PART I - PREFACE

Please note – I am happy to discuss details with anyone interested. Reach me at dickbozung@SevenArrowsMusic.net

1. INTRODUCTION

This has been a work in progress for over 40 years (1979 - 2022). There have been some interruptions along the way.(like hurricane Hugo's 16 ft storm surge thru the old farmhouse I care-took on the South Carolina coastal marsh, north of Charleston - everything washed away). Then there were the interesting shop situations, in my Dad's workshop in Santa Monica, Ca., on various front porches, in an old small cow milking barn, in bedrooms, etc. It has been an amazing ride and I am grateful to all the others who have assisted along the way. It is time for the ***GIVING*** and ***SHARING*** - the **Nightingales** are finally ready to fledge, imperfect, as with all things natural. *I certainly have no intention of replacing the autoharp – just complimenting it!*

I began with an autoharp back in the early 70's on a commune near Ojai, Ca. I have always loved its inherent simplicity and beautiful sound. In the 80's I evolved into a music therapist of sorts, working with some blind and hearing impaired persons. Proceeding and during this process I became very immersed in hugging an autoharp close to my chest and in contact with my ear and playing it blind. So over time I experimented with designing autoharp like instruments with minor variations (more comfortable to hold against my ear, fewer and easier to tune strings, etc.) that met the following primary criteria.

1. A longer instrument that can be ***comfortably*** held against one's ***chest*** and ***ear*** while ***sitting fully upright*** or ***standing,*** supported in the lap or by a strap (12 versions on three body sizes varying in overall length from 24 to 35 in.). We have all probably experienced the magic of feeling an instrument's vibration against our chest and the sensory sensation when our ear is in direct contact with the instrument itself (the derivation of the new term ***'Ear'idescent***).

*2. An instrument with **fewer strings to tune and guitar tuners** for easy tuning and utilizing readily available guitar strings (12 to 20 strings ranging from a 59 wound to a 10 plain (steel strings, the small version with optional nylon strings as well); almost 3 octave range from f2 to g5 across all the versions. Nightingales can also be fitted with traditional autoharp tuning pins if preferred.*

3. A **Guitaro** like chording arrangement which I find well suited to ***comfortably*** accessing the chord tabs (at the ends of the bars and in just 2 rows) so that one can easily memorize and access the correct chord bar ***blind*** (chord mechanism higher on the instrument – strumming below). I personally have a strong preference for playing with my eyes closed, especially when improvising. Most of the major and dominant 7^{th} chords are in one row (in a re-curing I-IV-V sequence) and the minors, suspended and major 7^{th} chords are in the other row (all major chords are next to their relative minors).

4. An instrument playable in **multiple keys at a time** (with a minimum of all major and relative minor chords in the playable keys) and easily re-tunable to play in multiple **diatonic keys** without any re-stringing. In a diatonic tuning, with the addition of partial 7^{th} and "open 5th" power chords, the instruments range is extended to play in several other ***"pseudo-keys".***

5. An instrument with an **easily moveable bridge** so that if not at A-440, with just a slight adjustment of the moveable bridge, the tuning is instantly brought to A-440 without having to re-tune all of the strings. The moveable bridge also facilitates play in all keys (much like using a capo on a fretted instrument).

6. An instrument with a **powerful highly resonant guitar-like sound** facilitated by a totally different structural design – deep body (3 in), thin soundboard and backboard (3/32 to 1/8 in), long scale length and a large body volume (like a guitar) - and weighing less (4-6 lbs) than the traditional autoharp. Wide (3 in) thin (1/8 to ¼ in) sides provide unmatched structural support. All of these changes result in an instrument similar in sound volume to the autoharp in spite of having far fewer and less stressed strings.

7. A **simple 15 bar chord mechanism**, easily removable from the instrument as a whole (facilitating instant switching from a multi-key chord mechanism to a diatonic chord mechanism), and also with easy to remove individual chord bars (and requiring no springs - open celled weather-stripping instead). Or utilizing a conventional 15 bar autoharp chord mechanism with modified bars. Understand that each bar plays from 6 to 8 different chords depending on the position of the moveable bridge (the interchangeable chord bar guides will be explained later). This system also facilitates automatic chord transposition, ie, using the chord guide matching the written music while playing in a different key depending on the bridge position (much simpler than re-writing the chords on the music in a different key).

8. An instrument with a slightly **wider string spacing** facilitating better string attack, a shorter string stroke (because of fewer strings) and with less string tension for more comfortable play with ones' bare fingers.

9. And lastly, because one of my prime purposes in life has been to use music, especially with children (many years working in various State Artist-in-Education programs), to foster a deep love and respect for the earth, it made sense to create an instrument (with vibrant colors) to represent a natural beautiful creative music maker like the ***Nightingale.*** If you let her, she will sing her own songs, at times, acting as a conduit, interpreting the observations and feelings of some of your most beloved wild beings. Each instrument comes with a hanger so that it can easily be displayed, when not in use, on any wall as a beautiful example of ***"Musical Art.".***

Please search **Nightingale Autoharp** on **YouTube** to see and listen to Nightingales being played and on **eBay** to see available prototype versions available for sale. Also go to **Luth.org** archives and search same name for more info.

The NIGHTINGAL FAMILY of 'EAR'IDESCENT AUTOHARPS - INNOVATIONS/UNIQUENESS

(see US Patent # 4,481,855)

General Musical Instruments

1. Designed so that while played standing or sitting the sound body is comfortably in contact with the players chest and ear ('ear'idescent) resulting in a most amazing ***sensory auditory*** and ***vibratory*** experience (and easily played with one's eyes closed).

2. Additionally, a Music Therapy instrument designed to empower the deaf, hearing impaired, blind , etc., etc., to easily play.

3. An easy to make musical instrument using readily available dimensional woods/accessories and requiring few specialized tools.

General Harps

A unique 12 to 20 string 'ear'idescent diatonic harp with moveable bridge so that it can be played in all keys (no chord mechanism).

General Autoharps

1. Fewer guitar strings with guitar tuners (phosphor bronze/steel and nylon option on the smallest version).

2. A deep large body with thin sound and back boards and sides with a strong independent non-interfering interior structure

3. On the 16 string instrument in 1 key mode, there are at least 7 notes in all chords - 1 more than on a 6 string guitar. On the 14 string instrument there are at least 6 notes in all chords (7 in one). And with many strings on all versions, the notes in melodies sustain for a long time like a harp (versus a guitar where changing notes fretted on the same string mutes the previous note).

4. A moveable bridge so that it can be played in all keys and instantly brought to A-440 or another pitch without having to individually re-tune all the strings. This also enables the instrument to be played in a variety of different pitch ranges.

5. An optional instantly removable chord mechanism to give the look and feel of playing a diatonic harp.

6. The addition of power and partial 7^{th} chords on a diatonically tuned instrument facilitating play in several ***"pseudo-keys."***

7. A chord mechanism situated so as to avoid the necessity of strumming cross-handed and easily played with the eyes closed.

8. With my quick release chord mechanism, instantly removable/replaceable chord bars and instantly adjustable longitudinally on the instrument to suit different players preferences and minimizing nodal feedback.

9. The combination of interchangeable chord guides for reading music in different keys and a moveable bridge for playing in many keys means the instrument is capable of ***transposing music automatically***, i.e., use the chord guide fitting the key the music is written in and move the bridge to the key you want to actually play the music in.

10. Wider string spacing increasing string attack and simplifying the felting process.

11. Choice of various interchangeable key combination set-ups to suit the preferences of different players.

Please see the GAL drawings as general guides for the Zither and Guitar Tuners Nightingales

There has been a mid-June 2022 update reflected *<u>in this document,</u>* incorporating some changes in these designs, and particularly, *a new last minute return of the smaller Model X (baby).*

The following documentation best describes the latest actual design details.

Simplifying – getting the Nightingales down to 3 basic body sizes (12 variations, 12 – 20 strings)

I. <u>MODEL X and MODEL A (Small and Medium Body) Nightingales (8 versions)</u>

(***All have the same scale lengths, and therefore common tunings, string sizing and chords)***

<u>Properties common to all Model X and Model A Nightingales</u>

4 degrees body angles. Soundboard and back thickness 3/32-1/8 in.; X tail length = 13 ¼; A = 14 ½ in.; string ht. = ½ in.; riser = 1/8 – 3/16 in.; 3 or 3 ½ in. sound hole; 15 chord bar mechanism with guides (7/16 wide) storage; leather handle. (Note: length = body length, not including headpiece or leg rest.)

<u>F/C Set-up Keys at various bridge positions</u>

bridge positions	7	6	| **5**	**4**	**3**	**2**	**1**	**0**	-1 (tuned down)
approximate scales	13-3/8	14-1/8	| 15	15-7/8	16-13/16	17-13/16	18-7/8	**<u>20</u>**	21 ½
playable primary keys	GorC	F#orB	| **ForB*b***	**EorA**	**E*b*orA*b***	**DorG**	**C#orF#**	**<u>CorF</u>**	**B*b*orE*b***
pseudo-keys	*(D)(G D)*	*(C#)(F# C#)*	*(C) (F.C)*	*(B) (E.B)*	*(Bb) (Eb.Bb)*	*(A)(D.A)*	*(G#)(C#.G#)*	*(G)(C.G)*	*(F#)(B.F#)*

<u>F/C Set-up 15 BAR 1 KEY at a time CHORDS at the 0 bridge position</u> *(1 or 2 pseudo-keys)*

Notation through-out: primary full key(s) = <u>underlined</u>; pseudo-key(s) = in (parens)

chord bar #	**1L**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
									|---------**(G)5**-------|						
<u>F</u> chord guide	Cadd2	Cs4	**B*b***	Edim	**<u>F</u>**	*Dm*	**(C)**	*Am*	*Gm*	Fs4	**Gp7**	Cj7	**Dp7**	Fj7	Fadd2
<u>C</u> chord guide	Cadd2	Cs4	Bdim	*Em*	**F**	*Dm*	**<u>C</u>**	*Am*	**(G)**	Fs#4	**Gp7**	Cj7	**Dp7**	Fj7	Fadd2

(2 bar open 5th power chords - C5=C+Cs4 or Cs4+Cadd2; F5=F+Cs4; G5=G or Gm+Gp7; D5=D or Dm+Dp7)

or

<u>C/G Set-up Keys at various bridge positions</u>

(Same strings, different Key combinations and chords and high Key of C option at the 5th bridge position)

bridge positions	7	6	| **5**	**4**	**3**	**2**	**1**	**0**	-1 (tuned down)
approximate scales	13-3/8	14-1/8	| 15	15-7/8	16-13/16	17-13/16	18-7/8	**<u>20</u>**	21 ½
primary keys	DorG	C#orF#	| **CorF**	**B*b*orE*b***	**B*b*orE*b***	**AorD**	**A*b*orD*b***	**GorC**	**F#orB** or **ForB*b***
pseudo-keys	*(A)(D,A)*	*(G#)(C#,G#)*	*(G)(C,G)*	*(F#)(B.F#)*	*(F) (Bb.F)*	*(E)(A.E)*	*(Eb)(Ab.Eb)*	*(D)(G.D)*	*(C#)(F#.C#)* *(C)(F. C)*

<u>C/G Set-up 15 BAR 1 KEY at a time CHORDS at the 0 bridge position</u> *(1 or 2 pseudo-keys)*

Notation through-out: primary full key(s) = <u>underlined</u>; pseudo-key(s) = in (parens)

chord bar #	**1L**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
									|---------**(D)5**-------|						
<u>C</u> chord guide	Cadd2	Cs4	**F**	Bdim	**<u>C</u>**	*Am*	**(G)**	*Em*	*Dm*	Gs4	**Dp7**	Cj7	**Ap7**	Fj7	*Dm7*
<u>G</u> chord guide	Cadd2	Cs#4	F#dim	*Bm*	**C**	*Am*	**<u>G</u>**	*Em*	**(D)**	Gs4	**Dp7**	Cj7	**Ap7**	*Am6*	**D7**

(2 bar open 5th power chords - C5=C+Cs4 or Cs#4; F5=F+Cs4; G5=G+Gs4; D5=D or Dm+Dp7; A5=Ap7+Fj7 or Am6)

(1) ***XP-12*** *(Alto **P**inned – steel strings only – C/F Set-up only)*

Autoharp tuning pins, partial lower body **24** x 8 x 8 (6 ¼ + 1 ¾ tail) base x 2 ½ - 3 in.; soundboard and back thickness 3/32 -1/8 in.; 4 in gap between longitudinal supports, with far left ¼ wide support added; string spacing @ 3/8 = 4.125 stroke; 1 ¼ in - 1st string inset; leg brace 1 in; 3 in. sound hole;wt = 4 lb. Soundboard bracing optional. Tuning wrench and guides are integrated into the instrument under false tail feathers. ***(15 bar chord mechanism or Single-bar chorder – see pgs. 10 & 11.)***
Re-tune 1 string for the adjunct key at each bridge position.

Alto String Sizing and Tuning at the 0 bridge position

string no.	12	11	10	9	8	7	6	5	4	3	2	1
steel gauges	**47w**	**42**	**36**	**34**	**30**	**26**	**23**	**21**	**17p**	**15**	**14**	**12**
F tuning	***c3***	***d***	***e***	***f***	***g3***	***a***	***bb***	***c4***	***d***	***e***	***f4***	***g4***
C tuning	***c3***	***d***	***e***	***f***	***g3***	***a***	***b***	***c4***	***d***	***e***	***f4***	***g4***

Chords C = c e g c e g; F = c f a c f; G = d g b d g; B*b* = d f b*b* d f

****** (2) *XG-12*** *(**A**lto – steel or nylon strings) *****

Guitar tuners, full lower body; **24** x 9 top (includes 1 in. headpiece overhang) x 8 (6 ¼ + 1 ¾ tail) base x 2 ½ - 3 in.; ½ thumb rest; longitudinal supports gap 4 in.; headpiece 5¼ (3) x 6-5/8 (5) x 7¼ (4) in. @ 14 degrees. String spacing @ 3/8 = 4.125 in. stroke; ½ in. - 1st string inset 3 in. sound hole; wt 4 ½ lbs.; leg brace ½ in.; optional internal pickup. *Re-tune 1 or 2 strings for the adjunct key.*

Alto String Sizing and Tuning at the 0 bridge position

string no.	12	11	10	9	8	7	6	5	4	3	2	1
optional nylon gauges	***41w***	***37***	***33***	***30***	***28***	***25***	***22***	***40p***	***36***	***32***	***30***	***26***
optional G tuning	***c3***	***d***	***e***	***f#***	***g3***	***a***	***b***	***c4***	***d***	***e***	***f#4***	***g4***

(Same steel strings, chords and tunings as the XP-12)

or

******** ***XGS - 12*** *(soprano - nylon strings only – same specs as **XG-12**) *****

Soprano String Sizing and Tuning at the 0 bridge position

string no.	12	11	10	9	8	7	6	5	4	3	2	1	
nylon gauges	**30w**	**28**	**25**	**22**	**40p**	**36**	**32**	**29**	**26**	**23**	**20**	**18**	
F tuning	***f3***	***g***	***a***	***bb***	***c4***	***d***	***e***	***f***	***g***	***a***	***bb***	***c5***	
C tuning	***f3***	***g***	***a***	***b***	***c4***	***d***	***e***	***f***	***g***	***a***	***b***	***c5***	**
G tuning	***f#3***	***g***	***a***	***b***	***c4***	***d***	***e***	***f#***	***g***	***a***	***b***	***c5***	**

Chords @ 0 – **G** = g b d g b; **C** = g c e g c; **F** = f a c f a c; **B*b*** = f b*b* d f b*b;* **D** = f# a d f# a and

Chords @ #5 – **G** = b d g b d; **C** = c e g c e; **F** = c f a c f; **B*b*** = b*b* d f b*b* d f; **E*b*** = b*b* e*b* g b*b* e*b*

(3) ***AP-12*** *(**A**lto – steel strings)*

Autoharp tuning pins, partial lower body **26** x 8¼ x 8 (6 ¼ + 1 ¾ tail) base x 2 ½ - 3 in.; soundboard and back thickness 3/32 -1/8 in.; 4 in gap between longitudinal supports, with far left ¼ wide support added; string spacing 3/8, 5/16 = 4.125 stroke; 1 ¼ in - 1st string inset; leg brace 1 in.; wt = 4 lb. Tuning wrench/guides integrated into the instrument under false tail feathers.
Re-tune 1 or 2 strings for the adjunct key at each bridge position.

(Same steel strings, chords and tunings as the XP-12).

(4) ***AG-12*** *(**A**lto – steel or nylon strings)*

Guitar tuners, full lower body; **26** x 9¼ top (includes 1 in. headpiece extension tapering down to ½ thumb rest) x 8 (6¼ + 1¾ tail base x 2½ - 3 in.; longitudinal supports gap 4 in.; headpiece 5¼ (3) x 6-5/8 (5) x 7¼ (4) in. @ 14 degrees. String spacing @ 3/8 = 4 4.125 in. stroke; ½ in. 1st string inset; 3 ½ in. sound hole; wt 4 ½ lbs.; leg brace ½ in.; optional internal pickup.
Re-tune 1 or 2 strings for the adjunct key.

(Same strings, chords and tunings as the XG-12).

(5) ***AP -14*** *(baritone **P**inned – steel strings)*

Autoharp tuning pins, partial lower body **26** x 8¼ x 8 (6 ¼ + 1 ¾ tail) base x 2 ½ - 3 in.; soundboard and back thickness 3/32 -1/8 in.; 4 in gap between longitudinal supports, with far left ¼ wide support added; string spacing 3/8, 5/16 = 4.125 stroke; 1 ¼ in - 1st string inset; leg brace 1 in.; wt = 4 lb. Tuning wrench and guides are integrated into the instrument under false tail feathers.
Re-tune 1 or 2 strings for the adjunct key at each bridge position.

String Sizing and Tuning at the 0 bridge position

string no.	14	13	12	11	10	9	8	7	**6**	5	4	3	2	1
steel string gauges	**59w**	**47**	**42**	**38**	**36**	**32**	**28**	**24**	**21**	**17p**	**15**	**14**	**12**	**10**
C Tuning Guide	***g2***	***c3***	***d***	***e***	***f***	***g***	***a***	***b***	***c4***	***d***	***e***	***f***	***g4***	***a***
F Tuning Guide	***g2***	***c3***	***d***	***e***	***f***	***g***	***a***	***bb***	***c4***	***d***	***e***	***f***	***g4***	***a***
G Tuning Guide	***g2***	***c3***	***d***	***e***	***f#***	***g***	***a***	***b***	***c4***	***d***	***e***	***f#***	***g4***	***a***
steel	(28 lbs	32 lbs							25lbs	23lbs	22lbs	22lbs	20lbs	18 lbs/58%)

chords C = g c e g c e g; F = c f a c f a; G = g d g b d g; B*b* = d f b*b* d f; D = d f# a d f# a

**** (6) ***AG –14*** *(baritone - **steel** strings)****

Guitar tuners, full lower body; **26** x 9¼ top (includes 1 in. headpiece extension tapering down to ½ thumb rest) x 8 (6¼ + 1¾ tail) base x 2 ½ - 3 in.; longitudinal supports gap 4 in. Headpiece 6 (4) x 6-5/8 (6) x 7 ¼ (4) in., @ 12.5 degrees, w/1 in. overlap. String spacing @ 3/8, 5/16 = 4.125 in. stroke; ½ in - 1st string inset; 4 degrees body angles, leg brace ½ in., wt 4 ¾ lbs.; optional pickup.
Re-tune 1 or 2 strings for the adjunct key at each bridge position.

String Sizing, Tuning and Chords at the 0 bridge position same as the AP-14

**** (7) ***AG–16*** *(full range baritone - **steel** strings) ****

Guitar tuners, full lower body; **26** x 9 ¼ top (same) x 8 (6 ¼ + 1 ¾ tail) base x 2 ½ - 3 in.; longitudinal supports gap 4 in. Headpiece 6¾ (5) x 6-5/8 (6) x 7¼ (5) in. @ 11 degrees. String spacing 5/16 x 3, 9/32 x 12; stroke = 4.3 in.; 3/8 in – 1st string inset; ½ in. thumb rest; leg brace ½ in., wt 5 lbs.; optional internal pickup. *Re-tune 2 strings for the adjunct key at each bridge position.*

String Sizing and Tuning at the 0 bridge position

string no.	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
steel string gauges	**59w**	**54**	**49**	**47**	**42**	**38**	**36**	**32**	**28**	**24**	**21**	**17p**	**15**	**14**	**12**	**10**
C Tuning Guide	***g2***	***a***	***b***	***c3***	***d***	***e***	***f***	***g***	***a***	***b***	***c4***	***d***	***e***	***f***	***g4***	***a***
F Tuning Guide	***g2***	***a***	***bb***	***c3***	***d***	***e***	***f***	***g***	***a***	***bb***	***c4***	***d***	***e***	***f***	***g4***	***a***
G Tuning Guide	***g2***	***a***	***b***	***c3***	***d***	***e***	***f#***	***g***	***a***	***b***	***c4***	***d***	***e***	***f#***	***g4***	***a***

chords C = g c e g c e g; F = a c f a c f a; G = g b d g b d g; B*b* = b*b* d f b*b* d f; D = a d f# a d f# a

(8) ***Also could be made in a pinned version, as AP-16***

II. MODEL B Large Body Nightingales (4 versions – 1, 2 and 3 Keys at a time)

Properties common to all Model B Guitar Tuners Nightingales

4 degrees body angles; steel strings, full lower body **28** x 9 ½ top (same as A) x 8 (6 ¼ + 1 ¾ tail) base x 2 ½ - 3 in.; longitudinal supports gap 4 in.; 3 ½ in. sound hole; soundboard and back thickness 3/32-1/8 in.; string ht. = ½ in.; ½ in. thumb rest; riser = 1/8 – 3/16 in.; tail @ 16 ½ in. from base; leg brace ½ in.; 15 chord bar mechanism w/guide storage; leather handle; internal pickup. (length = body length, not including headpiece or leg rest)

Keys Set-up at various bridge positions

approximate scales	15	15-7/8	16-13/16	17-13/16	18-7/8	20	21-3/16	**22 ½**	24
bridge positions	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**	-1 (tuned down)
primary keys	**G/C**	**F#/B**	**F/B*b***	**E/A**	**E*b*/A*b***	**D/G**	**C#/F#**	**C/F**	**B/E or B*b*/E*b***
pseudo-keys	*(D)(G D)*	*(C#)(F# C#)*	*(C) (F. C)*	*(B) (E.B)*	*(Bb)(Eb.Bb)*	*(A)(D.A)*	*(G#)(C#.G#)*	*(G)(C.G)*	*(F#)(B.F#) (F)(Bb.F)*

(9) ***BG – 14*** *(lower range baritone* – **1** key at a time*)*

Guitar tuners; 1 key at a time, string spacing @ 3/8 x 2, 5/16 = 4.2 in. stroke. Headpiece 6 (4) x 6-5/8 (6) x 7 ¼ (4) in., @ 12.5 degrees; wt 5 lbs.; ½ in - 1st string inset. Difference vs **AG–14**, larger size, scale length, bigger volume, lower tuning range.

String Sizing and Tuning at the 0 bridge position

[Re-tune 1 string (no. 6) for the adjunct key at each bridge position]

string no.	14	13	12	11	10	9	8	7	**6**	5	4	3	2	1
steel string gauges	**59w**	**54w**	**42**	**38**	**34**	**32**	**28**	**24**	**21**	**17p**	**15**	**13**	**12**	**10**
C Tuning Guide	***f2***	***g***	***c3***	***d***	***e***	***f***	***g***	***a***	***b***	***c4***	***d***	***e***	***f***	***g4***
F Tuning Guide	***f2*** (28 lbs	***g*** 30 lbs	***c3*** 33lbs	***d*** 33	***e***	***f***	***g***	***a***	***bb***	***c4***	***d***	***e***	***f***	***g4*** 18 lbs/58%)

chords C = g c e g c e g; F = f c f a c f; G = g d g b d g; B*b* = f d f b*b* d f

15 BAR 1 KEY at a time CHORDS at the 0 bridge position *(1 or 2 pseudo-keys)*

(Same as the Model A's C/F Set-up)

****** (10)** ***BG - 16*** *(full range baritone* **- 1** or **2 Keys** at a time modes) ****

Guitar tuners; **1 or 2 Keys at a time modes**, String spacing 5/16 x 3, 9/32 x 12; stroke = 4.3 in.; 3/8 in – 1st string inset; Headpiece 6 ¾ (5) x 6-5/8 (6) x 7 ¼ (5) in. @ 11 degrees; wt 5 ½ lbs.

String Sizing for both modes

string no.	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
steel string gauges	**59w**	**54**	**49**	**44**	**42**	**38**	**34**	**32**	**28**	**24**	**21**	**17p**	**15**	**13**	**12**	**10**

Tuning at the 0 bridge position in the 2 Keys at a time mode

[Re-tune 2 strings for free diatonic melody play at each bridge position]

string no.	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
C & F Tuning Guide	***g2*** (33 lbs	***a***	***bb***	***b***	***c3***	***d***	***e***	***f***	***g***	***a***	***bb***	***b***	***c4***	***d***	***e***	***f*** 16 lbs/44%)

chords = C = g c e g c e ; F = a c f a c f; G = g b d g b d g; B*b* = b*b* d f b*b* d

2 KEYS at a time CHORDS at the 0 bridge position *(1 pseudo-key)*

chord bar #	**1L**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
F & C chord guide	Cadd	Cs4	**B*b***	*Gm*	**F**	*Dm*	**C**	*Am*	**(G)**	*Em*	Fs4	Cj7	**Dp7**	Fj7	Fadd2

(2 bar open 5th power chords - C5=C+Cs4; F5=F+Cs4; G5=Gm+G)

Note: Option to consider would be Key of C mute bar for quick diatonic melody picking instead of re-tuning 2 strings.

Tuning at the 0 bridge position in the 1 Key at a time mode

[Re-tune 2 strings (nos. 6 and 13) for the adjunct key at each bridge position]

string no.	16	15	14	**13**	12	11	10	9	8	7	**6**	5	4	3	2	1
C Tuning Guide	***f2***	***g***	***a***	***b***	***c3***	***d***	***e***	***f***	***g***	***a***	***b***	***c4***	***d***	***e***	***f***	***g4***
F Tuning Guide	***f2*** (28 lbs	***g*** 30 lbs	***a*** 31 lbs	***bb*** 32 lbs	***c3*** 33	***d***	***e***	***f***	***g***	***a***	***bb***	***c4***	***d***	***e***	***f*** 18 lbs/58%)	***g4***

chords = C= g c e g c e g; F= f a c f a c f; G= g b d g b d g; B*b*= f b*b* d f b*b* d

1 KEY at a time CHORDS at the 0 bridge position *(1 or 2 pseudo-keys)*

Same as the Model A's C/F Set-up

(11) ***Also could be made in a pinned version - BP-16***

****** (12)** ***BP - 20*** *(fullest range baritone* - **3 Keys** at a time) ****

Autoharp tuning pins; full lower body **28** x 8 ½ (includes 1 in. tuner support tapering down to ½ in. thumb rest/chord bar end support) x 8 (6 ¼ + 1 ¾ tail) base x 2 ½ - 3 in.; soundboard and back thickness 3/32-1/8 in.; 4 in gap between longitudinal supports and left side another ¼ support; ¼ in. string spacing; stroke = 4 ¾ in.; 3/8 in - 1st string inset; string ht.= ½ in.; riser = 1/8 to 3/16 in.; in.; leg brace 1 in.; 15 chord bars; 3 ½ in. sound hole; wt 5 ½ lbs.; tail @ 16 ½ in.; tuning wrench stored at the top. Internal pick-up and optional fine tuners.

Keys Set-up @ various bridge positions

approximate scales	15	15-7/8	16-13/16	17-13/16	18-7/8	20	21-3/16	**22 ½**	24
bridge positions	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**	-1 (tuned down)
playable keys	**G&C&F**	**F#&B&E**	**F&B*b*&E*b***	**E&A&D**	**E*b*&A*b*&D*b***	**D&G&C**	**C#&F#&B**	**C&F&B*b***	**B&E&A**

String sizes and Tuning at the 0 bridge position (Re-tune 4 strings for instant diatonic play)

string no.	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
steel strings	**59w**	**54**	**49**	**47**	**44**	**42**	**38**	**36**	**34**	**32**	**28**	**25**	**23**	**21**	**17p**	**15**	**14**	**13**	**12**	**10**
3 KEY TUNING	***f2***	***g***	***a***	***bb***	***b***	***c3***	***d***	***eb***	***e***	***f***	***g3***	***a***	***bb***	***b***	***c4***	***d***	***eb***	***e***	***f***	***g***

3 Keys at a time Chords at the 0 bridge position

chord bar #	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
B*b*&F&C chord guide	Fs4	Bbs4	**E*b***	*Cm*	**B*b***	*Gm*	**F**	*Dm*	**C**	*Am*	**G**	*Em*	Fj7	B*b*j7	E*b*j7
C&G&D chord guide	Gs4	Cs4	**F**	*Dm*	**C**	*Am*	**G**	*Em*	**D**	*Bm*	**A**	*F#m*	Gj7	Cj7	Fj7

(2 bar open 5th power chords - C5=C+Cs4; F5=F+Cs4; G5=G+Gs4)

Note: Option to consider would be adding mute bar(s) for quick diatonic melody picking.

SUMMARIES - TUNING COMPARISONS across ALL Models and Versions

tunings	*e2*	*f*	*g*	*a*	*b*	*c3*	*d*	*e*	*f*	*g*	*a*	*b*	*c4*	*d*	*e4*	*f*	*g*	*a*	*b*	*c5*	*d*	*e*	*f*	*g*	*a*	*b*	*c6*
INSTRUMENT/SCALE																											
guitar/25 ½	x			x			x			x		x			x												
baritone uk/19							x			x		x			x												
soprano uk/15													x		x		x	x									
mandolin/14										x				x				x				x					

Model X Nightingales ***e2 f g a b c3 d e f3 g a bb b c4 d e f4 g a bb b c5 d e f g a***
(24 in body, 20 in scale)

XP-12 strings pinned alto steel 20 in. scale (CorF or GorC Set-up @ 0)

						x	x	x	x	x	x		x	x	x	x	x	x									

XG-12 strings guitar tuners alto steel or nylon/20 in. scale (either Set-up @ 0)

XG-12 steel						x	x	x	x	x	x		x	x	x	x	x	x									
XGS-12 soprano nylon version/20 in. scale								x	x	x		x	x	x	x	x	x	x	x	x							
high C (C/F @ #7 & G/C @ #5)											x		x	x	x	x	x	x	x		x	x	x	x			

Model A Nightingales ***e2 f g a b c3 d e f3 g a b c4 d e f4 g a b c5 d e f g a b c6***
(26 in body, 20 in scale)

AP-12 strings pinned alto steel 20 in. scale (CorF or GorC Set-up @ 0)

						x	x	x	x	x	x	x	x	x	x	x	x										

AG-12 strings guitar tuners alto steel or nylon (either Set-up @ 0)

						x	x	x	x	x	x	x	x	x	x	x	x										

	e2	***f***	***g***	***a***	***b***	***c3***	***d***	***e***	***f***	***g***	***a***	***b***	***c4***	***d***	***e***	***f***	***g***	***a***	***b***	***c5***	***d***	***e***	***f***	***g***	***a***	***b***	***c6***
AP/AG-14 strings (either Set-up)	x					x	x	x	x	x	x	x	x	x	x	x	x	x									
AP/AG-16 strings - steel strings	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x									

Model B Nightingales ***e2 f g a b c3 d e f g a b c4 d e f g a b c5 d e f g a b c6***
(28 in body; 22 ½ in. scale)

BG-14 strings (C or F Set-up @ 0)

	x	x				x	x	x	x	x	x	x	x	x	x	x	x										
high C or G @ #7 = 14-15/16 in						x	x			x	x	x	x	x	x	x	x	x	x	x							

	e2	***f***	***g***	***a***	***b***	***c3***	***d***	***e***	***f***	***g***	***a***	***b***	***c4***	***d***	***e***	***f***	***g***	***a***	***b***	***c5***	***d***	***e***	***f***	***g***	***a***	***b***	***c6***
BG/BP-16 strings																											
2 keys (C & F Set-up @ 0)		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x										
1 key (C or F Set-up @ 0)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x										
BP-20 strings																											
3 keys (C&F&B*b* Set-up @ 0)	x	x	x	x	x	x	x	xx	x	x	x	xx	x	x	xx	x	x										

STRING GAUGE COMPARISONS across both Scale Lengths (tuning at the 0 bridge position)

Tuning	*f2*	*g*	*a*	*bb*	*b*	*c*	*d3*	*eb*	*e*	*f*	*f#*	*g3*	*a*	*bb*	*b*	*c*	*d4*	*eb*	*e*	*f*	*f#*	*g4*	*a*	*b*	*c5*
20 inches steel		**59w**		**54**		**49**		**47**	**42**			**36**	**34**			**30**		**26**		**23**		**21**	**17p**		**15**		**14**		**12**			
22 ½ inches steel	**59w**		**54**		**49**		**47**	**45**		**42**	**38**		**36**	**34**	**32**	**30**	**28**		**24**	**22**	**21**	**17p**	**15**		**14**		**13**	**12**	**11**	**10**		
20 inches nylon		**54w**		**49**		**44**		**41**	**37**			**33**	***31w***			***28***		***25***		***22***		***40p***	***36***			***32***	***30***		***26***	***23***	***20***	***18***

CHORD COMPARISONS

C/G Set-up 15 BAR 1 KEY at a time CHORDS at the 0 bridge position *(1 or 2 pseudo-keys)*

***Notation through-out: primary full key(s)* = underlined; pseudo-key*(s)* = in (parens)**

chord bar #	**1L**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
									|---------(D)5--------|						
C chord guide	Cadd2	Cs4	**F**	Bdim	**C**	*Am*	(**G**)	*Em*	*Dm*	Gs4	**Dp7**	Cj7	**Ap7**	Fj7	*Dm7*
G chord guide	Cadd2	Cs#4	F#dim	*Bm*	**C**	*Am*	**G**	*Em*	**(D)**	Gs4	**Dp7**	Cj7	**Ap7**	*Am6*	**D7**

(2 bar open 5th power chords - C5=C+Cs4 or Cs#4; F5=F+Cs4; G5=G+Gs4; D5=D or Dm+Dp7; A5=Ap7+Fj7 or Am6)

F/C Set-up 15 BAR 1 KEY at a time CHORDS at the 0 bridge position *(1 or 2 pseudo-keys)*

***Notation through-out: primary full key(s)* = underlined; pseudo-key*(s)* = in (parens)**

chord bar #	**1L**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
									|---------(G)5--------|						
F chord guide	Cadd2	Cs4	**B*b***	Edim	**F**	*Dm*	**(C)**	*Am*	*Gm*	Fs4	**Gp7**	Cj7	**Dp7**	Fj7	Fadd2
C chord guide	Cadd2	Cs4	Bdim	*Em*	**F**	*Dm*	**C**	*Am*	**(G)**	Fs#4	**Gp7**	Cj7	**Dp7**	Fj7	Fadd2

(2 bar open 5th power chords - C5=C+Cs4 or Cs4+Cadd2; F5=F+Cs4; G5=G or Gm+Gp7; D5=D or Dm+Dp7)

B-16 15 BAR 2 KEYS at a time CHORDS at the 0 bridge position *(1 pseudo-key)*

chord bar #	**1L**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
F & C chord guide	Cadd2	Cs4	**B*b***	*Gm*	**F**	*Dm*	**C**	*Am*	**(G)**	*Em*	Fs4	Cj7	**Dp7**	Fj7	Fadd2

(2 bar open 5th power chords - C5=C+Cs4; F5=F+Cs4; G5=Gm+G)

BP-20 15 BAR 3 KEYS at a time CHORDS at the 0 bridge position

chord bar #	**1L**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
B*b*&F&C chord guide	Fs4	B*b*s4	**E*b***	*Cm*	**B*b***	*Gm*	**F**	*Dm*	**C**	*Am*	**G**	*Em*	Fj7	B*b*j7	E*b*j7
C&G&D chord guide	Gs4	Cs4	**F**	*Dm*	**C**	*Am*	**G**	*Em*	**D**	*Bm*	**A**	*F#m*	Gj7	Cj7	Fj7

(2 bar open 5th power chords - C5=C+Cs4; F5=F+Cs4; G5=G+Gs4)

***X*P-12 Single-bar chorder version**

Suitable for lap chording and negating the need for any chord mechanism thereby greatly reducing the cost. Also great for random 'ear'idescent harp melody play. With the single bar chorder the 12 Key of C chords = *Am/Am7*, C/Cj7, *Dm/Dm7*, *Em/Em7*, F/Fj7 and G/G7.

The guides combine both **tuning** and **chords** and fit under the strings. The Single-bar chorder is integrated into the instrument under the false tail feathers. No pseudo keys available. The upper case letters indicate the various chording positions (as well as the tuning). The **underlined letters** correspond to the playable key at the appropriate bridge position.

It incorporates a simple single hand held bar with felts on the bottom spaced so that when pushed down on the strings at different locations it produces all major, *minor*, dominant and major 7th chords in the key one is playing in. It is placed on the strings to the left of the **tuning guide**, with one end resting on the riser provided on the soundboard. It is moved laterally across the strings with the **marker pointing to the upper case letters on the chord/tuning guide** (which also represent the **chord** being played). Push the bar down evenly and gently and strum across the strings and you will get the chord the marker is pointing to. If you tilt the bar chorder about 45 degrees to the left and strum, you will get the 7th of the chord indicated. Re-tune 1 string for the adjunct key.

Single Bar Chorder Chord/Tuning Guides

string no.	keys =	guide no. 1 (tilt for 7ths) side A	guide no. 1 (tilt for 7ths) side B	guide no. 2 (tilt for 7ths) side A	guide no. 2 (tilt for 7ths) side B	guide no. 3 (tilt for 7ths) side A	guide no. 3 (tilt for 7ths) side B	
		F	**C**	**G**	**D**	**A**	**E**	
1		g	g	a	a	b	b	
2		f	f	g	g	a	a	
3		e	e	f#	f#	g#	g#	
4		*Dm*	*Dm*	*Em*	*Em*	*F#m*	*F#m*	
5		**C**	**C**	**D**	**D**	**E**	**E**	
6		**B*b***	b	**C**	c#	**D**	d#	re-tunable string for adjunct key
7		*Am*	*Am*	*Bm*	*Bm*	*C#m*	*C#m*	
8		*Gm*	**G**	*Am*	**A**	*Bm*	**B**	
9		**F**	**F**	**G**	**G**	**A**	**A**	
10		e	*Em*	f#	*F#m*	g#	*G#m*	
11		*Dm*	*Dm*	*Em*	*Em*	*F#m*	*F#m*	
12		**C**	**C**	**D**	**D**	**E**	**E**	

SUMMARIES - DIMENSIONAL CHARACTERITICS across ALL Models and Versions

***Autoharp Tuning Pins*: 12 & 14 string versions available with *Partial* bodies**

16 and 20 string versions with *Full* bodies only

***Guitar Tuners*: 12 – 16 string versions available with *Full* bodies only**

Goal – bridge centered over "actual resonating chamber" as much as possible

(*length* = body length, not including headpiece or leg rest; *body base width* = structural body width)

Pinned Partial Bodies (false tail feathers)

Model	*# strings*	*length*	*gap*	*body base width*	*tail feathers*	*total base width*	*string spacing*	*string stroke*	*1st inset*
X	***12***	***24***	***4***	***6 ¼***	***1 ¾***	***8***	***3/8***	***4-1/8***	***1 ¼***
A	***14***	***26***	***4***	***6 ¼***	***1 ¾***	***8***	***3/8; 5/16***	***4-1/8***	***1 ¼***

Guitar Tuners Full Bodies

Model(s)	*# strings*	*length*	*gap*	*body base width*	*tail feathers*	*total base width*	*string spacing*	*string stroke*	*1st inset*
X&A	***12***	***24/26***	***4***	***6 ¼***	***1 ¾***	***8***	***3/8***	***4-1/8***	***1/2***
A&B	***14***	***26/28***	***4***	***6 ¼***	***1 ¾***	***8***	***3/8; 5/16***	***4-1/8***	***1/2***
A&B	***16***	***26/28***	***4***	***6 ¼***	***1 ¾***	***8***	***5/16 x 3; 9/32 x 12***	***4-1/4+***	***3/8***

Pinned Full Bodies

Model(s)	*# strings*	*length*	*gap*	*body base width*	*tail feathers*	*total base width*	*string spacing*	*string stroke*	*1st inset*
A	***16***	***26***	***4***	***6 ¼***	***1 ¾***	***8***	***5/16 x 3, 9/32 x 12***	***4-1/4 +***	***3/8***
B	***20***	***28***	***4***	***6 ¼***	***1 ¾***	***8***	***1/4***	***4 ¾***	***3/8***

LUTHIER NOTES

Best I can do as of June 2022 – many possible options. Look at drawings & photos, but this guide best detail

My favorites – XG-12 steel (C/F) and XGS-12 nylon (G/C); AG-14 (G/C); AG-16 (G/C)** or **BG-16 (C/F); BP-20

A good beginning instrument to get your feet wet would be the AP-14 – pinned w/steel strings or the AG-14 with guitar tuners

Suggest serious builders refer to all of the GAL archived photos for additional (not necessarily definitive) guidance.

Just 3 basic body types, in pinned and guitar tuners versions. When encountering minor variations in some dimensions between this guidance and the drawings, *refer to this guidance.* There are some minor mistakes herein.

Just to be clear, on autoharp tuning pin versions, tops and bases from ¾ oak or maple. On guitar tuners versions, bases the same and headpieces from 9/16 to 5/8 thick oak or maple. Longitudinal supports on all versions either ¼ x 2 ½ to 3 in. poplar or oak.

I'd like to reinforce the possibility that all of the variations can actually be made using autoharp tuning pins if one prefers, and most without going to the trouble of using full bodies (meaning the resonating chamber extends below the tail feathers),nor requiring kerfing, bracing, bending wood and installing a support to hold one end of same.

Regarding the spacing of guitar tuners, I have been using single economy tuners from Stewart-MacDonald. In order to achieve a balanced look for the strings on the headpiece, one needs to experiment with the placement of each tuner. For instance, from the specs for the ***Model AG 12*** string on pg 5, you will note that it reads "headpiece 5¼ (3) x 6-5/8 (5) x7¼ (4) in @ 14 degrees". To get a nice balanced string look, try placing 3 tuners on the 5 ¼ right side of the headpiece, 5 tuners along the 6-5/8 top, and 4 more tuners along the left side (the 7 ¼ refers to the overall width of the headpiece at the bottom – not the left side dimension). The distances between tuners will vary in most cases (except maybe along the top where you can use a 6 string jig as a guide). The 14 degrees refers to the angle of the headpiece relative to the instrument body. String spacing is varied to increase attack on large diameter strings. ***Note slightly wider string spacing and strokes on 14 and 16 string versions in this document vs drawing.***

Dark headpiece and bridges with silver reference dots. Guides black ink on beige background. Use traditional 15 bar autoharp chord bar holders (7-1/8 in - 2 part chord bars – see photos). Risers on chord bars 7/8 and 1/2 in. **Tuning Guide** (2 keys/side) in use fits under the strings on the headpiece. Make **base of all headpieces 7 ¼** and **tops 6-5/8 in. wide** and **headpiece overhang** on the right side 1 in. All tuners inset **½ in.** from edges. **Start tuners up 1 in** to insure no interference with Tuning Guides. Tuning Guides 1/16 x ½ x 7-1/8 in.(up to **5** = 12 key signatures) stored between chord bar holders w/Velcro. Outside edges of holders spaced at 7 ½ in. Chord Guides 1/16 x ½ x 6-1/8 in. (up to **6** = 12 key signatures) stored on tops and sides of chord bar holders w/Velcro. **Thumb rest/extension for chord bar holder 1/2 in.** Add interior chord bar tabs to odd numbered chord bars for lap play. Room for clip on tuner at the upper right corner of the instrument below the headpiece tapering down to the thumb rest/chord bar holder on all guitar tuners versions (on partial body versions, clip tuner to tail feathers). On versions with nylon strings the end piece needs to be modified slightly to accommodate tie end nylon strings (there are end tabs available for nylon strings). Add a leather strap on the side near the chord bar mechanism.

On all versions, areas to experiment include: size and placement of sound hole (traditional mid-way sound hole or hole at the base?) and full vs partial body (false tail feathers) and on pinned versions, pre-drilled tuning pins at angle? Also bracing configurations, oak longitudinal supports and angled riser at base. Tail feathers transition attachment means for full-bodied versions. Left side 1/8 or ¼ in on guitar tuner versions? Alaska Specialty Woods has long Dulcimer sitka spruce soundboards (0.180 thickness) which when joined and planned down further make for perfect Nightingale soundboards. 1/8 birch plywood good for backs and sides.

2 varying sets of key set-ups, could be reduced to 1? No matter what, great similarities across all variations with respect to chords and position thereof (see summaries) simplifying making the guides. Little overlap in tuning guides because of differences in no. of strings, string spacing and insert distances all of which could probably undergo more simplification. Same chord mechanisms and chord bar lengths on all variations. From the chord and tuning information provided in this document at the 0 bridge position, it will be easy to create chord and tuning guides for all the other bridge positions. **(See new Chord & Tuning Guides document.)**

All strings can be re-tuned to other pitches, lowing as much as a whole step (but no raising) to facilitate different tunings (useful for harp melody play). Actual Chords and their sequencing easily modified. Travelers to rigidify and keep the strings from buzzing are important. The instrument can also be easily played with one's ear against the back or other side and sounds quite good when played as a hand drum as well as hammering chords in a lap mode.

Looking back – consider making the Seven Arrows quick release chord mechanism (very easy to change out chord bars)

PLEASE VISIT "The Child Who Went to the Zoo – the RE-WILDING Musical" on YouTube

More summary (possibly redundant) information

1. Regarding all models, they are now based on very similar body dimensions and string strokes. This also means they all share the same length bridges, travelers, risers, chord bars, chord and tuning guides.

2. Use a standard 15 bar autoharp chord mechanism, now located higher up on the instrument, ***above*** the sound hole. It is bolted to the thumb rest on the right side in 2 places and screwed into the soundboard in 3 places on the other end. All the chord and tuning guides are stored on the tops and sides and between the chord bar holders (held in place with small pieces of Velcro).

3. Each side of a chord guide is associated with one key while each side of a tuning tuning guide is associated with a minimum of two adjunct keys (except in the case of the 3 key Model BP-20).

4. When tuning all of the guitar tuners versions, the tuning guide is placed on the headpiece just above the bridge (held in place with small pieces of Velcro). There is room at the upper right hand corner below the headpiece for a clip-on tuner.

5. The uneven spacing of the tuning machines on these headpieces is intended to even out the spacing of the strings coming off the top, thereby giving the instrument a more symmetrical look (a totally trial and error exercise).

6. Removing a portion of the headpiece to reduce the instruments weight and give it a different look is entirely optional. I do however suggest adding a means by which the instrument can easily be hung on a wall such as a 1/2 wide x 1/8 in thick piece of oak rounded on the lower edge (nice hand hold when picking the instrument up) screwed at a right angle to the back of both ends of the longitudinal supports (see the photos).

7. The size and positioning of the soundboard X brace is my best guess and seems to be working fine – I am no expert.

8. Regarding the placement of the sound hole with painted heart, the drawings are an accurate reflection of the location of a birds heart (down low and towards the front, unlike on humans).

9. String reference dots – small silver dots (visible in low light on dark backgrounds) located on the moveable and top bridge and between the headpiece tuners to help guide the player to the correct string for tuning are indicated on the drawings. The traveler acorn nuts are located at the same spacing as the string reference dots. The bridges and headpiece need to be stained dark.

10. The stains chosen to best represent a Nightingale's coloration are Minwax classic gray #271 for the head and beak, and gunstock #231 for the tail feathers. Before staining I add a pre-stain over the entire body which also seems to act as a good sanding sealer. I usually try to use pieces of iridescent glass or gem stones for the eye. The outlining and feathering details are done with permanent ink pens. Of course, there is much latitude for those with the inclination and skills to embellish upon what I have done.

11. If one is creating a Model X or A 12 string version, which is to be outfitted with either ***nylon*** or steel strings, the riser needs to be located parallel to and along the upper edge of the base, thereby allowing room for string thru holes to be drilled 3/8 in from the lower edge of the base at a 45 degree angle to facilitate ball or tie-end nylon strings.

12. Since I have been dependent on using dimensional woods available at my local lumber store, I have been using nominal ¼ x 2 ½ poplar for the longitudinal supports. If one is not so limited, consider making that actual width 2 ¾-3 in. That extra ¼-½ in will give a little more clearance for the top row of tuning machines when the instrument is resting on a table. (Best to make a drawing using your finished headpiece dimensions to insure that there is some tuners clearance when the instrument is laid flat on its back.)

13. If using screws to tie the frame together (#6), those tieing the ½ poplar into the longitudinal supports at the top are not shown. What is shown are the screws through the left piece of poplar added at the top into the additional bracing glued to the left longitudinal support to better support the headpiece. This I have added to insure a good secure structure.

14. Regarding string sizing, I have done the best I could do using string gauge calculators. I am pretty confident about the nylon string sizing for the 12 string soprano version of the Model X (tight), but not so certain about the alto string sizing for the 12 string version– these need to be tight also.

15. Regarding the two part chord bars and where on the top bar to start the angled cut, it will most likely be around the mid-point of the bar itself (offset to the left of the strings center point – experiment and observe where it needs to be so that the bottom bar ends up pushing down evenly on all the strings).

16. Complete sets of **CHORD** and **TUNING GUIDES** for both Set-ups (G/C or C/F) and at all bridge positions can be found in the new document entitled **CHORD** and **TUNING GUIDES.**

The remainder of this document is based on information that may require a little tweaking. My apologies for some redundancy between what one has already read and the following. Double check everything before cutting/drilling.

Materials List (my apologies for some redundancy and possible inaccuracies)

Headpiece ¾ x 7 ¼ -5/16 oak or maple planned to 9/16-5/8, **base** ¾ x 2 ½ - 3 oak, **right side** and **internal support** ¼ x 2 ½ - 3 poplar or oak, **left side** and **tail** 1/8 birch plywood, **top spacers** ½ x 2 ½ - 3 poplar, **soundboard** and **backboard** 3/32 to 1/8 birch plywood or spruce (try thin brass as well), **bridges** 3/8 – ½ oak shoe molding, **string riser** 1/8 - 3/16 x 5/16 oak or maple, guitar or mandolin kerfing, bridge detail and end pins = 1/8 brass rod and 1 in piano bridge pins, economy guitar tuners, autoharp tuning pins, # 6 screws of various lengths, mute from tongue depressors and tighteners 4-40 x 3/8 screws, plain and lock washers with brass acorn nuts.

the Quick Release Chord Mechanism

Ends made from 1 x 1 corner molding, **sides** from 3/8 basswood, ¾ x ½ **open cell weather stripping** in lieu of springs, **lower chord bars** from 1/8 oak or maple, **upper bars** from ¼ x ½ basswood, keepers from 1/16 to 1/8 bass wood, dividers 1 in # 14 escutcheon pins, felt ¼ x 5/16, tuning and chord guides 1/16 basswood, ¾ beige Velcro. The traditional 15 bar autoharp chord mechanism can be converted into one that is easily moved up and down the instrument by simply screwing in rigid sides from 1/8 to ¼ in. poplar or oak at the top and bottom. This also provides additional space to store tuning and chord guides.

Tools Required

Almost all of the above dimensional wood available at local wood suppliers, Michaels and Woodcraft. Specialized tool – planer. Other small tools – compound electric miter saw, hand miter saw, drill press, band saw, table mounted belt sander, hand drill, router (optional).

Chord Bars

Chord bar sequencing is simply a suggested option. The intent is to keep as many of the major, dominant 7th and partial 7th chords in one row and to make open 5th power chords (depressing 2 bars at a time) as easy to execute as possible. Additionally, as much as possible, to make the major and minor chords in the primary key(s) to line up in the same relative positions in the chord mechanisms. One can always change the sequencing and the chords themselves, e.g., change out some of the partial 7th chords. Check sequencing of chords to minimize nodal feedback for most commonly played chords at most common bridge positions.

Keys Set-ups and string sizing

There are optional ways to set-up playable key combinations at various frets and the chords playable.

Miscellaneous Notes

The **bridge positions** (0 – 7) indicated on the sideboard are approximations and are best identified through testing once the optimum 0 bridge position scale length has been determined and the instrument has been strung and tuned (not necessarily a fretboard replica because of the variable angle of the strings at the bridge as it is moved). If wanting to play in the "tuned down keys" move the bridge towards the base to that point where further movement is difficult and doing so is not lowering the pitch.

The quick release chord mechanism is optional. All versions could be made using the standard 15 bar autoharp chord mechanism. The quick release chord mechanism is most suitable for those using different key set-ups and changing from 1 to 2 key modes on the 16 string instrument.

The term **mute** has been changed to **traveler** as its purpose is to rigidify the strings coming off the bridge and eliminate buzzing.

Each version can also be made using traditional autoharp tuning pins in lieu of guitar or mandolin tuners. This reduces the weight of the instrument, the complexity of making the headpiece for the tuners, and thereby reduces the cost of manufacture. Fine tuners can also be incorporated into this design.

The uneven spacing of headpiece tuners is meant to equalize as much as possible the look of the strings coming off the bridge.

The instruments are really not designed with the intention of constantly moving the bridge from one position to another or for changing from multi-key to one key modes, as a few of the strings with each move may need some slight tweaking. Instead**,** the intent is to provide the flexibility to play in a large array of diatonic and multi-key modes, assuming the instrument will be played for a while in one mode and then changed to another for extended play in that mode and at a given bridge position.

Each instrument might come with some extra felt, lower chord bar stock, Chord Guide and Tuning Guide stock and Users Guide

On SHARING **–** (the patent has long since expired) - it is my hope that persons wishing to make Nightingales will share among themselves detailed drawings, the making of chord and tuning guides and even possibly the quick release chord mechanism frame. Additionally, as a united group, if at least 20% of all proceeds from the sale of Nightingales could go to organizations dedicated to protecting wildlife and especially wild home lands that would be a wonderful thing. Here is a short list of such groups – The Center for Biological Diversity, The Giraffe Conservation Fund, The World Wildlife Fund, The Defenders of Wildlife, The Audubon Society, The National Wildlife Federation, The Nature Conservancy, etc., etc. For those wanting a prototype instrument, there are several available on ***eBay*** (search ***Nightingale Autoharp***) and several more of the very latest design from

dickbozung@SevenArrowsMusic.net. Check out **SevenArrowsMusic.net** and **GuitarSimplified.com.**

Sample Felting Template

Please note: the following is a rough example of the kind of template one would make for guidance in properly placing the felts on the lower chord bars for the typical 14 string G/C Set-up Chords. An **X** represents a place to remove the felt. The spacing between strings here is not to scale. On your template, drawn a line to the right of string #1 equaling the exact distance from the inside of right side of the chord mechanism to string #1 – this will serve as a guide to properly align your chord bars for felting. Please visit www.autoharp.com to order adhesive backed felt (¼ x 5/16) and for detailed instructions on applying the felt.

		chord bar #	1L	2	3	4	5	6	7	8	9	10	11	12	13	14	15
											|---------(D)5--------|						
Guide 2	**side A**	**C guide**	Cadd2	Cs4	**F**	Bdim	<u>**C**</u>	*Am*	**(G)**	*Em*	*Dm*	Gs4	**Dp7**	Cj7	**Ap7**	Fj7	*Dm7*
	(0)																
	side B	**G guide**	Cadd2	Cs#4	F#dim	*Bm*	**C**	*Am*	<u>**G**</u>	*Em*	**(D)**	Gs4	**Dp7**	Cj7	**Ap7**	*Am6*	**D7**

Steel String Numbers, Gauges & Tuning @ the 0 bridge position

	14	13	12	11	10	9	8	7	6	5	4	3	2	1	
string numbers	**14**	**13**	**12**	**11**	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	
string gauges	**59w**	**54**	**42**	**38**	**33**	**30**	**27**	**23**	**18p**	**17**	**15**	**13**	**11**	**10**	
Key of C Tuning	***g2***	***c3***	***d***	***e***	***f***	***g***	***a***	***b***	***c4***	***d***	***e***	***f***	***g***	***a***	(20 in. scale)
Key of G Tuning difference					**f#**							**f#**			

Bar # & Key of C Chords		14	13	12	11	10	9	8	7	6	5	4	3	2	1	**Key of G Chords**
1.	Cadd2		X	X	X		X			X	X	X		X		Cadd2
2.	Csus4 (c f g)	X	X			X	X			X			X	X		Csus#4 (c f# g)
3.	F (f a c)		X			X		X		X			X		X	F#dim (f# a c)
4.	Bdim (b d f)			X		X			X		X		X			Bm (b d f#)
5.	C (c e g)	X	X		X		X			X		X		X		C
6.	*Am* (a c e)		X		X			X		X		X			X	*Am*
7.	(G)	X		X			X		X		X			X		G
	string #	**14**	**13**	**12**	**11**	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	
	Tuning	***g2***	***c3***	***d***	***e***	***f#/f***	***g***	***a***	***b***	***c4***	***d***	***e***	***f#/f***	***g***	***a***	
8.	*Em* (e g b)	X			X		X		X			X		X		*Em*
9.	*Dm* (d f a)			X		X		X			X		X		X	D (d f# a)
10.	Gsus4 (g c d)	X	X	X			X			X	X			X		Gsus4
11.	Dp7 (d a c)		X	X				X		X	X				X	Dp7
12.	Cj7 (c e g b)		X	X		X		X		X	X		X		X	Cj7
13.	Fj7 (f a c e)		X		X	X		X		X		X			X	*Am6* (a c e f#)
14.	Dsus4 (d g a)	X		X				X			X			X	X	Dsus4
15.	Ap7 (a e g)	X			X		X	X				X		X	X	Ap7
	string #	**14**	**13**	**12**	**11**	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	

NIGHTINGALE ASSEMBLY

(Guitar Tuners versions – this may require some tweaking))

Headpiece

Cut to size from 9/16 to 5/8 oak or maple. Use template as guide. Drill upper left hole on top and upper holes on both sides. Pin and clamp jig and drill rest of holes with hand drill from front (no backing needed). Finish sand both sides and edges. Stain only front and sides. Use economy individual guitar tuning machines or facsimile - easy to install & replace. Drill bushing holes on drill press.

later

Fit to instrument. Mark cut-out and attachment holes. Cut/drill - #6 size/sand. Install bushings and tuners.

Base

Cut to size from 1 x 3 oak and mark all holes. Pre-drill all holes with 5/64 bridge pin bit. Base holes to secure to mid-support and right side sized tight for poplar (3/32). If installing internal pick-up, drill hole for jack.

After base set and holes into poplar drilled, enlarge holes in base (1/8 ?). Top screws in compression can be shorter (1 ½ vs 2). Glue for extra strength. For autoharp tuning pin versions in oak or maple drill holes with 3/16 bit.

Frame

Cut top spacer @ 4 degrees to proper width. Do all 4 degree cuts on inserts and spacers in advance so everything matches.

Cut out tuning machine ends of longitudinal supports. Start in further than needed. Clamp together and hand saw at 4 degrees and down 1/2 and saw other long cut.

Cut and glue together extra headpiece supports from ¼ and ¾ poplar.

Measure right longitudinal support and cut to length. Use headpiece and spacers as template to get correct left longitudinal support length. Drill top support holes (one is going to be for a strap button).

Cut out excess material from interior braces (¼ in on both sides but leaving a bit at both ends to match frame height).

Cut and glue bottom inserts if using screws (#6).

Drill, screw and glue box frame together. (because of inadequate tools, I have used screws to construct the frame)

Glue headpiece supports to frame (use opposite side of cut-out for parallel gluing surface)

Screw left spacer into headpiece support.

Cut left side (1/8 birch ply with kerfing or ¼ poplar to length and glue).

Glue curved support to right side with kerfing and install strap button.

Soundboard

Size soundboard, add internal bracing, cut sound hole and cut after insuring match with headpiece.

Glue soundboard and finish sand edges.

Install internal pick-up

Backboard and Headpiece

Cut backboard to size, including overhang at the base to accommodate gluing the ½ thick poplar leg rest.

Glue frame to backboard and sand (last if electrifying).

Final prep on headpiece supports, screw headpiece in place (do not glue).

Final steps

Oil base and then set bridge pins (#6, ¾ or 1 in.).

Cut/drill bridges (sand top bridge so can precisely drill holes for bridge pin holes) – temporarily affix headpieces to determine where pin break occurs. Stain and then oil.

Outline head, etc. and pre-stain, then stain within 2 hrs

Finish artwork detail (stain dry overnight) – beak brown

Set/glue top bridge, drill down bridge pin holes into body structure and install (use nail punch to adjust top string spacing). Use 1/8 to 5/32 brass rod for bridges.

Affix hanger – 3/8 to ½ wide 1/8 thick oak at a right angle to the ends of the headpiece supports.
(Drill feather holes and tuning wrench storage hole on top or right side bottom if making Autoharp Tuning pin version)

Varathane/lacquer top. Glue eye.

Mark key positions based on actual locations after stringing/experimentation on the side-board.

Oil sides and back. Then install strap buttons

Headpiece – dark stain; face - light grey stain with black markings; chord mechanism and mute - dark stain; tail – reddish stain with folk art feathering; base optional - light grey stain; beak - brown (Mimic actual Nightingale)

Traveler – Tongue depressors or facsimile with 5/8 adhesive backed nameboard felt attached to both interior sides. Use 4-40 x 3/8 machine screws with acorn nuts, flat & lock washers top (drill 3/32 holes thru top and bottom, then 9/64 top only) and install hardware. To install mute, slide bridge way forward to insert bottom, then slide mute back to install top.

File groves for accurate string placement on base.

Chord Mechanism

5/16" wide x ¼ deep felt. When cutting felt error on smaller wedges as can always shave back a little. When using the manufactured 15 bar chord bar ends, glue strips to soundboard to achieve 1/16 gap between chord bar felt and the strings first for good screw hold. Chord bar tops from ¼ x ½ x 2 ft basswood and bottoms from 1/8 x 5/16 oak or maple.

Alternative Quick-release Chord Mechanism

#14 x 1 escutcheon pins; ¼ x ½ x 2 ft basswood chord bars and 1/8 maple or oak bottoms; 3/8 x 3 x 2 ft basswood sides; corner molding; 1/32, 1/16, 3/32, 1/8 basswood filler. Minimum replaceable filler would be Velcro on both sides = 1/8. Could also consider adding material under foam to raise slightly. ½ x ¾ open cell weather stripping in lieu of springs (contact cement on wood). Contact cement under Velcro. Mark both ends of chord mechanism over first and last strings for proper re-positioning.

Assembly sequencing

1. frame (pick-up hole pre-drilled prior to assembly)

2. headpiece check.

3. sides and kerfing

4. install soundboard

5. pick-up installation

7. oil base and stain/oil bridges

8. install hitch pins

9. paint heart on and install backboard and glue leg rest to extension.

10. finish sand
11. oil backboard and headpiece supports
12. install hanger
13. outline graphics
14. pre-stain (sides included)
15. stain
16. outlining, feathering, bridge positions
17. set headpiece
18. prep top bridge
19. set, screw and glue bridges
20. set strap buttons
21. file string indents in bottom bridge
22. mark bridge positions/keys on side-board
23. lacquer top, tail feather side and head rest side
23. glue eye
24. string loosely and add mute (prefer the word ***traveler*** as purpose is to maintain string spacing and eliminate buzzing)
25. add bridge, and headpiece reference markings

To calculate the tension in steel strings, go to - https://wahiduddin.net/calc/calc_guitar_tension_from_size.htm

To get notes in a chord or identify chord names from a series of notes go to https://www.scales-chords.com/

Some of the less common chord formations

Dm6 = b d f a; ***Am6*** = a c e f#; **Cs#4** = c f# g; **Cadd2** = c d e g; **Cadd4** = c e g f; **C9** = c e g d; **C6/*Am7*** = c e g a;

Fadd2 = f g a c; **Gadd2** = g a b d; **Gp7** = g d f; **Dp7** = d a c; **Ap7** = a e g

G+Gs4 = **G5**; C+Cs4 = **C5**; Cs4+Gs4 = **C5**; D+Ds4 = **D5**

Some other last minute improvements/suggestions

1. Add a leather hand hold or facsimile on the instrument side near the chord mechanism. ¾ x 6 ½ in., inset about 5/8 in from back. Leather will compress nicely so as to not interfere with the chording hand.

2. 3 strap buttons, 2 at the base and the other at the top near the headpiece. Chord bar tabs ½ and 7/8.

3. Add ¼ in thick piece to portion of the soundboard extension near the headpiece to provide better grip for a clip-on tuner.

4. Use a compressible material under the chord bar ends so that the felt height above the strings can be tweaked over time.

5. String ties for nylon strings are available which simplify the process of securing nylon strings.

6. Try using different color tuners for the string(s) that are tweaked for the adjunct key.

My personal (all guitar tuners) favorites (X=gap in progression of diatonic notes)

	XG-12 steel alto (C/F)**;**	**XGS-12 nylon soprano** (G/C)**;**	**AG-14 &**	**AG-16 steel baritone** (G/C)**;**	**BG-16 – baritone** (C/F)
range @ 0	*c3 - g4*	*f3 - c5*	*g2 X a4*	*g2 - a4*	*f2 – g4 (full)*
range @ 5	*f3 - c5*	b*b3 - f5*	*c3 X d5*	*c3 - d5*	b*b2 – c5 (full)*
range @ 7	*g3 - d5*	*c4 - g5*	*N/A*	*N/A*	*c3 – d5 (full)*