

Of the master's dispersed leaves on the fabric of instruments: the drawing and the reasoning are his, in the mirror hand; the measures were reduced by a later student to the Spanish pattern of Torres, 1888, and noted in millimetres. The plan is set out on the solera before any wood is bent.

The Guitar Maker's Manuscript

OFFICINA HISPALENSIS · ARCHIVUM CHITARRÆ

TABULA I · CORPUS

Plate the First · the body, its woods and the division of the string

MENSURA INTEGRA Principal measures

Corpus body	485
Chorda scale	650
Ponticuli frets	19
Pondus weight, kg	1.4–1.8

I. LIGNUM SONORUM

Woods of Sound · materials & density



A. Picea Abies
Norway spruce
Soundboard, fan braces and harmonic bars. Quartered, grain of 1.0–2.0 mm; cedar is the alternative.
0.35–0.45 g/cm³



B. Dalbergia Latifolia
Indian rosewood
Back and sides, bent on the hot iron; the neck is Spanish cedar in one piece with the heel.
0.75–0.85 g/cm³

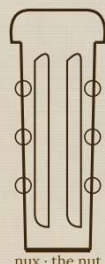


C. Diospyros Crassiflora
Gaboon ebony
Fingerboard, bridge and tie-block, bindings and the head plate. Rosette of dyed pear and holly.
0.95–1.10 g/cm³

II. CAPUT & COLLUM

Head & Neck · the slotted head and the Spanish heel

Longitudo capitis head length	175
Latitudo capitis head width	75
Fenestræ slots	2 × 100
Ratio verticilli tuner ratio	14 : 1
Latitudo ad nucem width at the nut	52.0
Spatium ad nucem string spacing, nut	43.0
Crassitudo ad I neck depth, first fret	21.0
Crassitudo ad IX neck depth, ninth fret	24.0



nux · the nut

The neck, its heel and the slotted head are cut from one billet of cedar; the sides enter the heel through six sawn slots, so that the box is built onto the neck and not the neck onto the box.

III. SOLERA & LATERA

Workboard & Sides · how the box is set out

Solera, concavitas workboard dome	R 4000
Trunci blocks	2
Latera, crassitudo side thickness	2.0
Altitudo ad collum depth at the neck	95.0
Altitudo ad caudam depth at the tail	100.0
Taeniæ linings	5 × 6
Filum purpuræ purfling width	1.5
Margines bindings	6.0 × 2.5

The Spanish maker works face down on the solera, whose dome is worked into the board itself; the top takes its curve from the bench before a single brace is glued to it.

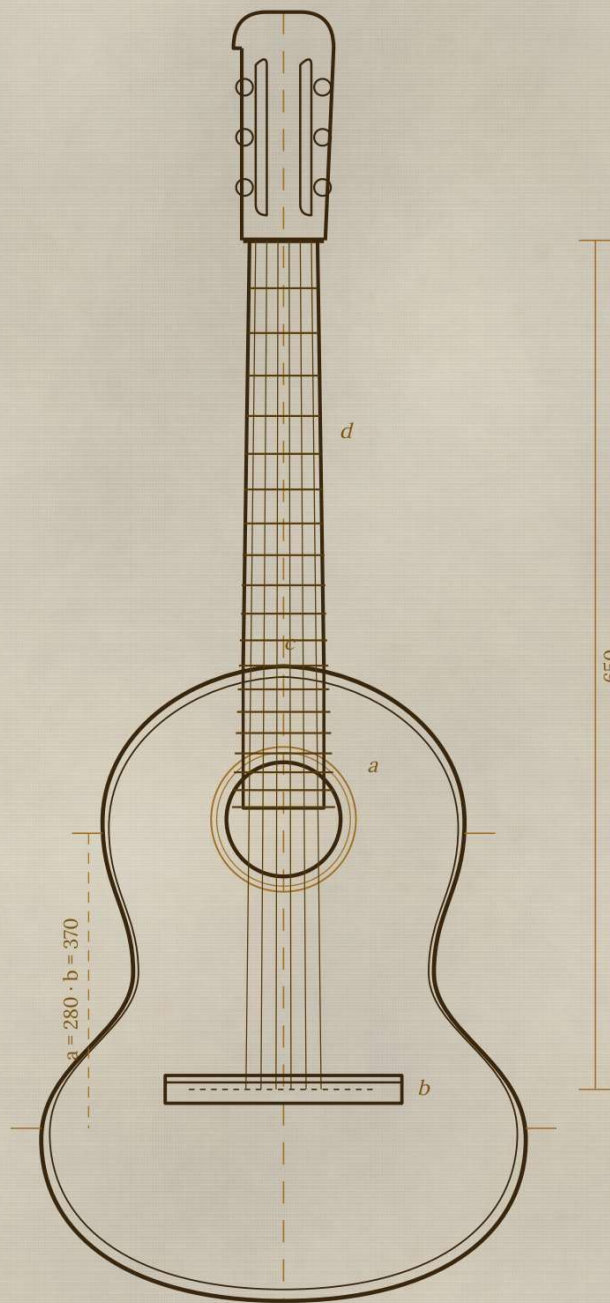
DE PLANTILLA

Of the Plan

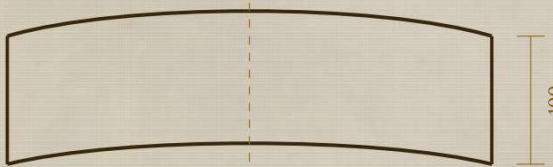
The Spanish tradition puts the neck first. Head, neck and heel are cut from one billet; the sides are slotted into the heel; the top is glued to the neck before the box exists at all. Nothing afterwards can be taken apart without undoing that joint, which is why the plantilla and the solera are drawn and dressed long before any spruce is touched. The guitar is not assembled — it is grown from the neck outward.

IV. STRUCTURA CHITARRÆ

The Structure of the Guitar · the plan & the string



Facies · front elevation, the plantilla of 1888



Secio ad caudam · section at the tail



a foramen & rosa, the soundhole · b pons, the bridge

c iunctura ad XII, the body joint · d ponticuli, the frets

a : b = 1 : 1.321
b : L = 1 : 1.311

$2^{1/12} = 1.0594631$
the equal division

650 mm
scale · XII frets to the body

V. MENSURAE CORPORIS

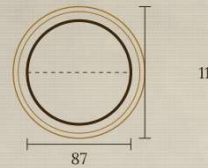
Measures of the Body · in millimetres

Longitudo corporis body length	485.0
Latitudo superior upper bout	280.0
Latitudo media waist	230.0
Latitudo inferior lower bout	370.0
Altitudo ad collum depth at the neck	95.0
Altitudo ad caudam depth at the tail	100.0
Chorda vibrans scale length	650.0
Iunctura body joint, at fret	XII
Crassitudo tabulae soundboard	2.0–2.5
Crassitudo fundi back	2.0
Longitudo tota overall length	985.0
Spatium ad pontem string spacing, bridge	58.0
Latitudo ad ponticulum XII fingerboard at fret XII	62.0

The lower bout stands to the body length as one to one and a third, and the waist falls at the half. The whole plan is drawn from the two circles of the bouts and the line joining their centres.

VI. FORAMEN & ROSA

Soundhole & Rosette · the mouth of the instrument



Diameter foraminis soundhole diameter	87.0
Diameter rosæ over the rosette	111.0
Latitudo rosæ rosette band	12.0
A iunctura below the body joint	55.0
Tessellæ tesserae in the mosaic	≈ 5000
Resonantia aeris air resonance	≈ 100 Hz

The mouth is cut to the air, not to the eye: widen it and the Helmholtz note rises and the bass thins; narrow it and the instrument gains weight but loses its carrying power.

VII. ACTIO & ELEVATIO

The Set-up · action, relief and the line of the strings

Elevatio ad XII, prima action at fret XII, treble	3.0
Elevatio ad XII, sexta action at fret XII, bass	4.0
Curvatura colli neck relief	0.1
Os pontis saddle above the top	9.0
Angulus fractionis break angle at the saddle	12°
Longitudo tabulae fingerboard length	480
Compensatio saddle compensation	1.5
Ponticuli frets, nickel silver	19

The plane of the fingerboard is set to fall a little below the saddle, so that the strings clear the frets of their own accord and the bridge is left to work in compression alone.

DE MENSURA

Of Measurement

The figures on this sheet are nominal. They are the measures of surviving Spanish instruments of the classical pattern, taken with the caliper at the points named, and they vary from one to the next by more than the third decimal place suggests. Where a figure and the ear disagree, the ear is the older authority. Read them as the bounds within which the work is known to succeed, not as a specification to be met. Take them as the record of a practice, not its rule: the same figures were reached in Sevilla, Madrid and Munich by men who never met.

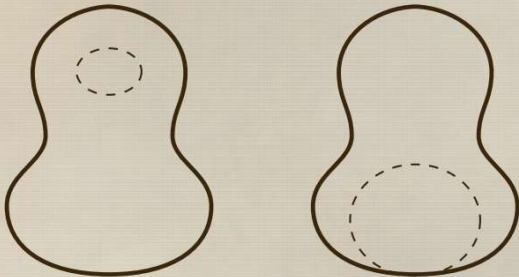
Tabula II · The Sounding Parts

Plate the Second · resonance, tension, the bracing, the bridge and the strings

OFFICINA HISPALENSIS

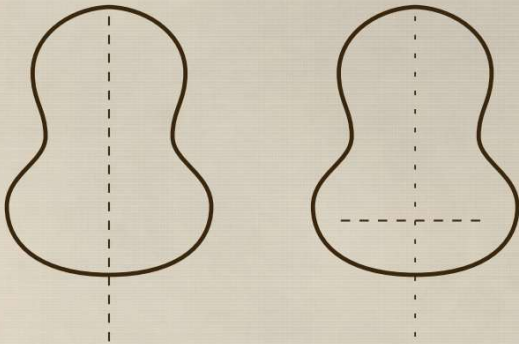
VIII. ARCHITECTURA ACUSTICA

Acoustic Architecture · the resonant modes of the box



A0 · 100 Hz
Helmholtz air mode

T(1,1) · 200 Hz
first monopole of the top



T(1,2) · 380 Hz
cross dipole

T(2,1) · 430 Hz
long dipole

The free top is tapped as the braces are thinned, near 200 Hz with the box open. Air and top must not fall together.

IX. TENSIO CHORDARUM

String Tension · nylon & wound basses, A = 440

Chorda	Hz	kg	Ø mm	Materia
E 4	329.6	7.4	0.71	Nylon
B 3	246.9	5.6	0.80	Nylon
G 3	196.0	5.4	1.00	Nylon
D 3	146.8	6.9	0.73	Wound
A 2	110.0	6.4	0.90	Wound
E 2	82.4	6.4	1.08	Wound

Total tension ≈ 38 kg · downforce on the bridge ≈ 8 kg

X. GRADATIO TABULARUM

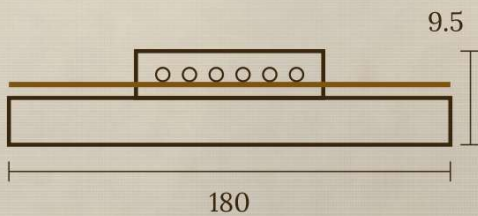
Graduation · the thicknesses of the plates

Tabula, centrum <i>soundboard, at the centre</i>	2.5
Tabula, ad marginem <i>soundboard, at the edge</i>	1.9
Sub ponte <i>under the bridge patch</i>	+1.5
Fundus <i>back</i>	2.0
Latera <i>sides</i>	2.0
Curvatura tabulæ <i>dome of the top</i>	R 4000
Curvatura fundi <i>dome of the back</i>	R 2500

The soundboard is thinned last and by ear: flexed across the grain, tapped at the bridge, until it answers with one clear note.

XI. PONS & SELLA

Bridge & Saddle · rosewood, tie-block & bone



sella & nodus · saddle and tie-block

Longitudo pontis <i>bridge length</i>	180.0
Altitudo tota <i>total height</i>	9.5
Nodus, altitudo <i>tie-block height</i>	12.0
Os, crassitudo <i>saddle, bone</i>	3.2
Os, prominentia <i>saddle above the bridge</i>	3.5
Spatium chordarum <i>string spacing</i>	58.0
Latitudo pontis <i>bridge width</i>	8.0

XII. DIVISIO CHORDÆ

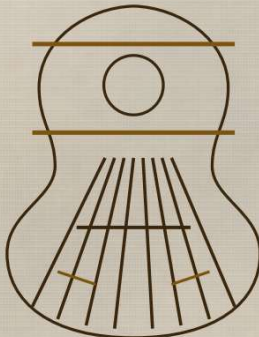
Division of the String · the twelfth root of two

Ponticulus I <i>first fret</i>	36.5
Ponticulus III <i>third</i>	103.5
Ponticulus V <i>fifth</i>	163.1
Ponticulus VII <i>seventh</i>	216.3
Ponticulus IX <i>ninth</i>	263.6
Ponticulus XII <i>twelfth · the half</i>	325.0
Ponticulus XV <i>fifteenth</i>	376.7
Ponticulus XIX <i>nineteenth</i>	433.1

Each fret stands to the next as one to the twelfth root of two, so that the twelfth divides the string exactly in half. The old rule of eighteen erred by a hair at the top of the board, and the ear found it.

XIII. TIGNA & FULCIMENTA

Braces & Bars · the fan beneath the top



Tabula ab intus · the top from within

Tigna flabelli <i>fan braces</i>	8
Tignum, sectio <i>fan brace section</i>	5 × 7
Trabes harmonicæ <i>harmonic bars</i>	2 × (8 × 14)
Trabes ad caudam <i>closing bars</i>	2
Lamina sub ponte <i>bridge patch</i>	1.5
Tigna fundi <i>back braces</i>	4

XIV. NOTA CURATORIS

Curator's Note · the French polish

Gummi laccae <i>shellac flakes, g</i>	200
Spiritus vini <i>spirit, litre</i>	1
Pumex <i>pumice, for the pores</i>	to fill
Oleum olivæ <i>oil, on the muñeca</i>	drops

Fifteen to twenty sessions with the pad, each thinner than the last, and a week's rest before the final spiriting off. The film is left thin enough to bend with the top: a heavy varnish silences a guitar more surely than a heavy brace.

XV. CURA & CONSERVATIO

Care of the Instrument · air, nails and frets

Humiditas <i>relative humidity</i>	45–55%
Temperatura <i>temperature</i>	18–22°C
Chordæ renovandæ <i>strings renewed</i>	60–100 hor.
Ponticuli poliendi <i>frets dressed</i>	5–10 anni
Curvatura inspicienda <i>relief checked</i>	singulis annis

A guitar left slack in a dry room will sink at the soundhole and never quite come back. Keep it strung, keep it cased, and keep the room steady.

XVI. CATALOGUS MAGISTRORUM

Catalogue of Masters · the Spanish school & its heirs

Antonio de Torres, Sevilla	1817–1892
Vicente Arias, Ciudad Real	1845–1912
Manuel Ramírez, Madrid	1864–1916
Santos Hernández, Madrid	1874–1943
Hermann Hauser I, Munich	1882–1952
Ignacio Fleta, Barcelona	1897–1977
Robert Bouchet, Paris	1898–1986

Tabula sicca, pons solutus: cave. — Beware a dry soundboard and a bridge lifting at its wings.



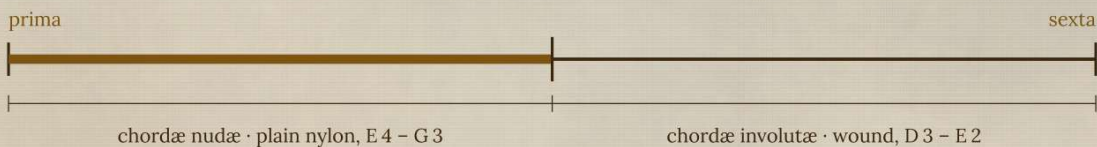
DE OFFICINA

Of the Workshop

Hide glue at sixty degrees, thin enough to run from the brush, and a joint rubbed rather than clamped. The solera on the bench, the plantilla on the wall, a hot iron for the sides and a knife kept sharp enough to cut a rosette tile clean. The tools of this trade have not changed in three hundred years because they were right at the start.

XVII. CHORDÆ

The Strings · nylon drawn, and silver-plated copper wound on floss



Chordæ count	6	Prima first, nylon	0.71
Tensio tota <i>whole bridge</i>	≈ 38 kg	Sexta sixth, wound	1.08
Longitudo <i>speaking length</i>	650	Filum argenti <i>silvered winding</i>	0.16

ARS LONGA · VITA BREVIS · MUSICA AETERNA

Art is long · life is short · music is eternal · ex codicibus deperditis Leonardi · Tabula II de II