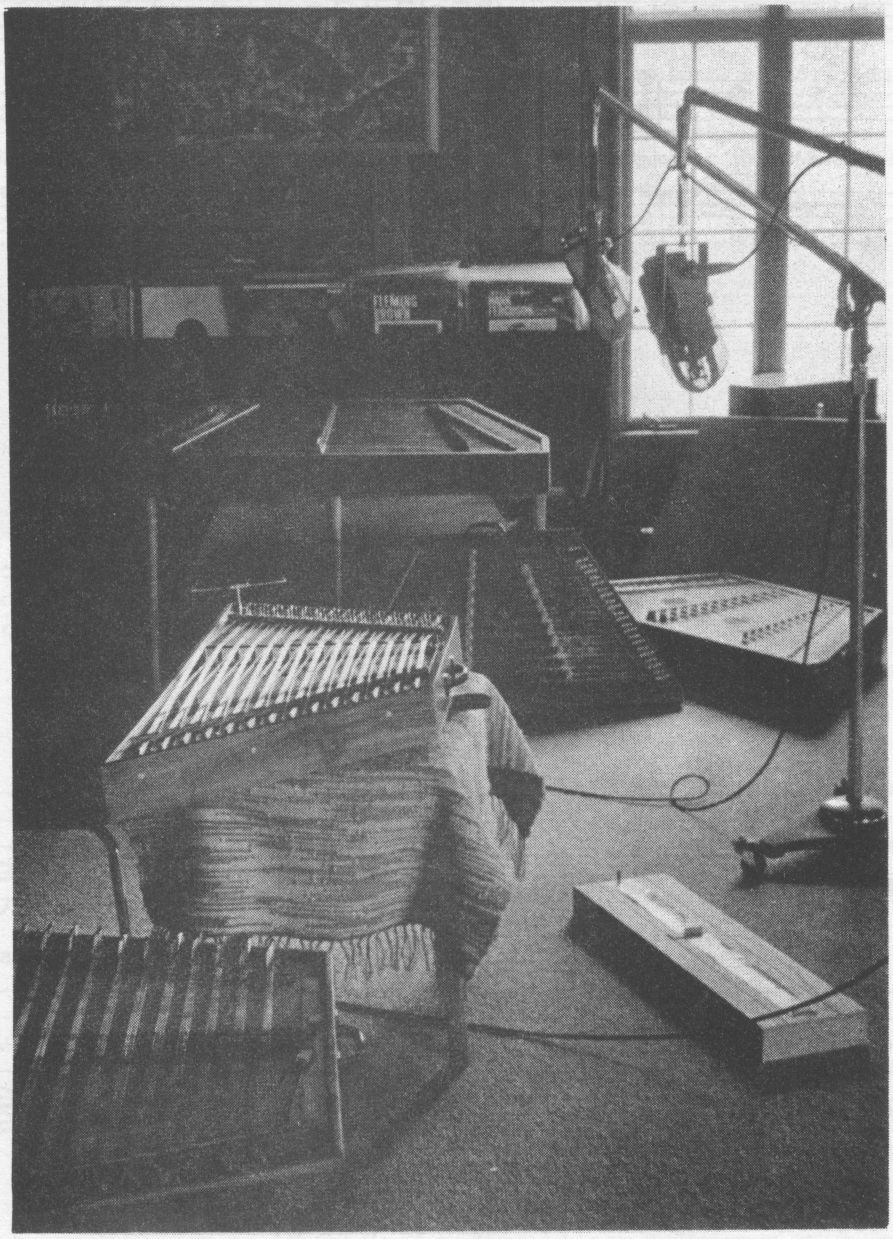
Both selections are played on dulcimer #21.



Above: St. Martin's, from page 32 of "The Easy Instructor" (Packard & Benthuysen Printers - c 1824).

Below: St. Martin's, as it appears on the accompanying record. Upper line is melody; lower line is dulcimer accompaniment. Music has been transposed down to the key of F major.





SIDE II: Band 1: The tremolo method and the short tremolo are illustrated here (see d, pg. 45). The first selection uses dulcimer #18; the second uses dulcimer #21.

Near, Oh My God, to Thee (tremolo)

"Sort-of Silver Bells" (short tremolo)

I made up the second tune after listening to Chet Parker play Silver Bells. It is played here using both soft and hard hammers.

SIDE II: Band 2: Here are a couple examples of arpeggios used in hammered dulcimer playing. Aunt Rhody is played on dulcimer #21, and approximates the notes represented on page 44. Merry-Go-Round is a more complex piece, played here as a duet on dulcimer #16.

Go Tell Aunt Rhody (arpeggio)

Merry-Go-Round (arpeggio & duet)

Band 3: If the hammered dulcimer is plucked with the fingers, it produces a remarkable, shimmery sound. The first example is a duet, played on dulcimer #21. The second example is played on my largest dulcimer, #13.

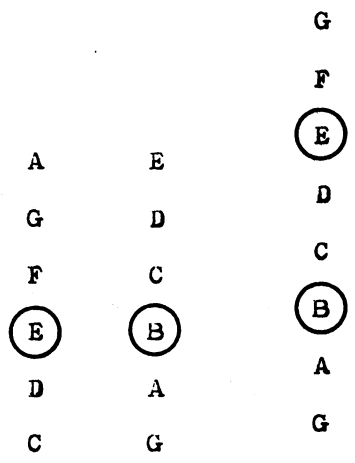
Psaltery Piece (duet)

Aura Lee (solo)

Music for Psaltery Piece is represented on the following page.

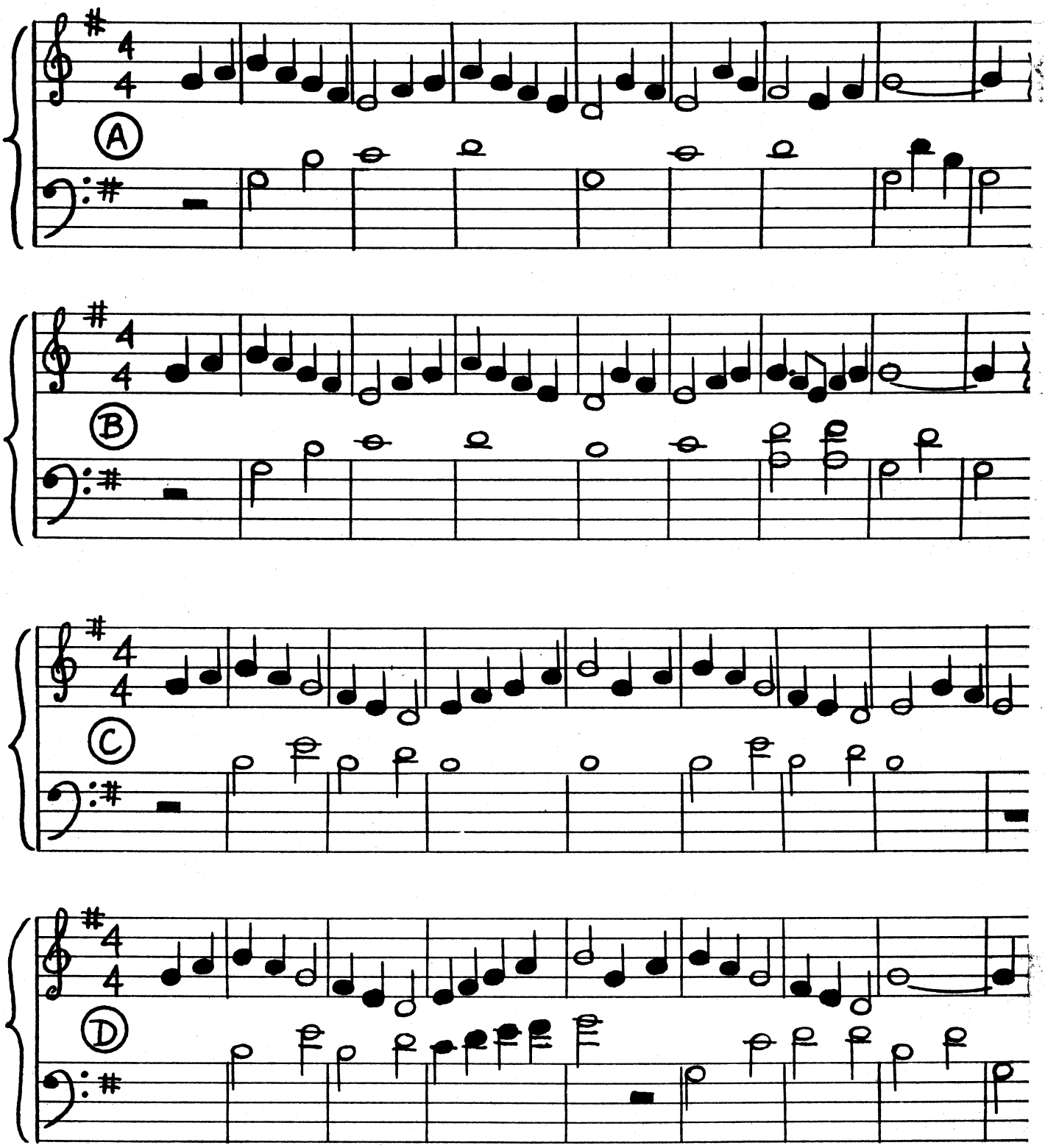
Band 4: The Irish Washerwoman was the first melody that Ann and I learned on the hammered dulcimer. Details of the strike pattern are shown on page 6. Ann plays it here, slowly at first, then more rapidly, using dulcimer #16.

Band 5: This is a "two-movement" exercise, beginning with Buckdancer's Choice as a solo on dulcimer #16. The dulcimer was then retuned in a minor scale and the same strike pattern applied, with Ann playing the bass strings as a duet. We call the minor form the Clogger's Inconsequential Selection. Original tuning is shown below. The circled notes were lowered one half-tone to get the (Dorian) minor tuning. Dulcimer only partially represented below.



"PSALTERY PIECE"

(Playing sequence: A B C D, A B C D, slow B)

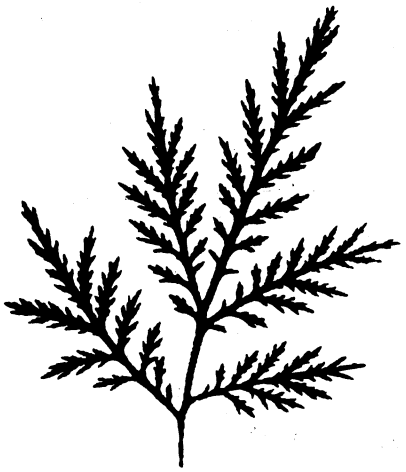


SIDE II: Band 6: This is Golden Slippers, played in the arpeggio style in both a high and low register on dulcimer #21.

Band 7: A couple years ago, Ann decided to check and see if it is really easy to build a hammered dulcimer, rather than that being some kind of spoof. I left the house one morning and returned a couple hours later to find her with a new, two-thirds finished dulcimer ! In this record band, we play duets on The Old Spinning Wheel and Redwing, using dulcimer #18 and Ann's dulcimer. Incidentally, hers is the one showing in the lower left corner of the photo on page 54.

Band 8: In Ruth Crawford Seeger's book **AMERICAN FOLK SONGS FOR CHILDREN**, there's a delightful song from Texas called Have a Little Dog. I've always liked the melody, particularly the first line. Several years ago I made up a tune which begins like Have a Little Dog. This tune we call Ruffles, and we play it here duet style on dulcimer #16.

Band 9: This is Dulcimer Jig, played by Russell Fluharty, who learned it from his mother.



H.W.M. December, 1971