



YEAR 1 CLOCK PROJECT DESIGN DRAWINGS

Jon Colombo. June 2014.





This pack contains working drawings and notes made as part of the First Year Clock Project undertaken as part of the first year of the West Dean 2 year Diploma in Conservation and Restoration of Clocks.

The project involves the design and manufacture of an eighteenth century style Hoop and Spur clock. The drawings in this pack represent an 'electronic sketch book'. They are not technical drawings, but are to scale, being used to test out aesthetic and other design considerations during the manufacture of the clock.

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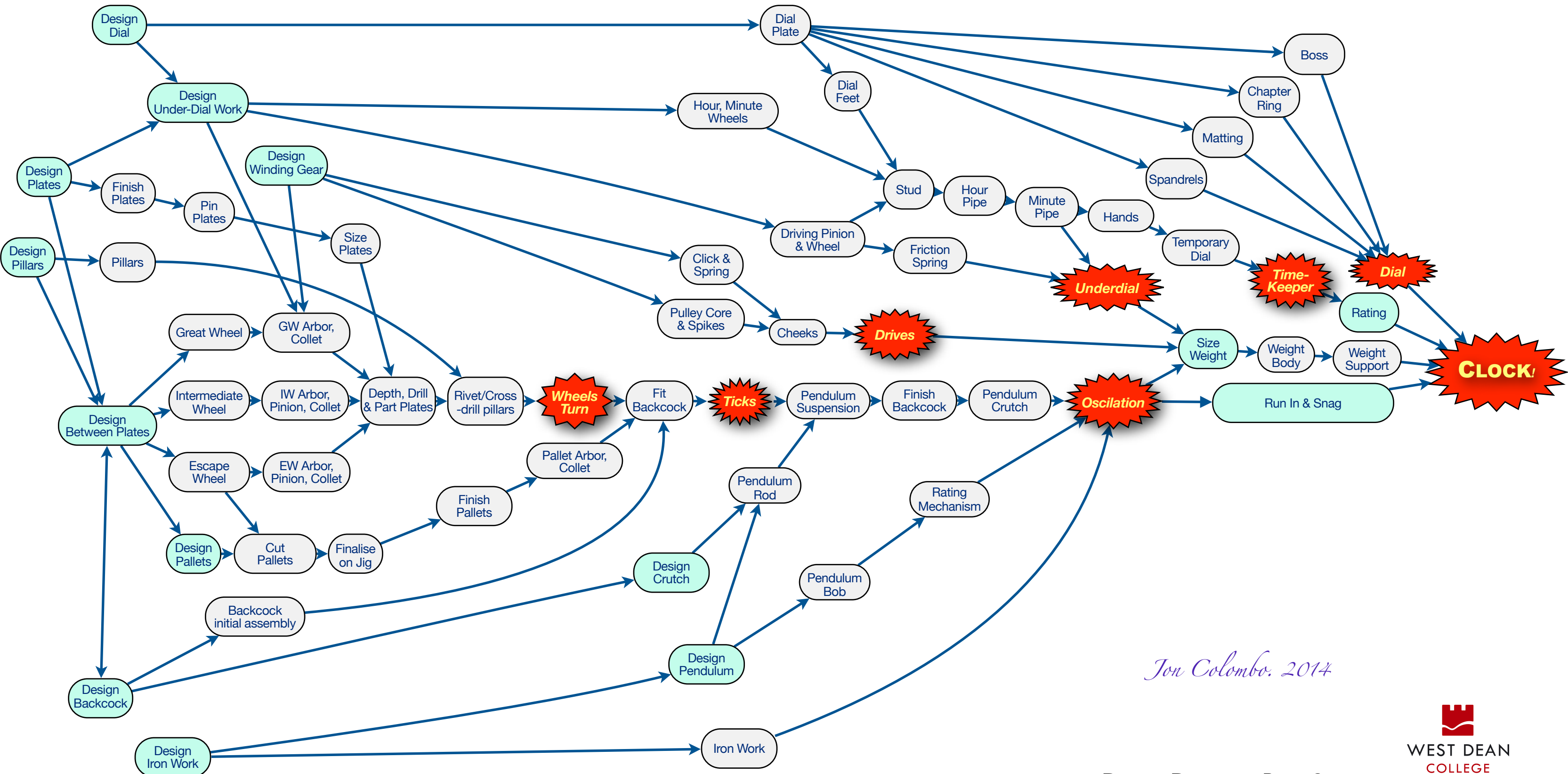


WEST DEAN
COLLEGE
YEAR 1 CLOCK PROJECT

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Planning: Process Flow

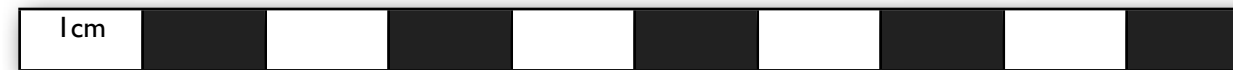
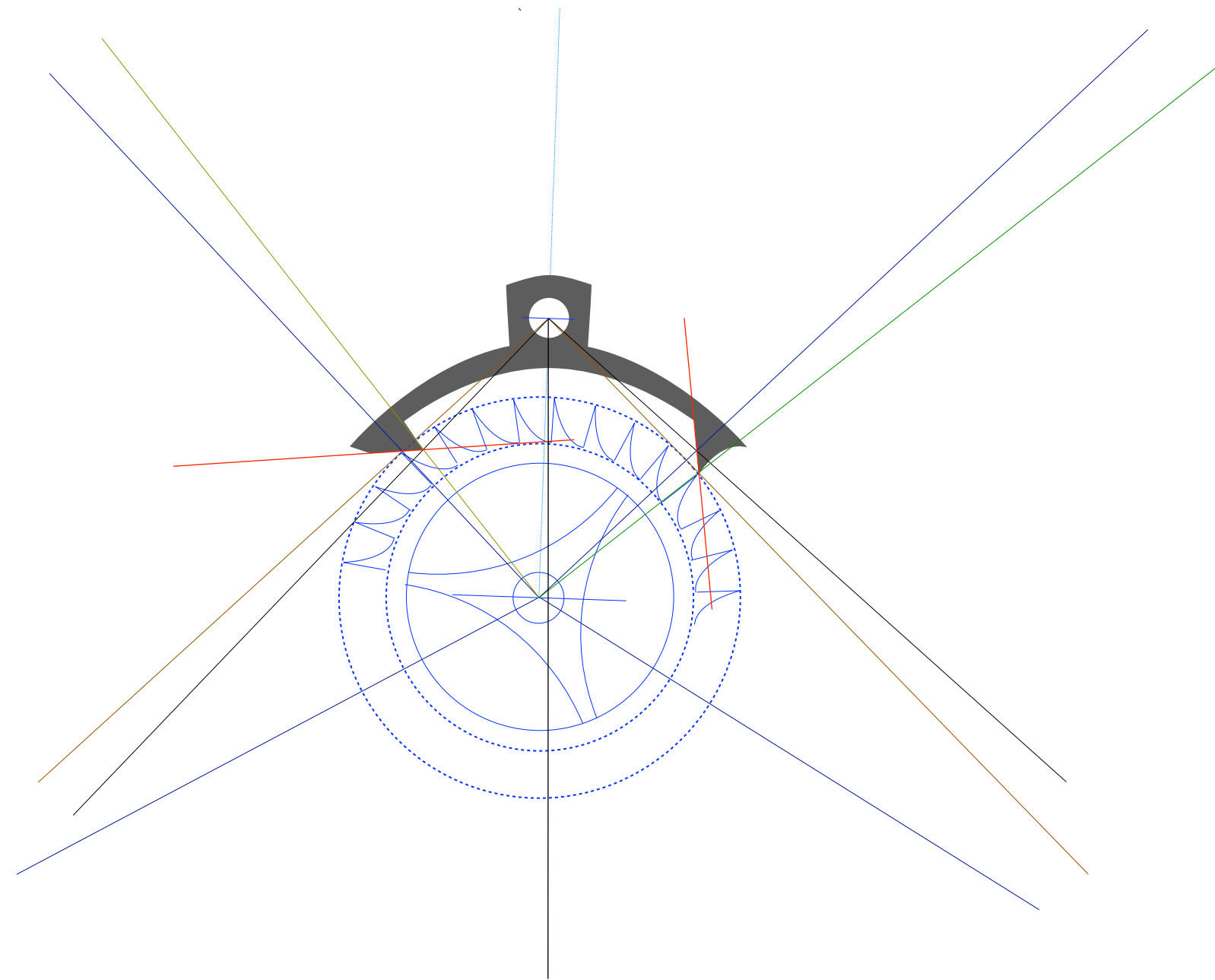


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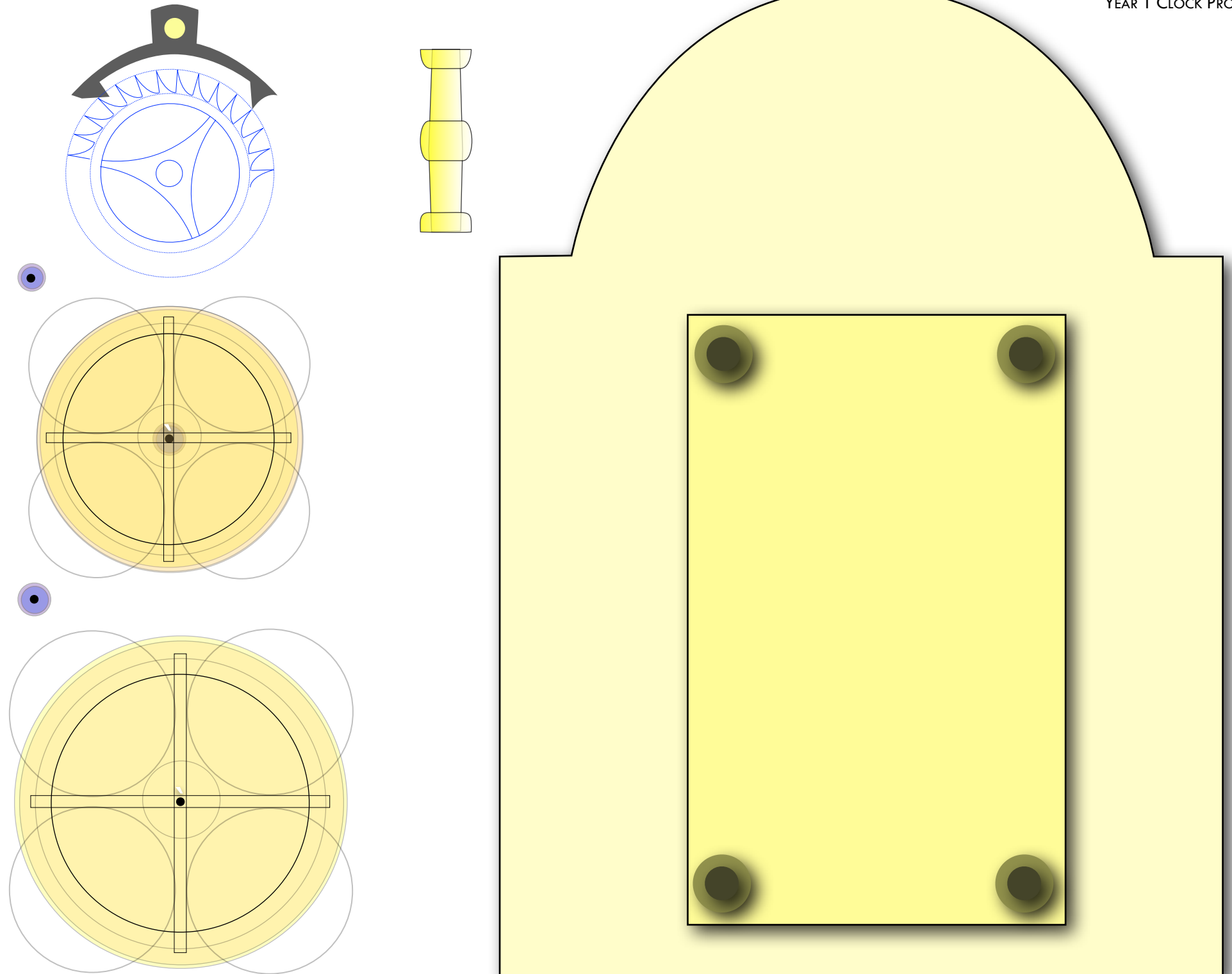
Escapement Design:

Notes:

- 'Square' Escapement
- 30 Teeth = 12° per tooth
- Outside Diameter 43
- Pallets appropriate to 18th Century Clock
- Impulse Angles 5°
- 6° Drop
- 7 1/2 Teeth between Pallets
- Tripod Crossing

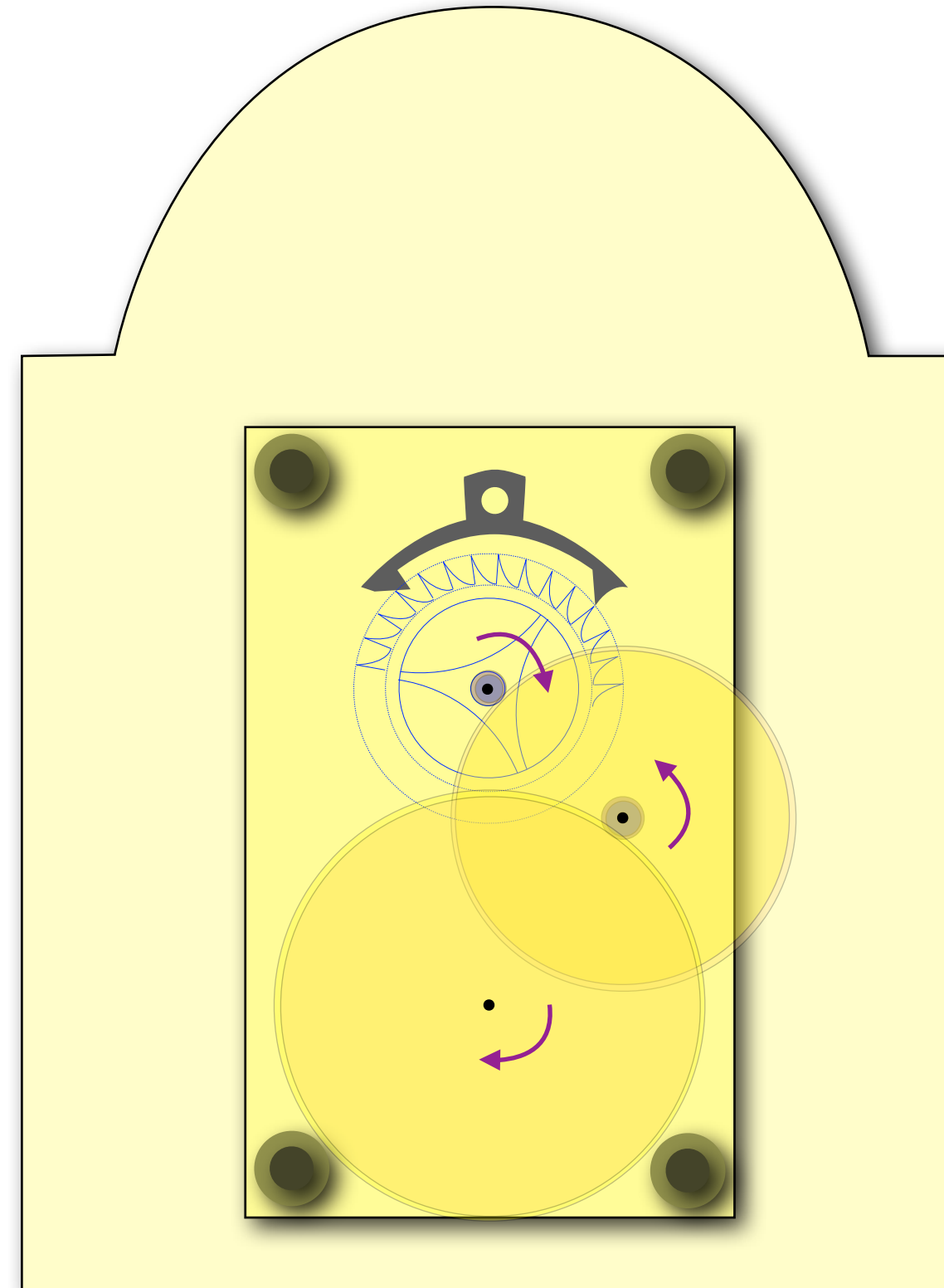


<p>Notes:</p> <ul style="list-style-type: none"> • Numbers in red are given • Wheels to be appropriately substantial • Escape Wheel to be Central - for simplicity • OD Formula for large wheel size is: #teeth + 2.76 x module • OD Formula for 6,7,8 pinions is: #teeth + 1.71 x module • Ideally weights should hang centrally • Pillars c 6:1 height to width ratio 	
<p>Other dimensions</p> <ul style="list-style-type: none"> • Plates: 126 x 78 • Pillars: 12ø max, 7ø min. 	<p>Escape</p> <ul style="list-style-type: none"> • Teeth: 30 • Module: <i>N/A</i> • PCD: <i>N/A</i> • Dia (total): 43
<p>Escape Pinion</p> <ul style="list-style-type: none"> • Leaves: 7 • Module: .65 • PCD: $7 \times .65 = 4.55\phi$ • Dia(total): $7 + 1.71 \times 0.65 = 5.66$ 	<p>Intermediate Wheel</p> <ul style="list-style-type: none"> • Teeth: 84 • Module .65 • PCD: $84 \times .65 = 54.6$ • Dia(total): $84 + 2.76 \times .65 = 56.4$ • Crossing data: <ul style="list-style-type: none"> § Collet: 10ϕ § Crossing c 2 min § Margin of 3 to give 16mm safety § 4 circles of 2.8ϕ @ 43.6 for crossings
<p>Intermediate Pinion</p> <ul style="list-style-type: none"> • Leaves: 8 • Module: .7 • PCD: $8 \times .7 = 5.6$ • Dia (total): $8 + 1.71 \times 0.7 = 6.78$ 	<p>Great Wheel</p> <ul style="list-style-type: none"> • Teeth: 96 • Module: .7 • PCD: $96 \times .7 = 67.2$ • Dia (total): $96 + 2.76 \times .7 = 69$ • Crossing data: <ul style="list-style-type: none"> § Collet: 10ϕ § Crossing c 2.2 min § Margin of 3 to give 16mm safety § 4 circles of 3.42ϕ @ 55.2 for crossings



Fit. Wheels as cut

<p>Notes:</p> <ul style="list-style-type: none"> • Numbers in red are given • Wheels to be appropriately substantial • Escape Wheel to be Central - for simplicity • Wheels have to clear the pillars • OD Formula for large wheel size is: #teeth + 2.76 x module • OD Formula for 6,7,8 pinions is: #teeth + 1.71 x module • Ideally weights should hang centrally • To get PCD given OD, need the Calculating Module = $(OD * Teeth) / (Teeth + 2.76)$... from this the cutter module can be chosen - should always be bigger than the Calculating Module, never smaller. 	
<p>Other dimensions</p> <ul style="list-style-type: none"> • Plates: 126 x 78 • Pillars: 12ø max, 7ø min. 	<p>Escape</p> <ul style="list-style-type: none"> • Teeth: 30 • Module: N/A • PCD: N/A • Dia (total): 43 • Centred 42.3 from top
<p>Escape Pinion</p> <ul style="list-style-type: none"> • Leaves: 7 • Calculating Module: .634 • Cutting Module: .65 • PCD: $7 \times .65 = 4.55$ • Dia(total): $7 + 1.71 \times 0.65 = 5.66$ 5.52 	<p>Intermediate Wheel</p> <ul style="list-style-type: none"> • Teeth: 84 • Calculating Module 6.34 • Cutting Module .65 • PCD: $84 \times .65 = 54.6$ 54 • Dia (total): $84 + 2.76 \times .65 = 56.4$ 55
<p>Intermediate Pinion</p> <ul style="list-style-type: none"> • Leaves: 8 • Calculating Module: .695 • Cutting Module: .7 • PCD: $8 \times .7 = 5.6$ • Dia (total): $8 + 1.71 \times 0.7 = 6.78$ 6.37 	<p>Great Wheel</p> <ul style="list-style-type: none"> • Teeth: 96 • Calculating Module: .695 • Cutting Module: .7 • PCD: $96 \times .7 = 67.2$ 67 • Dia (total): $96 + 2.76 \times .7 = 69$ 68.65 • Centred 34.8 from bottom



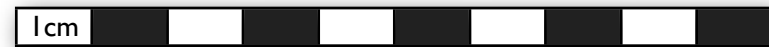
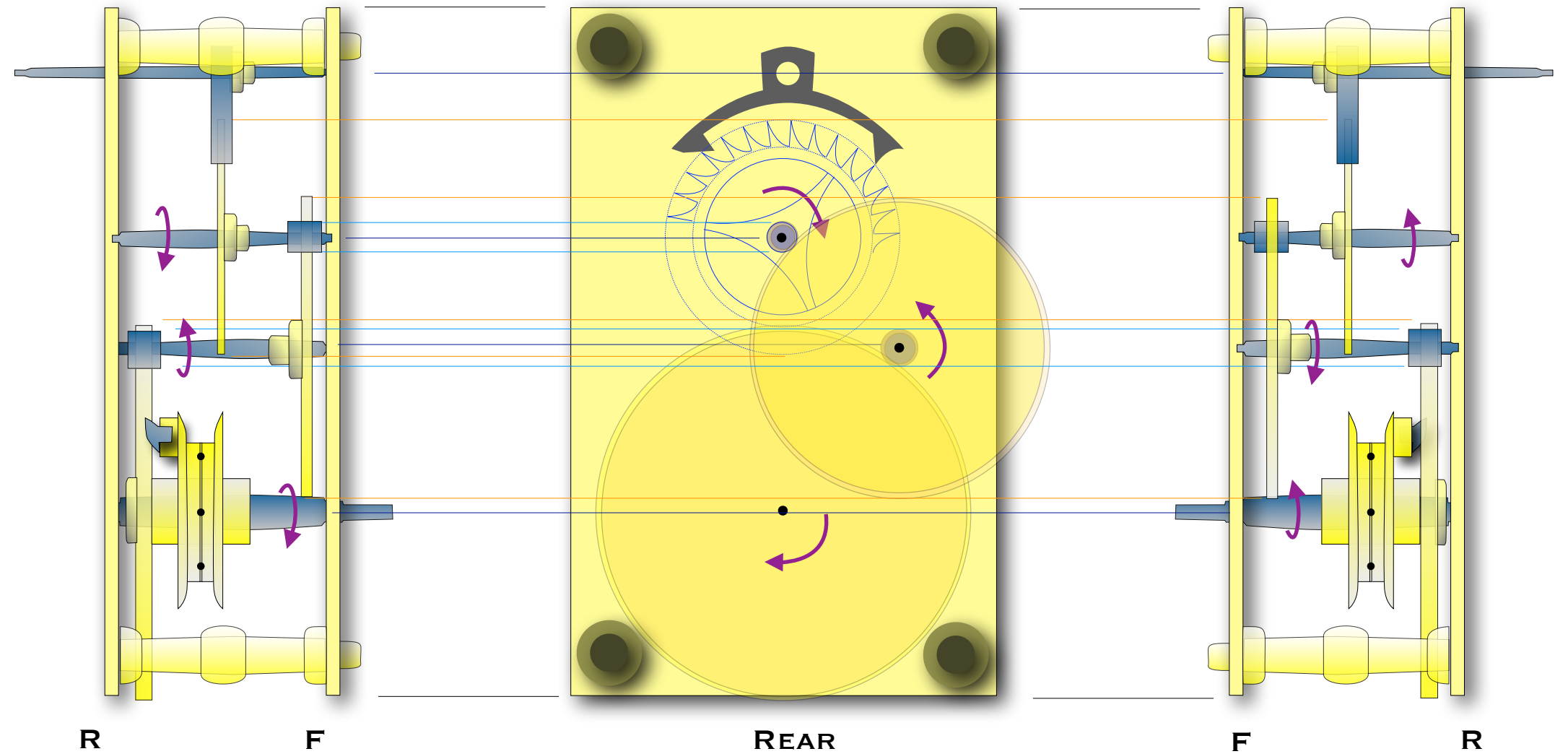
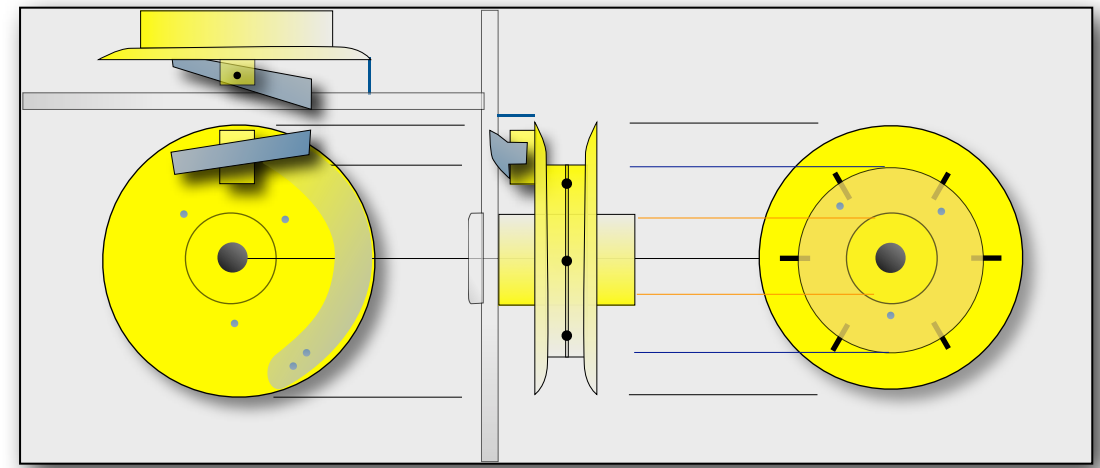
Train. Side profile

Notes:

- Pinion Length should be c 3 times thickness of the engaging wheel and about the same length as its diameter.
- Endshake can be a maximum of .5mm ideally .2 to .3.
- Sprocket should be as close to Great Wheel as possible.

Thicknesses/Measurements:

- Plates (Measured): 2.5
- Pillars (Measured) 37.75
- Pallets (Measured): 3.9
- Escape Wheel (Measured): 1.3
- Escape Wheel to Plate (Derived) 18
- Escape Pinion (Derived): 6.0
- Escape Pinion to Plate (Derived): 1.5
- Intermediate Wheel (Measured): 2.0
- Intermediate to Plate (Derived): 4
- Intermediate Pinion (Derived): 6.0
- Intermediate Pinion to Plate (M): 2.2
- Great Wheel (Measured) 2.2
- Great Wheel to Plate (Derived): <4
- Arbors c3.2ø
- Sprocket:
 - Centre 24.5ø 5.0 wide.
 - Cheeks 36ø 1.5 wide
 - Hub 10ø 18 wide
- Click
 - Brass width 3.3
 - Steel width 3



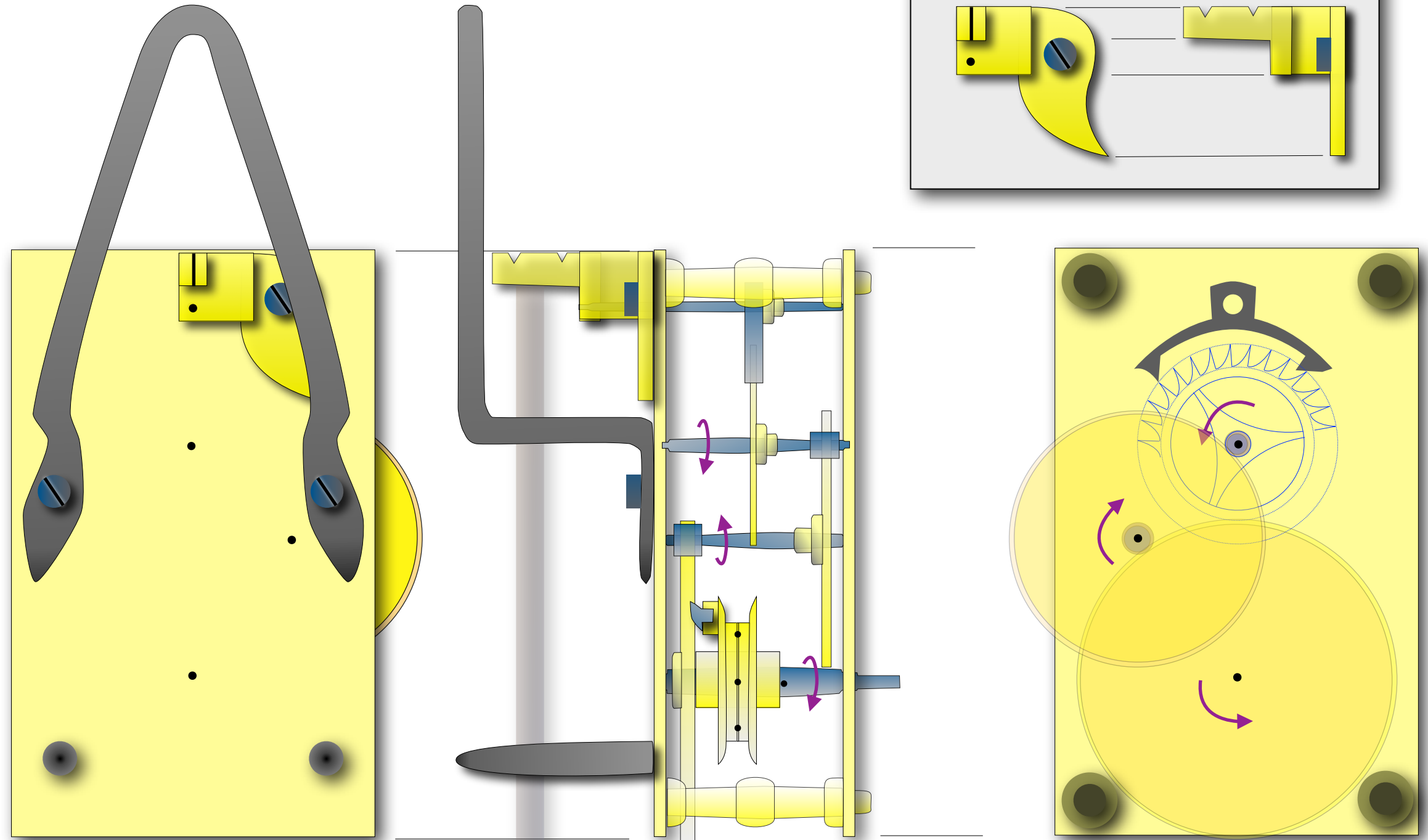
Backcock, Hoop, Spurs

Notes:

- Backcock, mixture of measurement and design - styled after John Whitehurst of Derby.

Thicknesses/Measurements:

- Hoop: 42 deep, 124 high (Measured) - width adjustable
- Screw Holes: 10 from side 52 from top.
- Pivot (Centre line of pendulum) to be at least 15 from wall. (Pendulum will be 15 inches long)

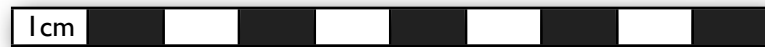


REAR

R

F

FRONT



Pendulum, Suspension, Crutch

Notes:

- 15" Pendulum, should be 17" overall (432mm)
- Spring is 1/4" wide and c 1/2" showing
- Use CZ108 for the Suspension Unit & Bob
- Crutch to be 'pin' type

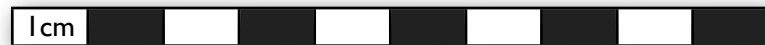
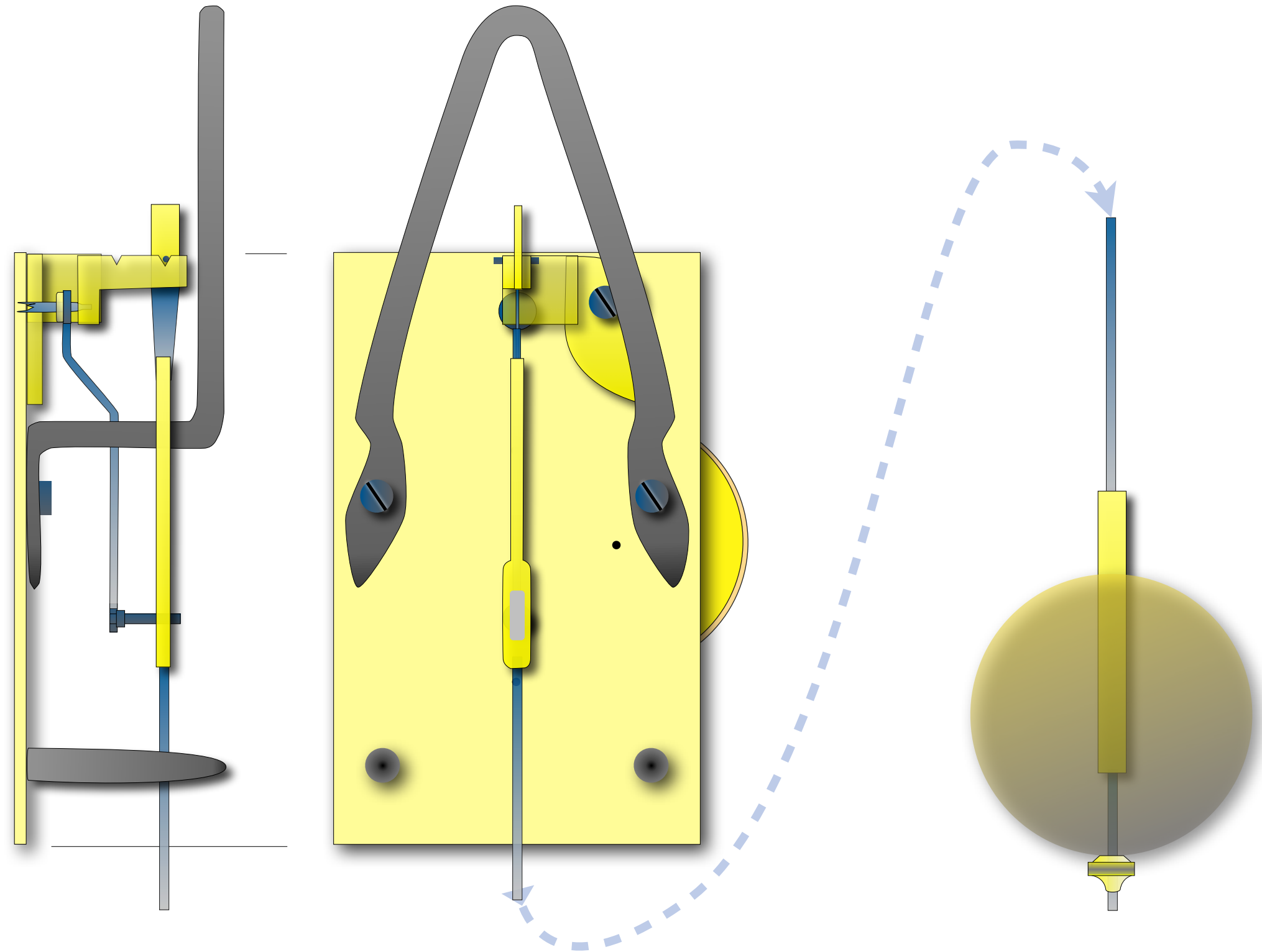
Measurements:

Pendulum

- Suspension Unit 18 High
- Spring 20 L (5mm TB overlap)
- Top block 66 L, 4 D, 6 W (Max)
- Rod (exc threads) 243 3ø
- Slide 60 L, 4 D, 6 W, 1° Taper
- Rating Thread 30 L 3ø
- Bob 60ø

Crutch

- Top circle 1.6 x 7ø
- Oval Section 1.6 x 2 x 60
- Bottom Circle 1.6 x 5ø
- Pin (inc thread) 15 x 3ø, M3 thread



Dial and Under-Dial Fit

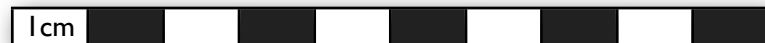
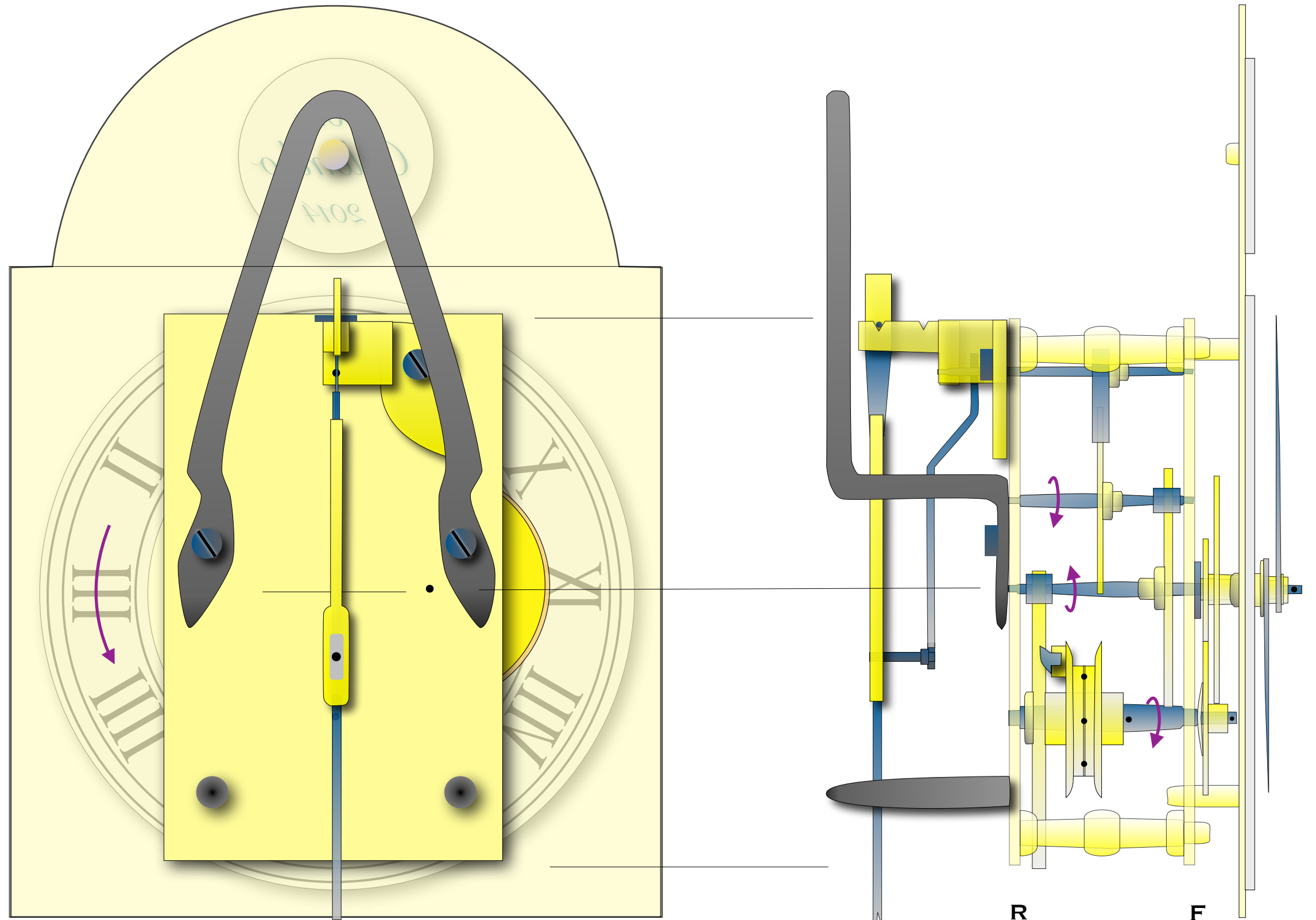
Notes:

- Great Wheel 8 turns in 12 hours
- Working assumption: Dial is 10mm from front plate
- Hour: Great Wheel Ratio 8:1
- Minute: Great Wheel Ratio 2:3
- Great Wheel should not protrude below plates.
- Cut twice around Cannon Wheel, moving cutter on one division to increase gap between teeth

Measurements:

- Great Wheel to Hands Centre: 29.5
- Front plate to dial back: 10
- GW Pinion Centre size: 3.87
- GW Arbor:
 - Max diameter: 6.5
 - Rear Pivot: 3.5 ϕ , 3 long
 - Front Pivot: 4 ϕ , 3 long
 - Between Plates: 37.1
 - Arbor Extension: 2.8 ϕ , 9 long
- Sprocket Pin to end (rear): 30.5
- Underdial Pin to end (front): 1.2
- Sprocket Pin Hole: 1.1 broached
- Underdial Pin Hole: 0.7 broached
- Friction Spring, .8 thick, 1 sprung 30 ϕ

	Teeth	PCD	OD	Thick	Mod	CMod
Hour Wheel	80	52.44	54.3	1.2	6.56	6.5
GW Pinion	10	6.56	8.37	4.5	6.56	6.5
Minute Wheel	36	23.6	25.43	1.2	6.56	6.5
Cannon	54	35.4	37.23	1.2	6.56	6.5



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Dial Aesthetics

Notes:

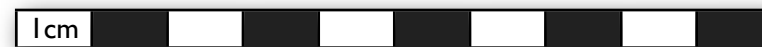
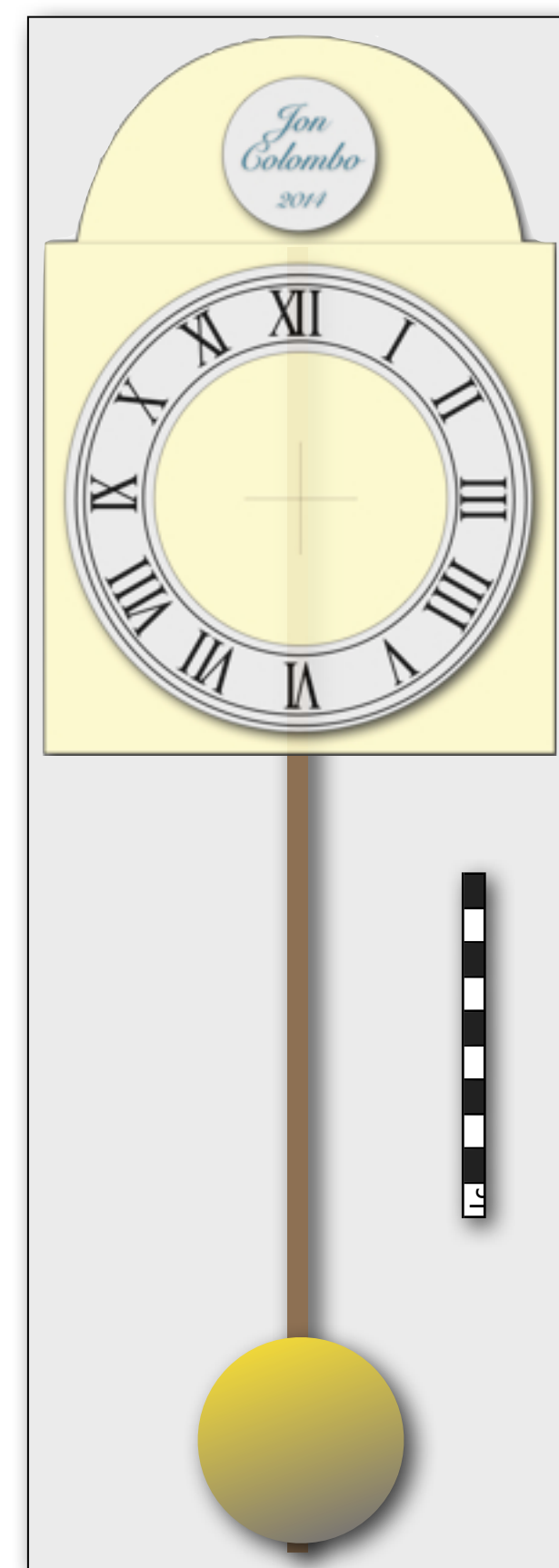
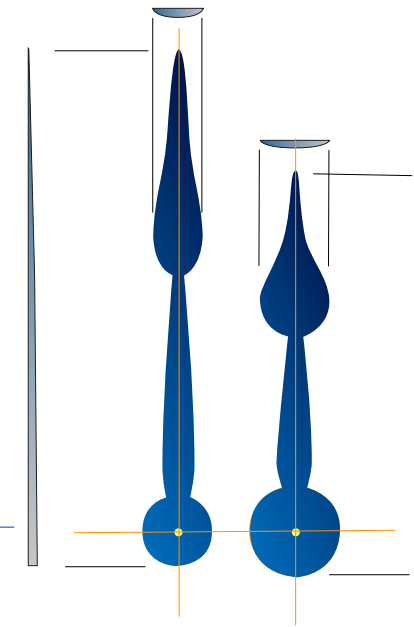
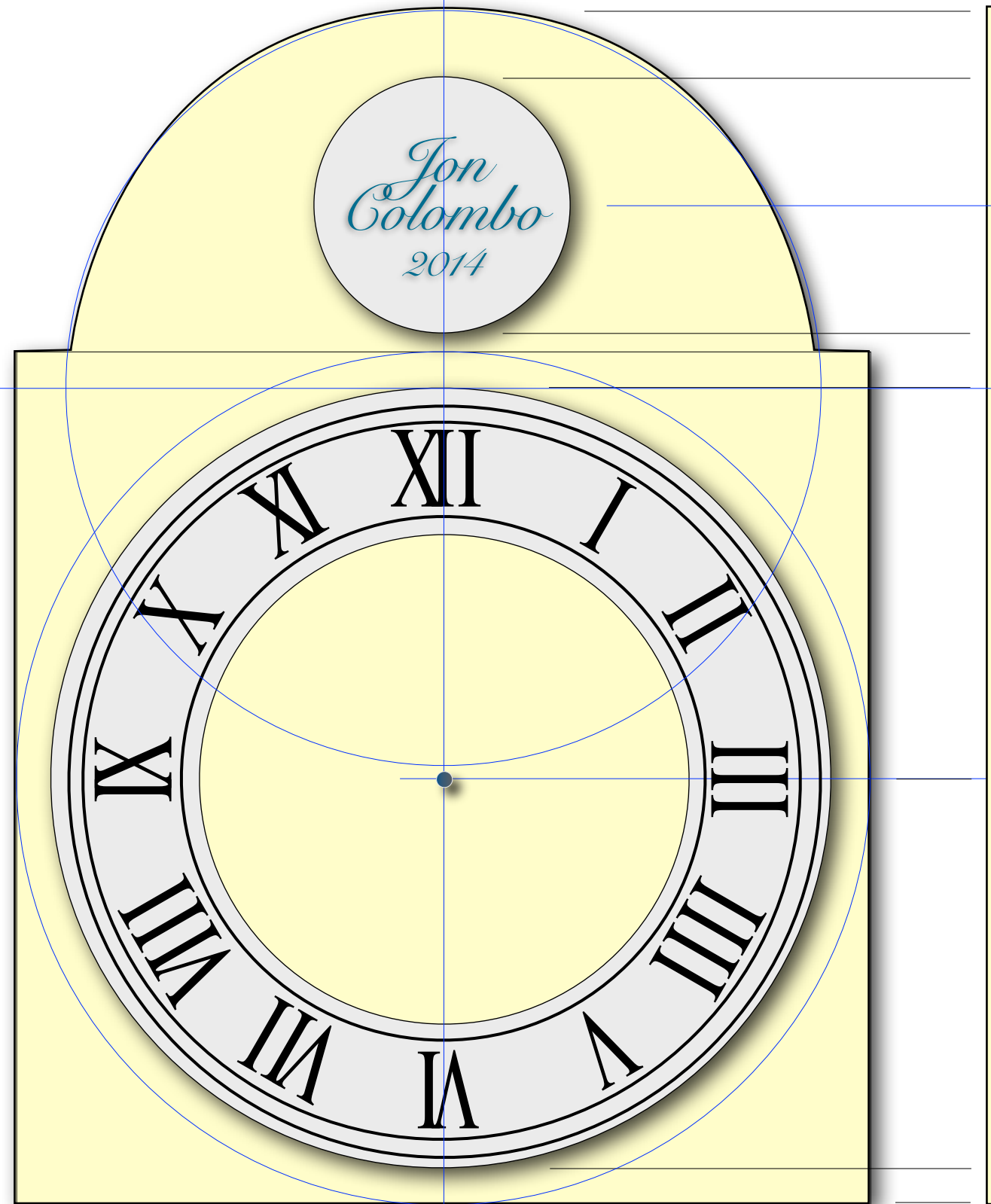
- Dimensions taken from 'Essay Dial' - but chapter ring designed for 2 hands.
- Proportions: Square with Break-arch
- Hands turn around centre of square
- Gap between hands no more than 1mm, ideally 1/2 mm

Measurements:

- Dial
 - Overall Height: 210
 - Square: 150
 - Thickness: 1.5
 - Arch: 132.6 ϕ , 69.1 to centre
- Chapter Ring:
 - Inner, Outer ϕ 86, 137
 - 1/4 hour Ring ϕ 92
 - Minute Ring ϕ 126, 132
 - Thickness 2.0
 - Feet 5 ϕ x 4
- Boss: 45 ϕ , 101.2 to Centre, 2.2 thick
- Minute Hand
 - Boss 9
 - Length 68.5
 - Thickness 1.2 max
- Hour Hand
 - Boss 12
 - Length 53.6
 - Thickness 1.2 max
- Pendulum (15") 381

Materials

- Dial Brass
- Chapter Ring, Boss Silvered Brass
- Hands Blued Steel

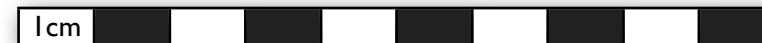
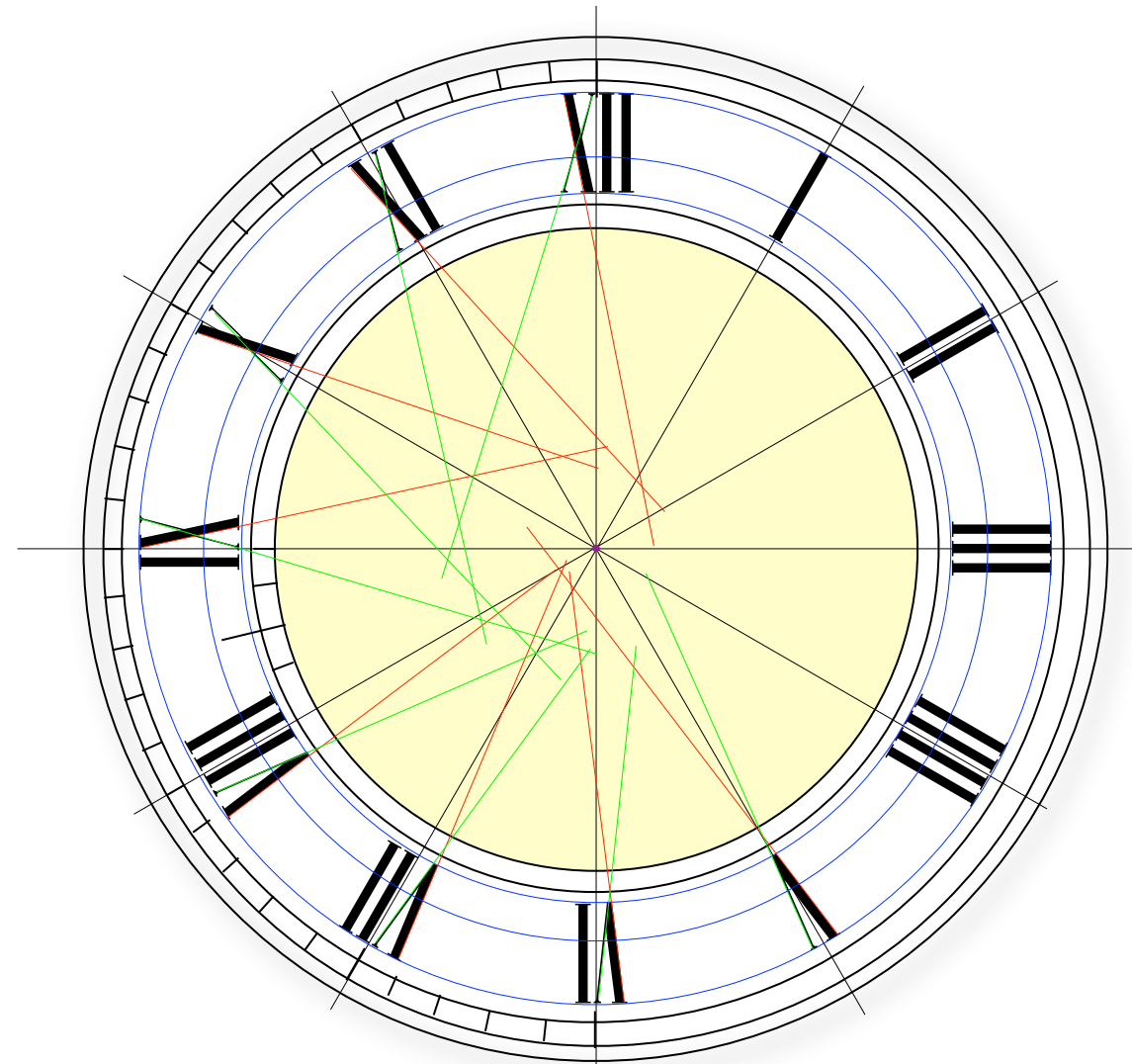


Chapter Ring Engraving

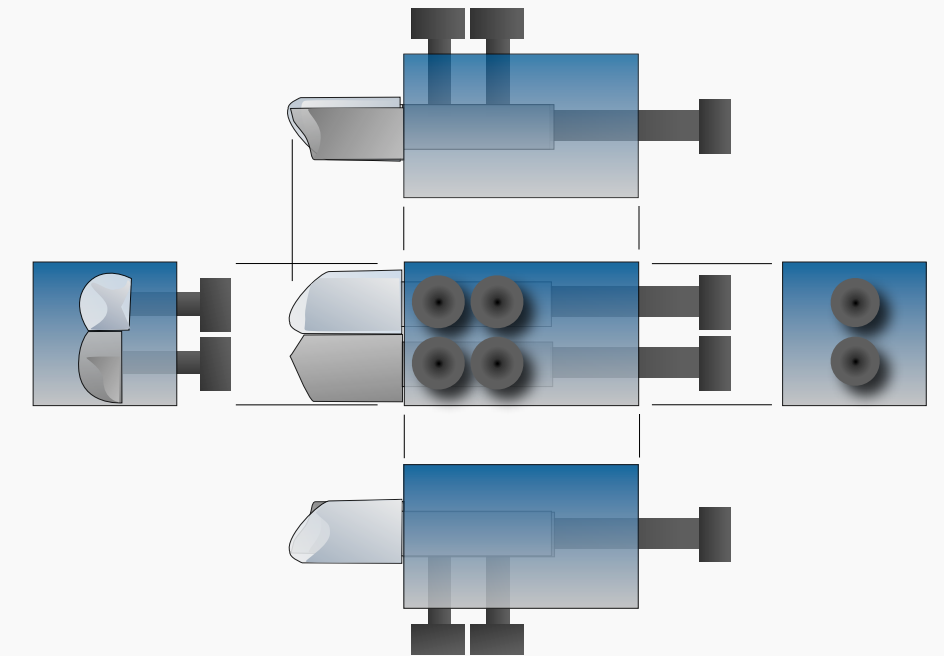
Instructions:

1. Scale to size, reverse, print out on laser for transfer.
2. Transfer to chapter ring blank. (Correctly sized/ finished disc, with feet) with nail varnish remover.
3. Mount on Mandrel with Plywood backing plate.
4. On Lathe, with tool in vertical slide, using dividing head, and working at 9 O'clock:
 1. Lightly scribe 2 top and bottom lines (blue on diagram) R 61 and 47.5mm.
 2. Engrave 3 Minute Rings, r: 66, 63, 46
 3. Engrave hour markers in minute ring and inner rings - helps line up numbers - add in minute, 1/4 and 1/2 hour markers.
 4. Engrave 'l's, c.l.4 mm wide. Use vertical slide to separate l's by 2.5.
 5. Adjust vertical slide to line up with each green line in turn and engrave thin line of X's and V's.
 6. Repeat for each red line in turn engraving thick lines of X's and V's (c.l.4).
 7. Engrave Serifs over the scribed lines.
 8. With boring tool cut out chapter ring.
 9. Hand finish Serifs etc.

For simplicity a standard font has been used, this produces flat letters. Manufactured numbers should follow the construction rings top and bottom.



Cutting Tool



Notes:

- 6 off Commercial M4 Hex Screws.
- Body: Mild Steel bar, filed square.
- Rubber: 10ø Silver Steel, turned, filed to shape, hardened, tempered, polished.
- Cutter: 10ø Silver Steel, turned, filed to shape, hardened, tempered, ground cutting edges.



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