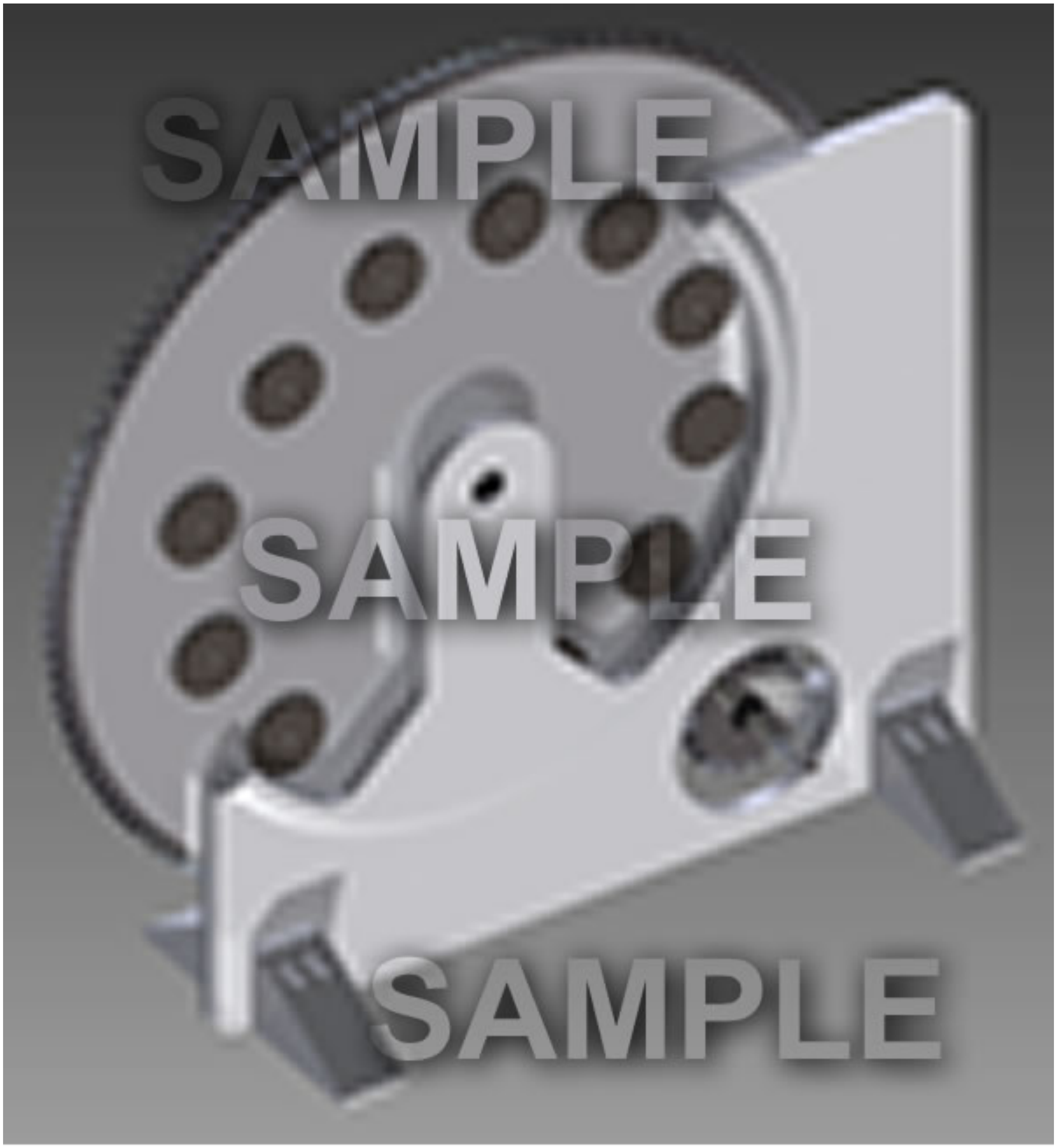
Development of the version 9.3 CCG Wheel

This is a 'snap shot' record of my 'conversations' with Engineer Eddy Rivas. It will help you see how the version 9.3 of the CCG Wheel was developed; which should help you duplicate / replicate the technology.

I needed CAD work done, so I sent out the preliminary information to a few people online.

Eddy Rivas was the only one who responded and he responded with this:



Obviously this wasn't the CCG Wheel, but it was an excellent close beginning from the limited information that I'd given and convinced me that it was worth following up with Eddy; he goes the extra mile!

The following pages are not my complete 'conversation' but should give you an idea of the creative process.

Centripetal Centrifugal Gravity Wheel (CCG Wheel) V 9.2

Engineer:
Eddy Rivas.

Date: 06/09/2015.

Introduction

This document describes and details the design of each of the components that comprise the CCG Wheel v9.2 system: Geometry, dimensions, recommendations for its manufacture and the assembly process. All this, under the guidelines previously proposed by the customer.

In the first part an overview of the system is given, identifying the components and subsystems that involve it. Later, in a more advanced stage of the content, these subsystems and its element will be described.

After the system is known, the assembly process will be detailed step by step, as a guidance for the user to get acquainted with the operation. Finally, in the final section (annexes) will be presented the blue prints and additional information of the components.

General structure of the system

According with the information provided for the client, the CCG Wheel is a system intending to exploit the gravitational energy, making it useful and storable.

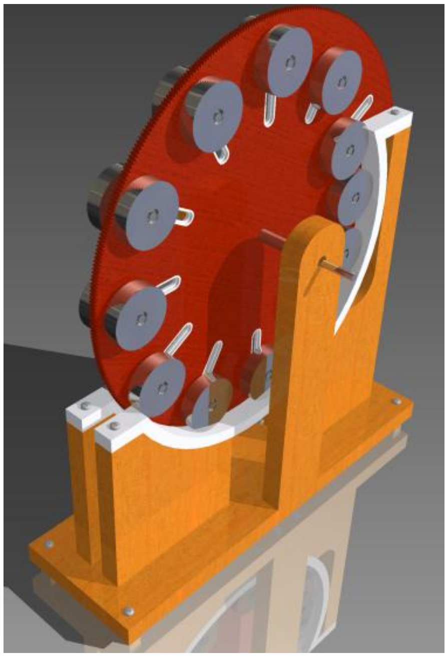


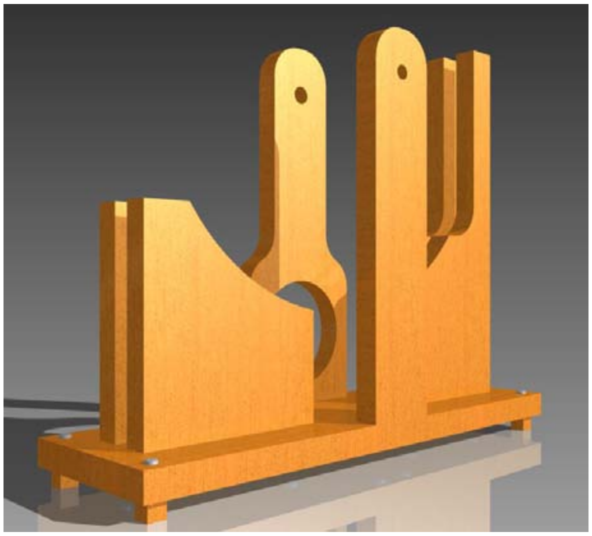
Figure. To be described.

The system is composed by following subsystems:

Frame

This is the main structure of the system, supports all the others and maintain the output shaft in an appropiate distance from the CR's center point. Components:

- ✓ 2 Support panels type A.
- ✓ 2 Support panels type B.
- ✓ 1 Frontal support.
- ✓ 1 Rear support.
- ✓ 1 Main base.
- ✓ 4 Ground supports.
- ✓ 1 auxiliary base.



Figure

Centripetal Ramp (CR)

Figure. To be described.

The CR constrain the cilindrical weights in a curved trayectory to the inner weights circle. Components (fasteners not included):

- ✓ 2 CRs (Centripel Ramps).

Power input system (CR)

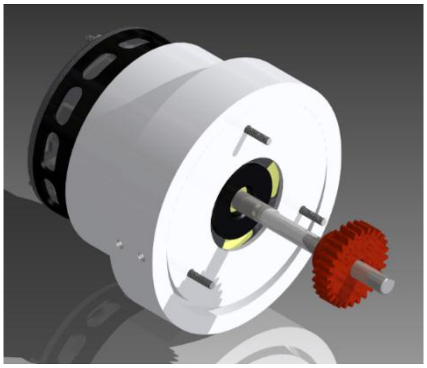


Figure. To be described.

This system empowers the main wheel through the input power pinion and can lead the motor housing up and down (fasteners not included):

- ✓ 2 Axials retainers type B.
- ✓ 1 Power input pinion.
- ✓ 1 Dayton AC Motor 60Hz, 1/8 hp.
- ✓ 1 Motor Housing.

CCG Wheel

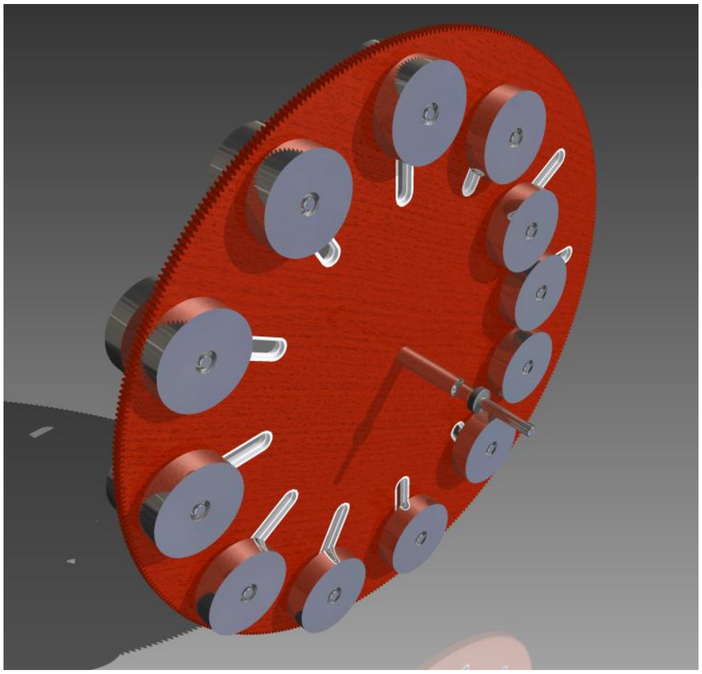


Figure. To be described.

This is for sure the principal system and with the CRs, comes to be the innovating component in this technology. With the movement of the weights and the rotation of the main wheel, it is expected to generate a torque in the output shaft. Components:

- ✓ 1 Long shaft (Output shaft).
- ✓ 12 Short shatfs (Weight shafts).
- ✓ 24 Bored shatfs (Weights).
- ✓ 24 Axial retainers type A.
- ✓ 1 Main wheel.
- ✓ 26 **SKF R 8-2Z** roller bearings.

Frame components

Below will be described each component of the frame:

- ✓ Support panel type A:

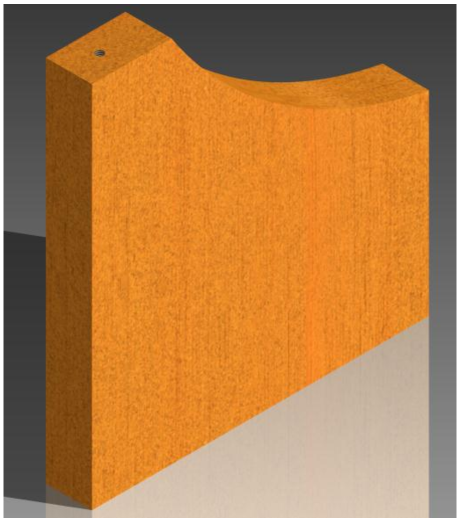


Figure. To be described.

It takes partially the weight of the CR and can be manufactured in structural wood with medium-high density, like pine wood, for example. It is fixed by fastener to the main base. Its dimensions will be detailed in blue prints at the final part of this document.

- ✓ Support panel type B:

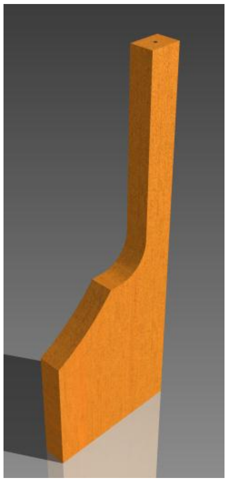


Figure. To be described.

This support takes a bigger porcentage of the weight than the above, because of the position it has in the structure, being bellow of the most closed part of the curve, respect to the trayectory of the weights. It is fixed to the main base by fasteners, and could be manufactured in the same materials of the type A, its dimensions will be detailed in blue prints at the final part of this document.

- ✓ Main base:

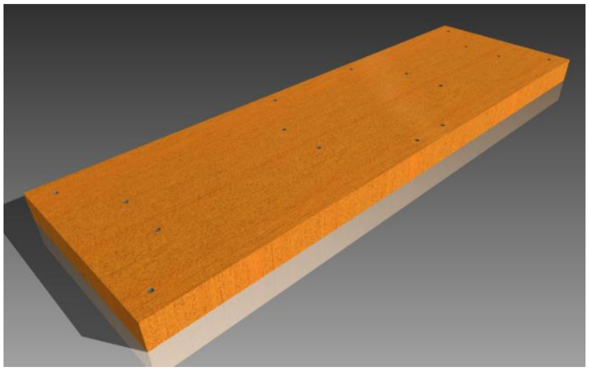


Figure. To be described.

The main base take the weight of the whole system, excepting the ground supports. Aditionally, this component maintains adequately spaced the supports type A and B each other. Same material the supports above. Its dimensions will be detailed in blue prints at the final part of this document.

- ✓ Frontal support:

Figure. To be described.

This component supports and retains the output shaft, and has a hole with two diameters in which the bearing is seated. Is fixed to the main base by fasteners.

- ✓ Rear support:

Figure. To be described.

It has two important functions in the whole system, the first is to support and retain the output shaft, and the second is to serve as a housing for the power input system (excepting the input power pinion). Same recommendations of the other supports, about the manufacturing materials.

- ✓ Auxiliary Base:

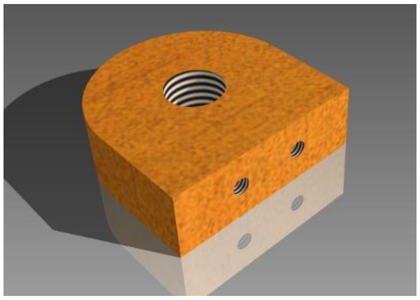


Figure. To be described.

This component is fixed by fastener to the lower section of the rear support, it serves as a base for the lifting bolt, which the user must use to lead up or down the motor housing, achieving in this way mate or not the pinion from the main wheel, varying the center distance between them.

Centripetal Ramp component

- ✓ Centripetal Ramp (CR):

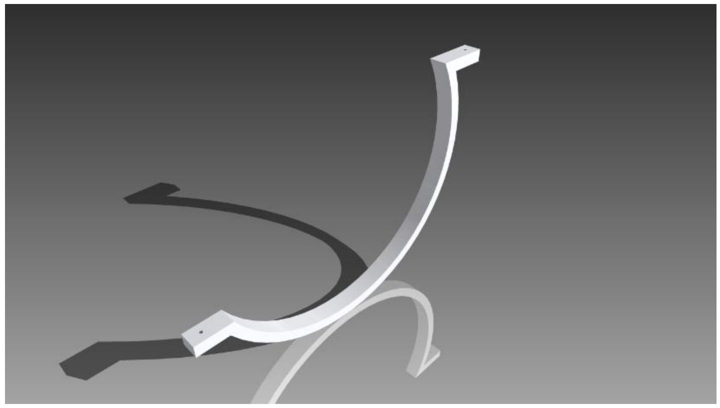


Figure. To be described.

The centripetal ramp forces the weight to get inside to the inner weight circle. In systems like this, it is necessary to save power as much it is posible, and this component in particular, represents a large surface of contact and power losses by friction. In this sense, the power losses will be in function of the superficial rugosity of the element, product of manufacturing finished and the caracteristics of the material to be specified for the component.

It was specified polished stainless steel (AISI 304) for the weights as a request by the client, that is because it is recommended to specify PTFE (Teflon) for the CR, being that the friction coefficient between this two materials is aproximately 0.04. Teflon is a comercial product and it is easier to machine than other materials with similar superficial caracteristics.

On the other hand, the CRs will be fixed to the support panels by fasteners, and they will be separated 1.125 in each other.

Power input system components

- ✓ Motor:

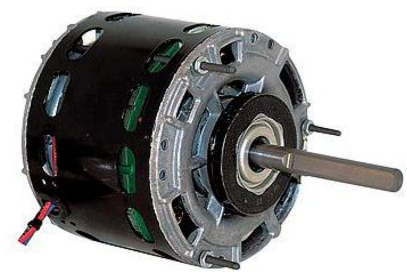


Figure. To be described.

The motor was suggest by the client, this supply the power giving the momentum to the main wheel, which after a while is expected to start working by itself.

- ✓ Motor housing:

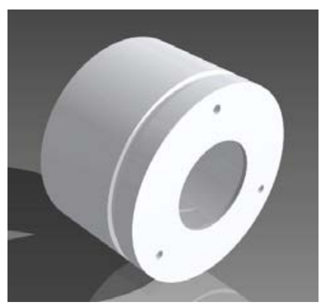


Figure. To be described.

In there, the motor will be seated, providing an outer surface with low friction (being that the material specified in this case is TPFE); it will be useful for leading up and down the motor. The housing has a groove where will be inserted the rail machined on the axial retainers type B surface, as it is explained below.

The component has also a planar face at its rear section which is facing the flat bottom of the lifting bolt. This bolt supports the weight of the motor and the housing, then, they will move vertically to the same extent as the bolt does it (and as long as the axial retainers allow).

- ✓ Axial retainers type B:

Figure. To be described.

In the image above, it can be seen the rails machined in the interior surface of the component, the observer could get confuse about the its geometry, and its basic form (when both retainers get assembled in the rear support) is indeed, two cirfunferences with a 0.25 in of distance between their centers, and that is why this length is the maximum height variation for the motor. This system only allows one degree of freedom for the motor movement (over the vertical axis).

- ✓ Power input pinion:

Figure. To be described.

The power input pinion will drive the spin of the motor shaft to the main wheel. It will be assembled with the power source (motor) with a prisoner placed against the motor shaft's planar face. The pinion will mesh with main wheel with 0.106 in of working depth; it means that a variation from its couple bigger than that, will be enough to stop transmiting power from the motor to the main wheel. It is specified Oak wood for its manufacture. The additional information about this componente will be presented in the annexes section of this document.

CCG Wheel components

- ✓ Long shaft:

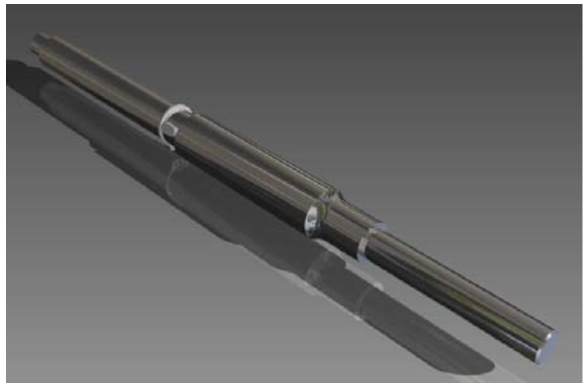


Figure. To be described.

In this shaft rests the main wheel, and they are assembled by a key. There is also a retaining ring for the gear to be seated axially. The shaft is supported by two deep groove roller bearing (SKF R 8-2Z), and have an extention beyond the first bearing (which is placed in the frontal support) for future adaptations of power taking.

In this case, it is specified steel (AISI 4140 Annealed) as manufacturing material. Blue print with more information in annexes section.

- ✓ Bored shaft (weight):

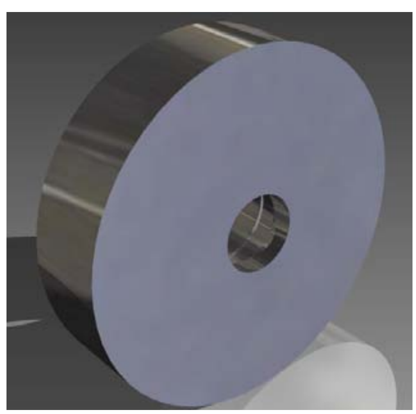


Figure. To be described.

This component serves as weight, but, it is indeed a bored shaft. It has a hole with two diameters where will be placed a deep groove roller bearing (SKF R 8-2Z) with help of an internal retaining ring. It was specified AISI 310 annealed polished (stainless steel), and it is important for the client to know that intending to achieve the minimum energy losses, I must be given the best surperficial finished featured by the manufacturer, taking in count that better finished means higher costs of production.

- ✓ Short shaft:

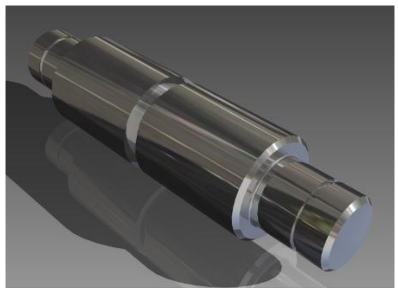


Figure. To be described.

It would be the support for the weights in their ends, and it is the mean by which they get connected with the rest of the CCG Wheel system. This shaft has a central groove to assembly with the rail, machined in the axial retainers type A, this conection constrains its translating movement but not its rotation on the axial axis of the shaft. The element can also move along the rail direction, in and out in the main wheel radius.

It is specified AISI 4140 annealed and polished (carbon steel). The best surface finished for the central section (largest diameter and groove) will be ideal, but, as is has been expressed above, the cost of production must be taken in count.

- ✓ Axial retainer type A:

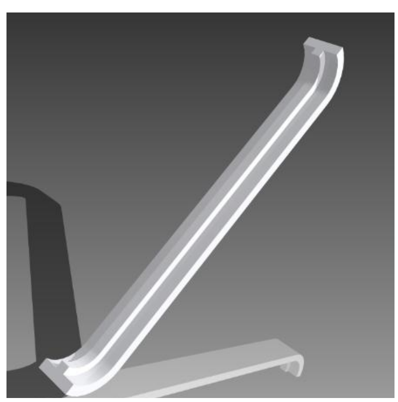


Figure. To be described.

This component would be inserted in the main wheel slots, and it will be seated by interference fit to avoid its lateral movement. It has a machined rail where the short shaft groove will be inserted. This component constrain those shafts and maintains them at a suitable distance from the main wheel lateral face.

For this element was speficied PTFE (Teflon), due to the surface caracteristics it posses.

- ✓ Roller bearings:

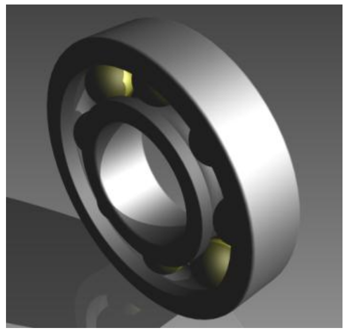
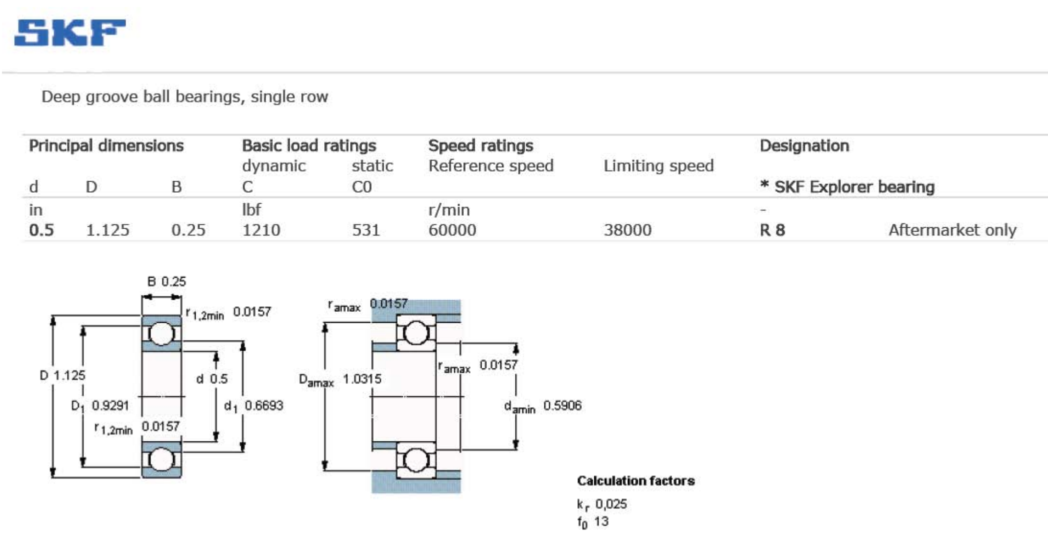


Figure. To be described.

The client had suggested a sealed roller bearing, but, this could represent a disadvantage, being that the seal of those components could generate more friction losses, because it has more surface in contact, thus, it was considered appropiate specify an open roller bearing, in substitution of the sealed one. Below its caracteristics are shown:



SKF

Deep groove ball bearings, single row

Principal dimensions			Basic load ratings		Speed ratings		Designation	
			dynamic	static	Reference speed	Limiting speed		
d	D	B	C	C0			* SKF Explorer bearing	
in			lbf		r/min		-	
0.5	1.125	0.25	1210	531	60000	38000	**R 8**	Aftermarket only

Figure. To be described.

- ✓ Main Wheel:

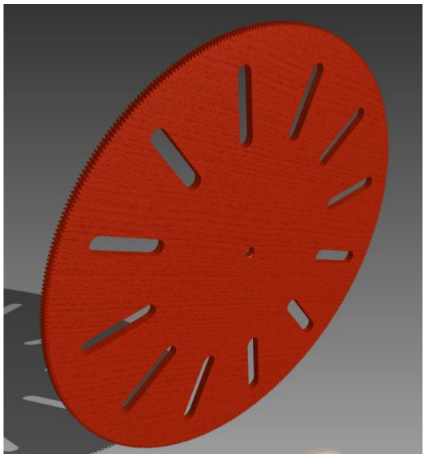


Figure. To be described.

The main Wheel is indeed a gearwheel and it will mate the input power pinion. It has 12 slots in which the axial retainers will be placed, and it has also two grooves machined in its inner diameter. This Wheel rests in the long shaft and transmits its torque by a mating between the grooves and the long shaft key.

Its geometric caracteristics as a gear will be given in the annexes section. For this element was specified the same material that for the pinion (Oak Wood).

Assembly Procedure

Once the general system and its parts have been known, the next stage is to describe step by step the assembly process.

- ✓ Step 1: Placing the frame base.

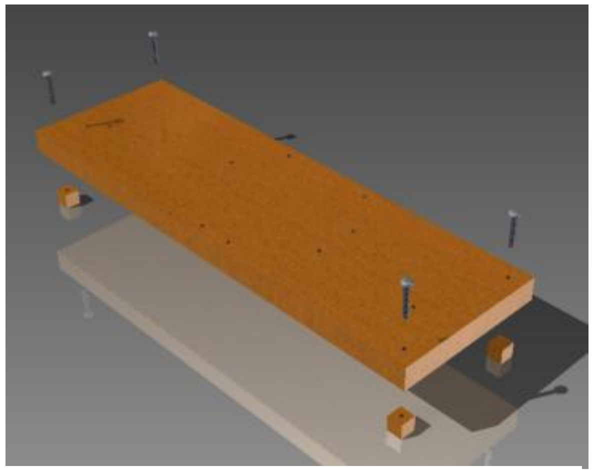


Figure. To be described.

First, the user must install the 4 ground supports to the main base by 4 cross recessed binding head machine screws type I (**5/16-18x2 UNC**) as it is shown above in the image. Then, it would be practical to place it on a desk.

- ✓ Step 2: Mounting Support panels and the CRS.

Figure. To be described.

The next is to install 3 support panels and the CRs in their places by 4 cross recessed binding head machine screws type I (**5/16-18x2 UNC** for the CRs) and by 6 cross recessed binding head machine screws type I (**5/16-18x2,5 UNC** for in the bottom of the panels).

- ✓ Step 3: Setting the long shaft in the main wheel.

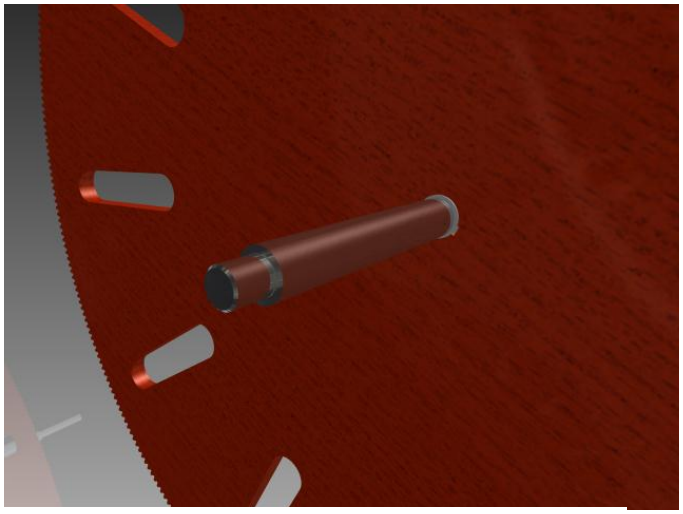


Figure. To be described.

Place de long shaft inside the inner diameter of the main wheel, taking care of the key to be mate with the groove, and then, setting the external retaining ring.

- ✓ Step 4: Setting one weight.

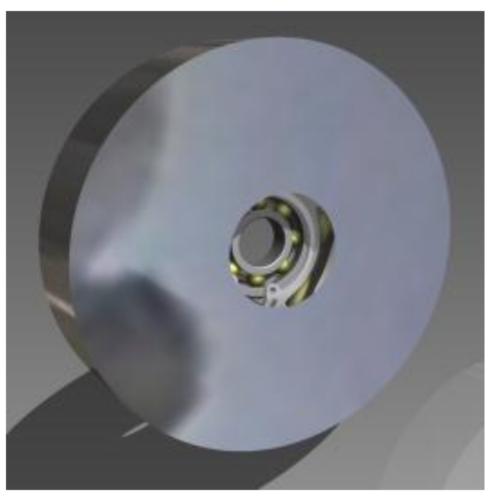


Figure. To be described.

As it is shown above, seat the roller bearing inside the weight and fix it setting the internal retaining ring.

- Step 5: Placing the short shaft.

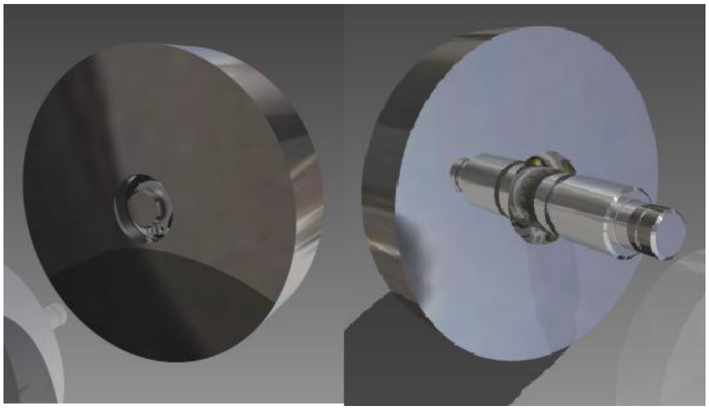


Figure. To be described.

Mount the shaft in the inner track of the roller bearing and constrain it with the external ring (left image).

- Step 6: Mounting in the Main wheel.

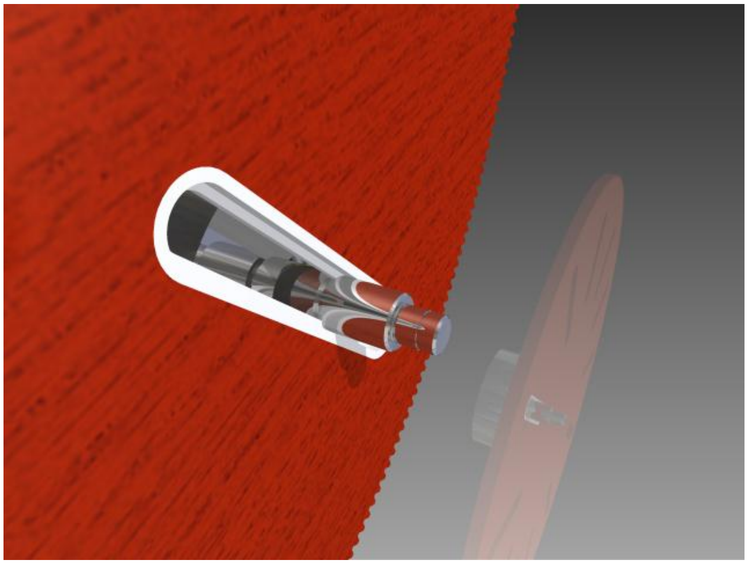


Figure. To be described.

Set one axial retainer above and below of the shaft by introducing the rails in the shaft groove, the place it by interference fit, then, seat all this components in the main wheel slots, as it is shown in the figure.

- ✓ Step 7: Installing the weight in the oher side of the main wheel.

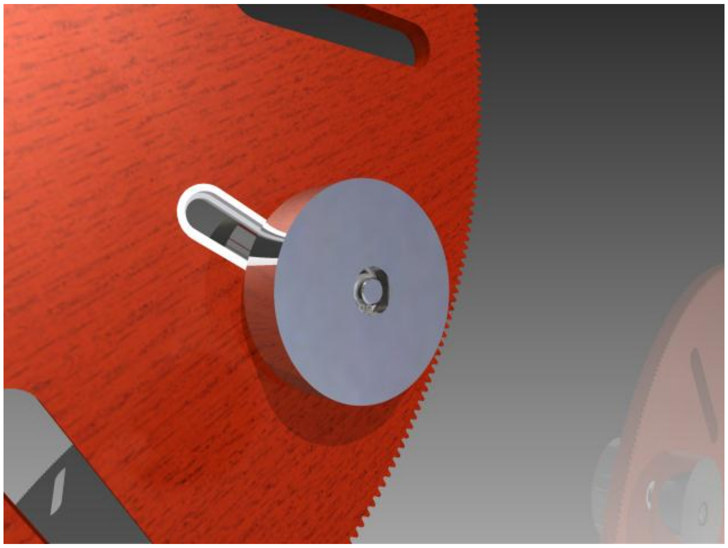


Figure. To be described.

Install the weight and the accessories on the opposite side, in the same way that the first one. Then, repeat this procedure with the further weights.

- ✓ Step 8: Seating the the roller bearings in the supports.

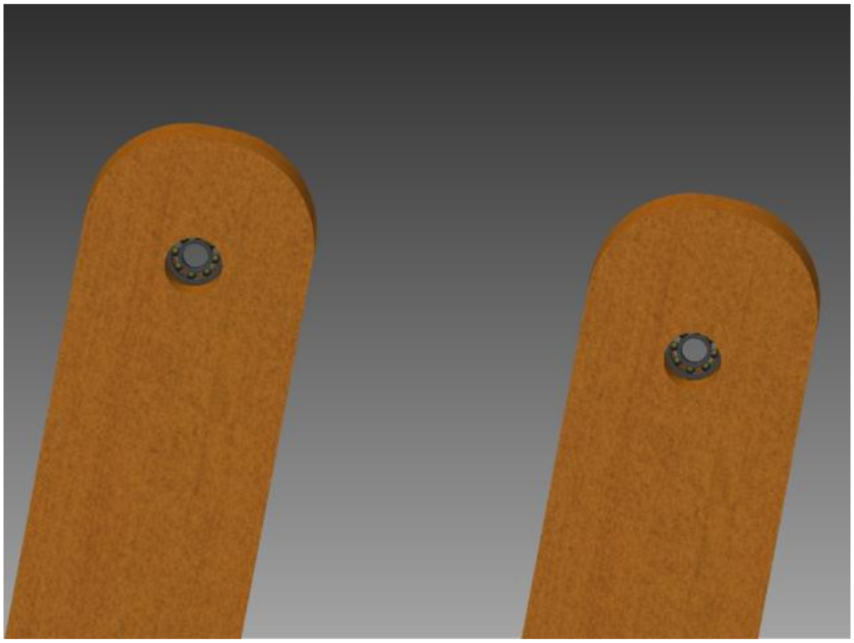


Figure. To be described.

Seat the roller bearings in their respective places into the supports (frontal and rear).

- ✓ Step 9: Mounting the main wheel on the supports.

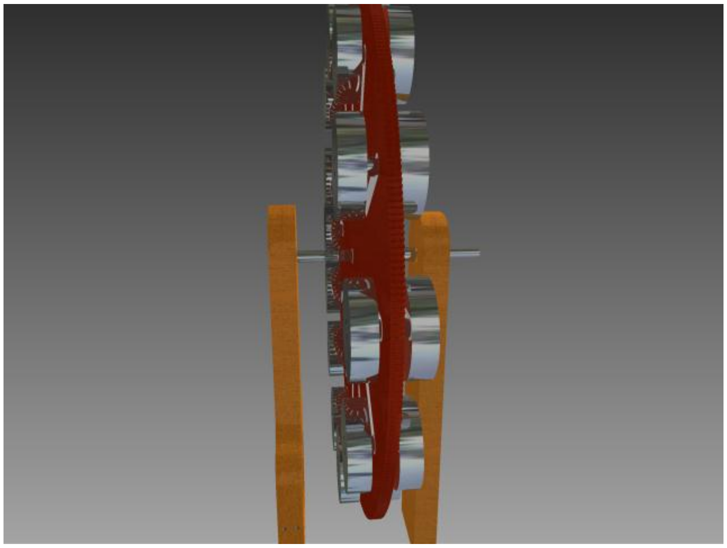


Figure. To be described.

The next is to mount the long shaft on inside the roller bearings in the support.

- ✓ Step 10: Installing the front support and the rear support on the main base.

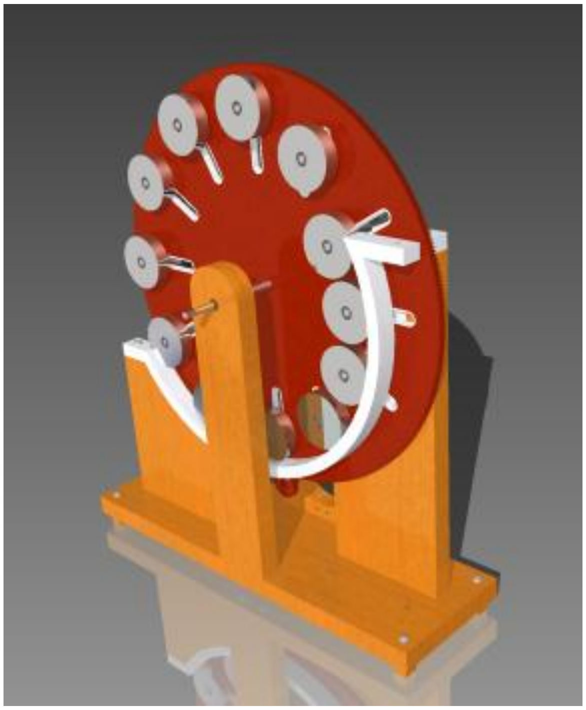


Figure. To be described.

Once the the CCG Wheel and the supports are assembled, these supports (rear and front) are installed on the main base.

- ✓ Step 11: Installing the front support and the rear support on the main base.

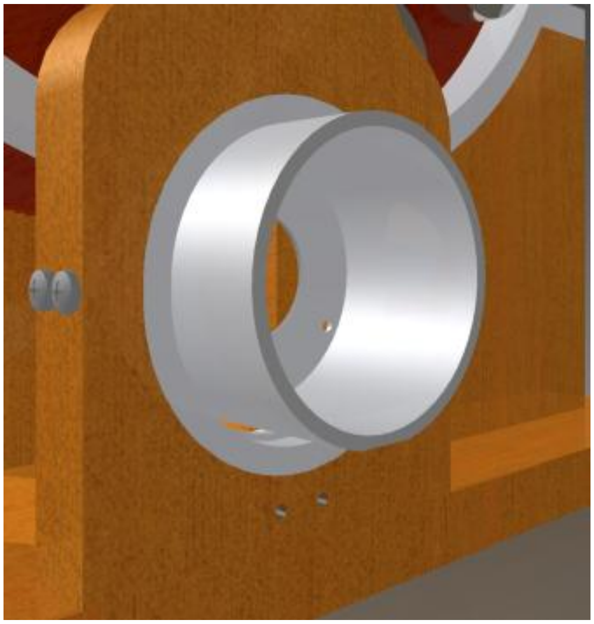


Figure. To be described.

Face the axial retainers type B each other, inserting the motor housing between them, mating the rail with the groove. Then, install the assembly in the rear support by 4 cross recessed binding head machine screws type I (**5/16-18x1.25 UNC**, 2 on each side).

- ✓ Step 12: Placing the motor and the auxiliary base.

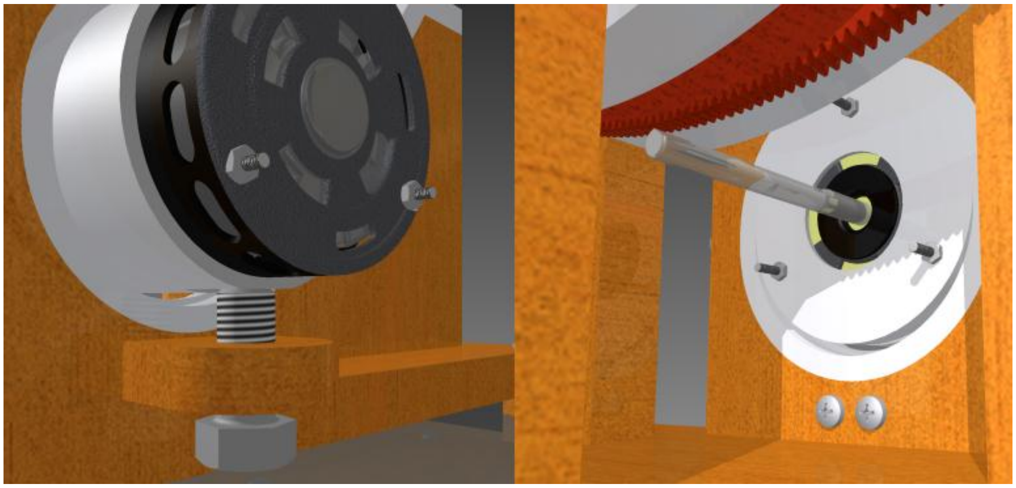


Figure. To be described.

Set the motor, the auxiliary base and the lifting bolt. Use 2 cross recessed binding head machine screws type I (**5/16-18x2 UNC**) for the base, 3 Chamfered bottom hex machine screw nuts (**#10-24 UNC**), and the lifting bolt (**1-8x2.25 UNC**).

- Step 13: Mounting the power input pinion.

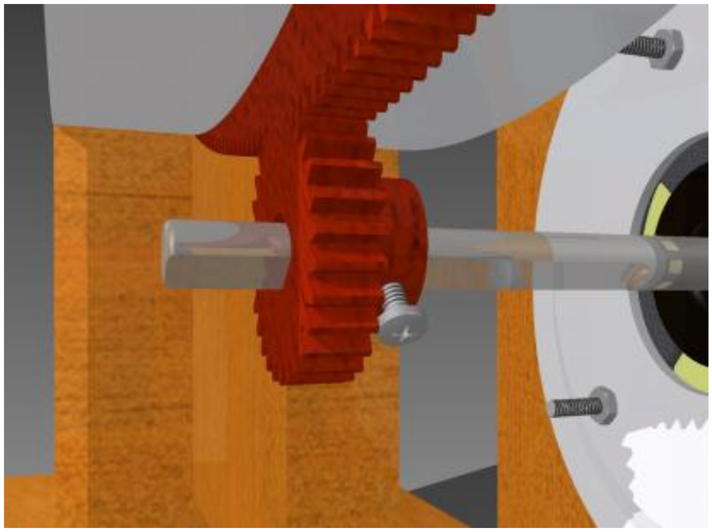


Figure. To be described.

Insert the pinion on the motor shaft and make it mate with the main wheel. Then, constrain the pinion with the prisoner (1 cross recessed binding head machine screws type I **#10-24x0.5 UNC**) inserted in its hub againt the planar face of the motor shaft.

- Step 14: Set the further support panel.

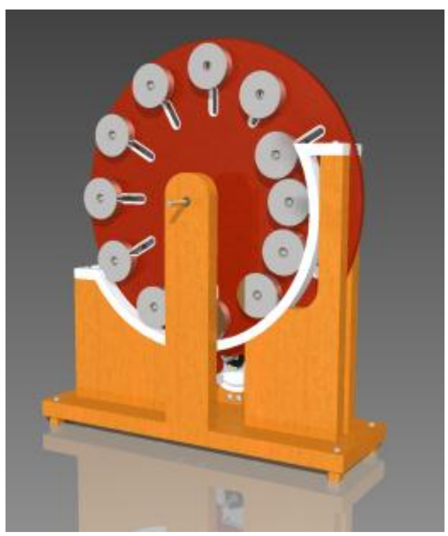


Figure. To be described.

Finally, set the support panel further on the main base, and fix it to the CR; by 2 cross recessed binding head machine screws type I (**5/16-18x2.5 UNC**) for the bottom and 1 cross recessed binding head machine screws type I (**5/16-18x2 UNC**) for the top. After this, the system is ready to be used.

Revision Notes for first delivery CCG Wheel pdf.
June 10, 2015 by George Wiseman

Eddy,
Very nice presentation. I'm impressed! And you seem to have grasped most of the working principles.

While I like most of your suggestions, there are some that I must correct.

1. I note that it would be slightly better if you ran a spell checker over the document, for correct spelling and grammar.
Spell checking is not needed for communication between us because I understand your meaning.
Your English is good but when we are done it'll all need to be correct for presentation to my customers and manufacturers.

2. Making the Main Wheel, CRs and Main Wheel supports out of wood should be OK for a prototype.
I'm dubious about having the CRs made out of 3 pieces each. I'd like them to be one piece because it's easier to make sure everything is lined up.

3. You seem to have miss-understood my intent with the weight bearings. I need them to be mounted inside the main wheel slots, *not inside the weights*.
I'm not sure how to describe why this is important. It has to do with the weight axle needing to turn counter-clockwise while sliding inward in the main wheel groove, when the weights are turning clockwise. Also, the OD of the bearings helps provide the 'angle' needed to prevent binding as the weights slide inward and are pressed against the side of the groove.

4. The bearings also need to be able to 'slide' in the main wheel groove, which is why I specified a 1/32" wider groove than the OD of the bearings, and 1/32" wider groove than the width of the two bearings.

This arrangement will prevent the bearings from 'binding' or 'wedging' in the main wheel groove as the weights are driven inward by the CRs. I engineered the bearing diameter and the curve of the CR to minimize the possibility of binding. This engineering takes into account the angle between the point the weight makes contact with the CR, the center of the weight axle as it relates to the angle of the Main Wheel groove and the diameter of the weight axle bearings.

5. So we still need bearing retaining covers on the main wheel grooves (as I specified)
OR (an idea based on your inspiration)
We could SPLIT the main wheel into two sides and re-engineer the grooves so that they are open in the middle of the wheel (for the two side-by-side bearings to slide and spin freely) and only wide enough for the axles to come through on the outsides (thus the wheel groove itself would have a 'lip' to retain the bearings).
The wheel sections would be bolted together with bolts located in areas that would not interfere with the movement of the weights (or recess the bolts).

6. The weights could be held onto the axles by clips as you depict. A very good suggestion. It will make the wheel easier to put together and take apart.

7. Maybe a clip in the middle of the weight axle would be a good idea too, to hold the axle centered in between the two inner bearings. This will help keep the weights 'registered' on the CRs and not rubbing against the side of the main wheel or striking the main wheel bearing supports.

8. While Teflon inserts (in the main wheel slots) are a good idea, I'm looking for lower cost and simplicity at this time.

Having those inserts made would be costly and I'm not seeing what would retain them in the slots (friction fit wouldn't hold them from sliding sideways)…
We can engineer the CCG Wheel for longevity and lowest friction after we've built and tested a prototype.
So no Teflon inserts in this design. If the main wheel grooves are smooth and lubricated, the friction should be minimized, at least enough for a prototype.

9. While I really like your idea to use Teflon covers on the CRs, I must again insist on solid CRs. Metal will provide low friction (like locomotive wheels on tracks) but hard wood would work OK.

Teflon is expensive and machining additional pieces is extra cost. We are trying to build a working 'proof of concept' prototype. It does not need to last for decades, just long enough to test.
If this CCG Wheel prototype works, I do agree that we should Teflon cover the CRs, for low wear and less noise.

10. I want you to check your CR curves. I want an optimum curve from the 8'oclock position to the 4 o'clock position, pushing the weights inward evenly so they do not bind in the slots.
At the 4 o'clock position the weights should be entirely on the inner radius and should stay there until they are released just past the 2 o'clock position.

11. I think we can simplify the motor mount to just be a metal faceplate. No need for a fabricated 'housing' for the motor. The motor is designed to 'hang' (be only mounted to) those bolts, so no housing is needed… In fact a housing could prevent the motor from cooling properly.
We could just allow the faceplate to move enough to arrange the gears to register properly. The motor is meant to stay connected at all times (it turns into a generator when overdriven) so no need to lower it to disconnect it. That's how we will collect the 'excess' power (if there is any).

12. I'm OK with using open bearings for the prototype, but a working wheel will need sealed bearings, to prevent dust from getting in and to retain inner lubrication.

Thank you, I can see that you worked hard on this. Hopefully this revision will do the job.

May the blessings be

George Wiseman

INV.
LATIN TECHNOLOGIES

Date: 06/12/2015.

Dear Mr. Wiseman.

It is our pleasure to communicate you that I have received your new indications and I started to working on; that is because I would like to inform you about an issue that has emerged, before we could keep going with the design.

Below, it will be presented:

1. In order to simplify the design and manufacturing of the CCG Wheel, as you have requested, I followed your indications about keeping the outside diameter of the main wheel to 24", but, this scaling resulted in several variations on the design.

   As you can see in the image attached in the main folder, making smaller the main wheel and leaving ½" of distance between the root diameter and the slots limits, forced the inner weight diameter to be reduced. Thus, having 4" diameter weights in the system is no longer possible, because, this means that when nearby weights are placed in the inner weight diameter at the same time, inevitably, they will be in contact.

   Apparently, the simplest solution for this could be to reduce the weights outside diameter from 4" to 3.25". In the "Reference" image it can be seen the interference between weights at 6 and 7 o' clock, and the clearance between the weights at 3 and 4 o' clock.

Now that I have notified the above, I would like to know if you agree with the proposed solution, for the purpose of keep going with the rest of the suggestions you have given in the last email. Please, have a very good day.

Best Regards.
>D
Eddy R.

INV.
LATIN TECHNOLOGIES

Date: 06/12/2015.

Design Updates-4

Greetings.

Dear Mr. Wiseman.

It is a great pleasure for us to greet you once again, and to communicate to you the last updates carried out in the CCG Wheel design. As the last time, we kindly hope you to be satisfy with these; please, notify if you do not.

Below, the updates will be presented, in the same order of request given to us in your last email:

1. The main wheel received the following changes:

   - ✓ The manufacturing material is now, plastic CPVC (Chlorinated Polyvinyl Chloride).
   - ✓ The outside diameter was kept of 24” and the thickness of 3/4" (by standard sheet size).
   - ✓ The outside ridges of the slots were eliminated, and the internal ridge was resized to 0.1875” of width (please, see “SW1”, “SW2” and “SW3” images in “Slot-Weight” folder).
   - ✓ The ball bearing that supports the main wheel was located at the center of the hole, and it is axially retained by an internal clip (retaining ring) (please, see “Misc1” image in the “Misc.” folder).
   - ✓ It was left 1/2" of material between root diameter and slot limit.

2. Seven spacer blocks were located between the CRs, as you request, for better support and stabilization (please, see “Misc3” and “Misc4” images, in “Misc.” folder.)
3. The weight assembly was reconfigured according to your indications, lengthening the weight axle for giving retaining rings for both sides of the weight (please, see “SW4”, “SW5” and “SW6” images in the “Slot-Weight” folder).
4. The outside diameter of the weight was resized to 3.4”, leaving a 0.086” clearance between nearby weights, when they are placed in the inner weight diameter at the same time (please, see “Misc2” image in the “Misc.” folder).
5. The CRs curve was updated according with the new weight diameters (please, see “Curve” image in the main folder).
6. The pinion’s diameter was specified in 1.5” (a size that you have requested). Importantly, this component must have a hub for its restraint by a prisoner on the motor shaft; thus, its overall width is wider than main wheel’s (please, see “Misc5” image in the “Misc.” folder.

You could find more images in the “CCG Wheel Renders” folder. Please, have a good night.

Best Regards.

:D

Engineer Eddy R.

Revision Notes for fourth delivery CCG Wheel pdf.
June 15, 2015 by George Wiseman

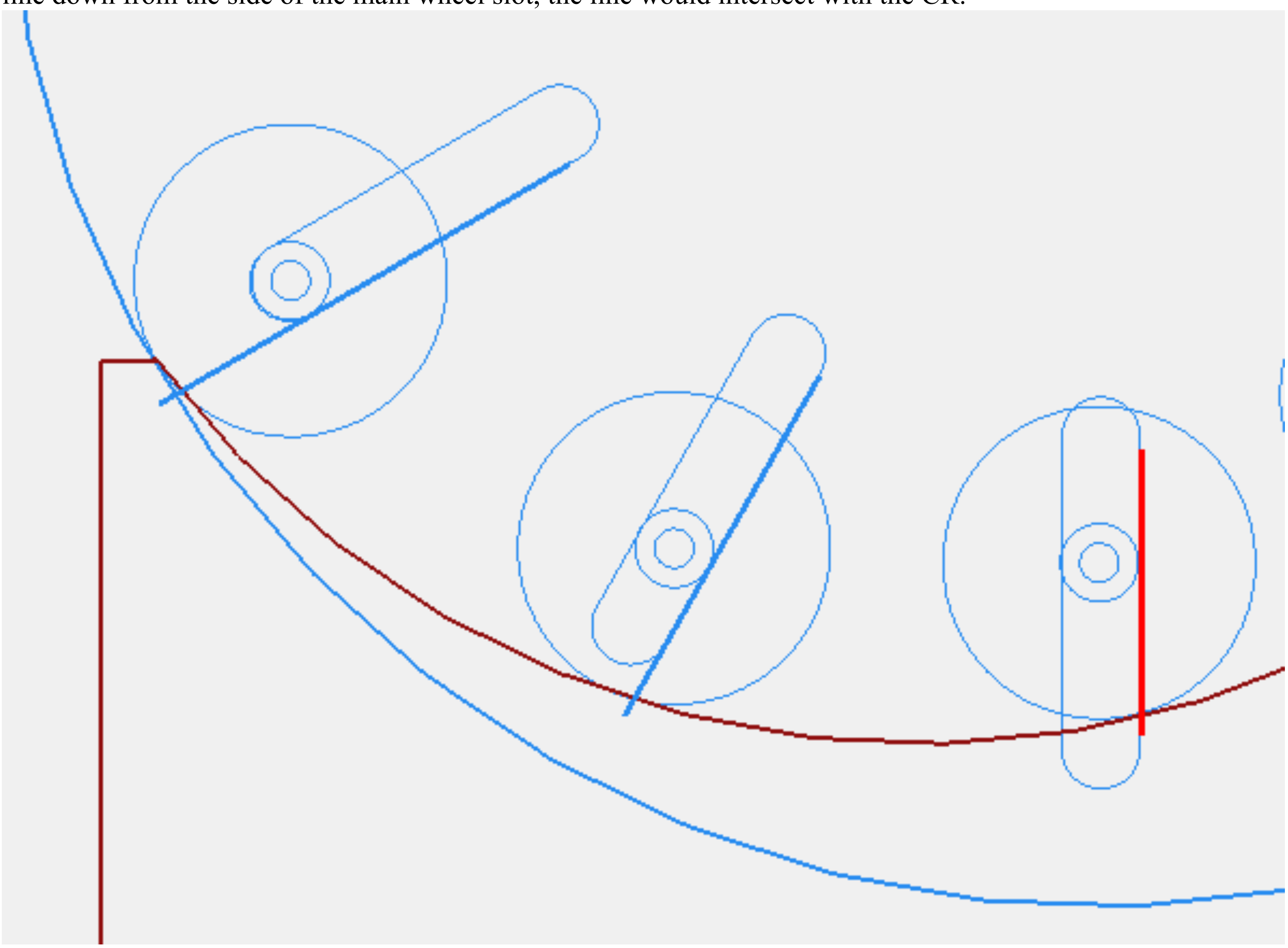
Eddy,
Very Very good work. We now have most of the details finalized.
Thank you, just one more detail and a couple of tweaks.

Drawing Detail 1.
I think there was a misunderstanding about the main wheel support(s). I want a support on both sides. I thought you were just not showing the support on the motor side so that I could see the weights on the wheel but I now see, *based on how you put the retaining clip on a bearing in the wheel*, that you are suggesting having just one main wheel support (on the non-motor side).

I want a support on both sides and I'd like the main wheel axle bearings to be in the supports, not in the wheel. There's no way a suspended axle like that will support the stresses that the wheel will put on it.

Tweak 1.
I think the new curve on the CRs is just a little flat, which will cause a tendency for the slot bearings to bind.
I could not see the details well enough but I'll tell you what I'm looking for…

I don't want the weight's point of contact with the CR **to exceed the place where**, if you drew an imaginary line down from the side of the main wheel slot, the line would intersect with the CR.



Tweak 2.
I appreciate you putting a 1.5" diameter gear on the motor, for the drawing, but I requested three different motor gear sizes and I didn't see you address that in this presentation.

Obviously, in addition to making the three different sizes of gears, I'll need the motor support to be able to move upward as I install smaller diameter gears, so the gears will mesh with the main wheel gear.

I need three gears because there are too many variables for me to calculate which size will be most efficient. We don't want the wheel to be turning too fast (faster than needed for it to work) because that'll just put unnecessary stress on it. But we want it to be turning fast enough to over-drive the motor (turning it into a generator).

The three motor gears 1" diameter, 1.25" diameter, 1.5" diameter

Note 1:
When depicting the weights at the top, (1 o'clock, 12 o'clock and 11 o'clock) they shouldn't rise farther than the opposite weight (7 o'clock, 6 o'clock and 5 o'clock respectively).

Note 2:
Once we finish this gig I have two more gigs for you to quote on.

I'm really excited ☺ Thank you again.

May the blessings be

George Wiseman

INV.
LATIN TECHNOLOGIES

Date: 06/12/2015.

Design Updates-4

Greetings.

Dear Mr. Wiseman.

As always, it is a great pleasure for us to greet you, and to present to you the updates carried out in the CCG Wheel design.

The design's updates will be presented, in the same order of request:

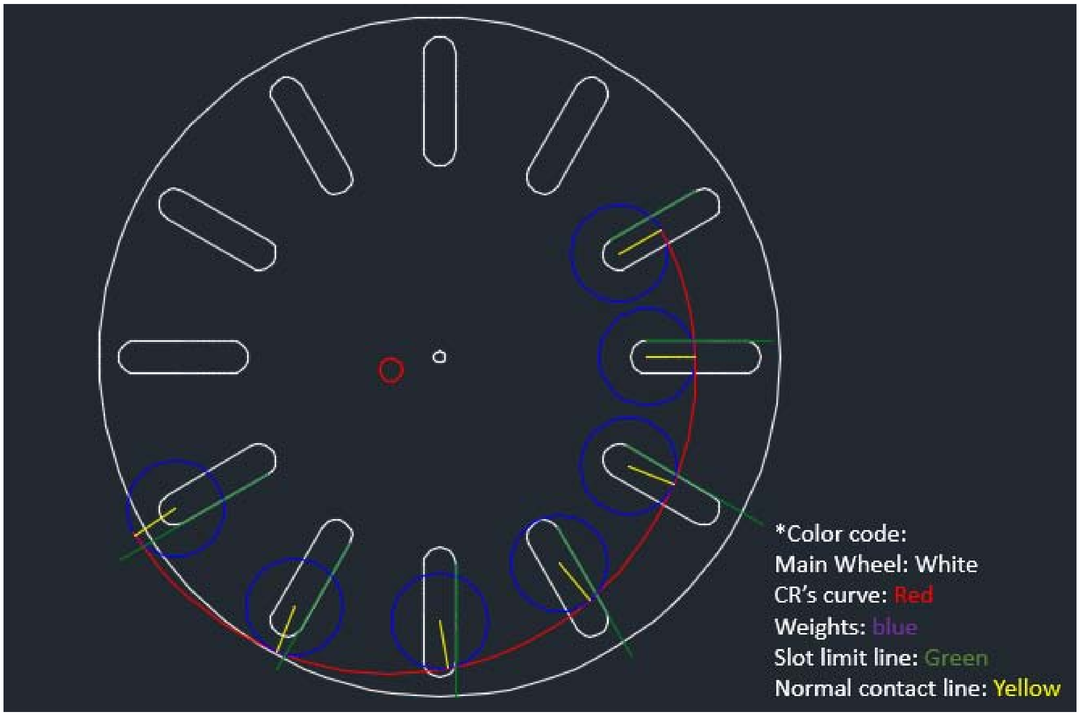
1. **Drawings Detail 1**:

   It has been added a support in the opposite side of the main wheel, so, from now there is a support in both side of it. It also have been seated the ball bearings inside of them, as you have indicated. The main wheel is located by interference fit in the center of the shaft and it is retained with clips in both side (please, see "Misc1" image in the "Misc" folder).

2. **Tweak 1**:

   We would like to let you know about the way we generate the CRs's curve according with the indications that you have given.

   The most appropriate way to avoid the weight's tendency for the slots to bind is building a regular curve. For purposes of explanation, a regular curve, is one where every point of it is equally spaced from a common central point (like a section of a circumference). So, for the first CCG Wheel design that we delivered to you, a regular curve was built in the CRs, as the image shows:

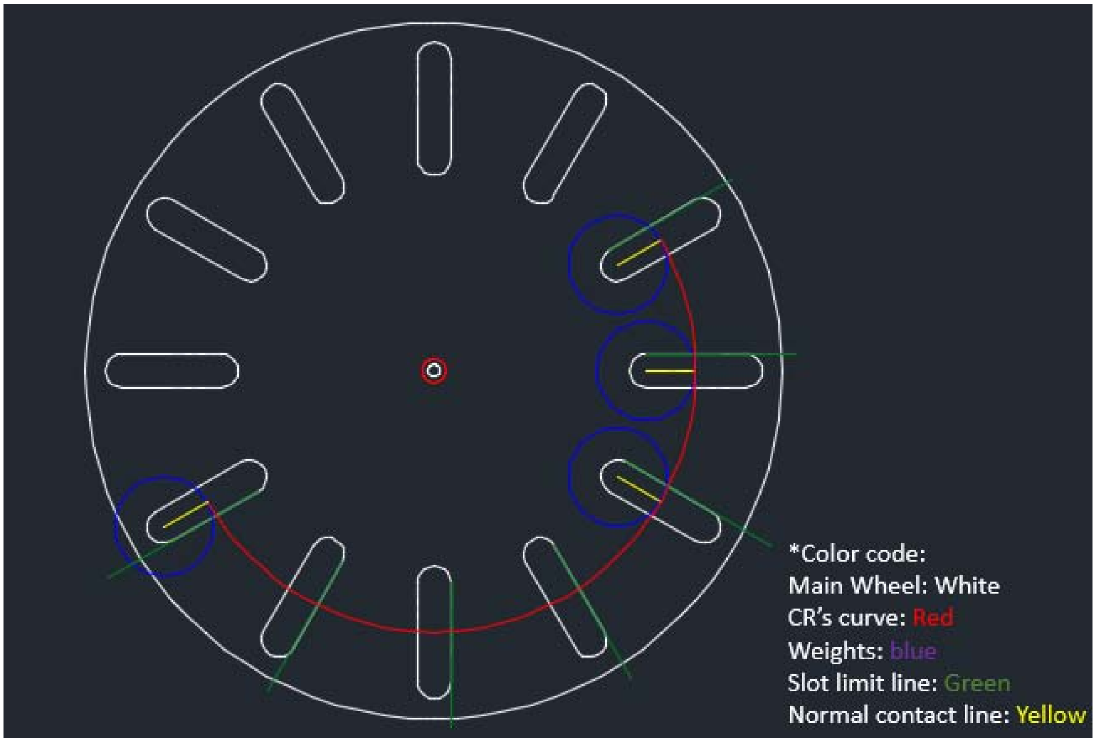


CR curve-regular (First design).

This is a regular curve whose center is offset from the center of the main wheel, and it allows the weights at 2 and 3 o'clock, to be entirely on the inner weight diameter, and the 4 o'clock with just 0.3821" to be on that diameter, too. This curve also allows the weight at 8 o'clock, to have a smooth entry to the CR.

The weight's contact point with the CR's curve will always be tangential to this (the curve) and perpendicular to the weight's center. As you could see, each weight's contact point remain behind the Slot limit line (see "color code" section in the image).

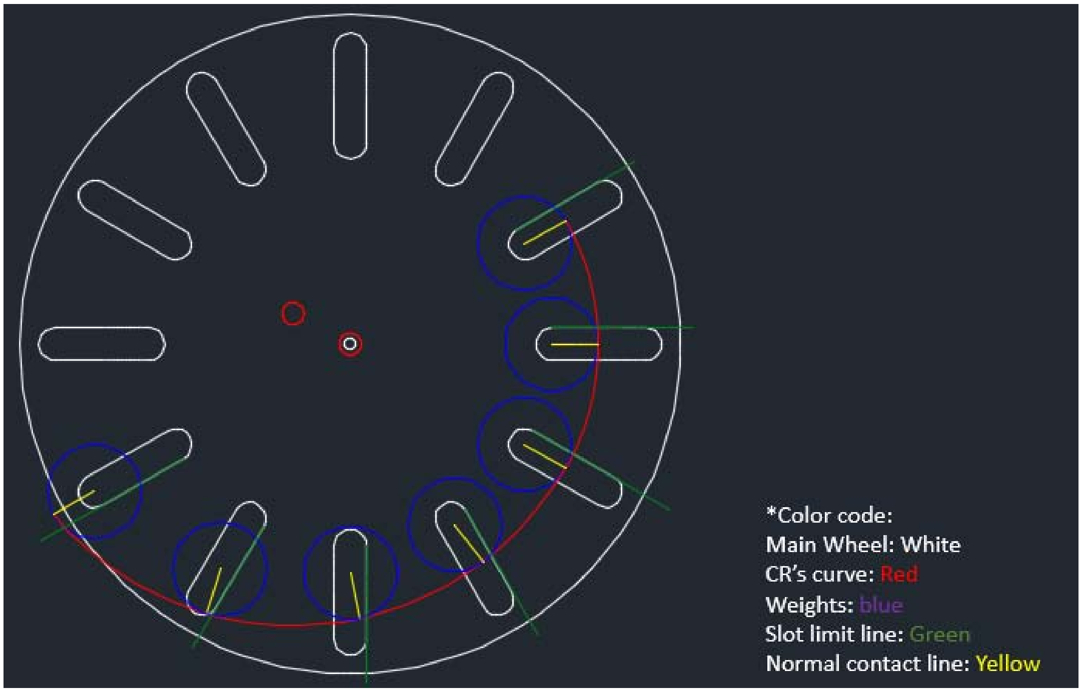
After this, we received an indication from you to modify the curve, because it was necessary for the weight at 4 o'clock to be entirely on the inner weight diameter. In this case, if the request is tried to be satisfied by proposing a regular curve, the result will be the following:



CR curve-regular (non-functional regular curve).

As you could see, this curve accomplishes the request of the weights at 2, 3 and 4 o'clock to be entirely inward, but, there's no way for the 8 o'clock weight to get in the curve. With this, it is known that a regular curve have to be discarded as a solution for this request. An irregular curve had to be proposed, and it is important to know that a curve like this sacrifices somewhat the smooth movement of the weights along the CRs at a certain point.

The irregular curve is the product of setting two regular curves in "series", one concentric with the main wheel's center, and one offset from it. This is shown below:



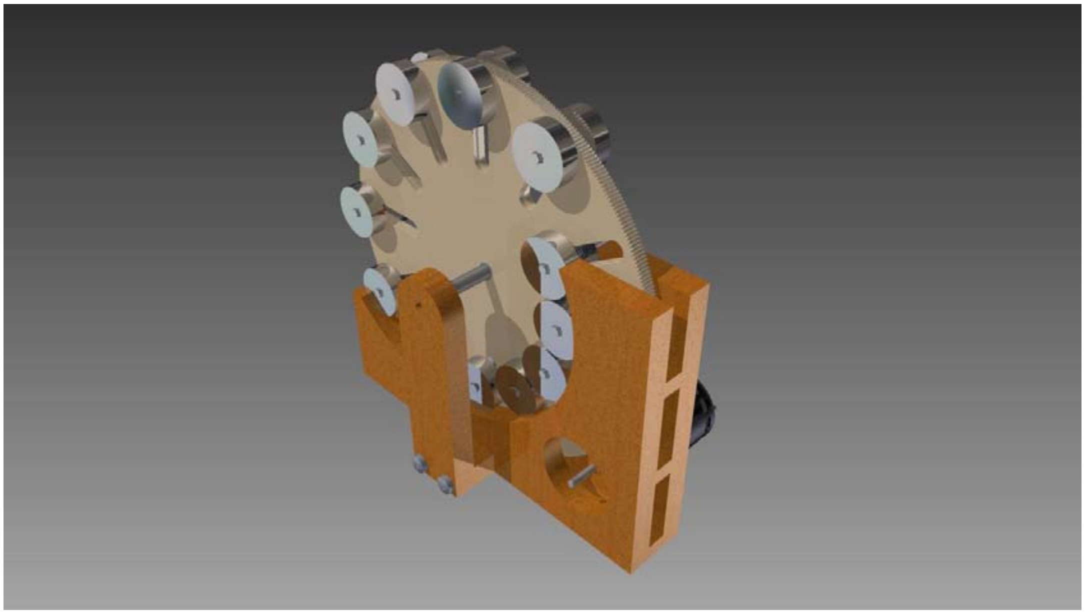
CR curve-irregular (last design).

Clockwise, the first curve goes from 2 o'clock weight to 4 o'clock weight, and this is concentric with the main wheel's center. On the other hand, the second curve goes from 4 o'clock weight to the incoming weight at 8 o'clock, and this is offset from the main wheel's center. The curves are set in "series", which means there is no irregularity at the point where they are joined, but it makes the overall curve somewhat flatter than the specified in the first CCG Wheel design (single regular curve).

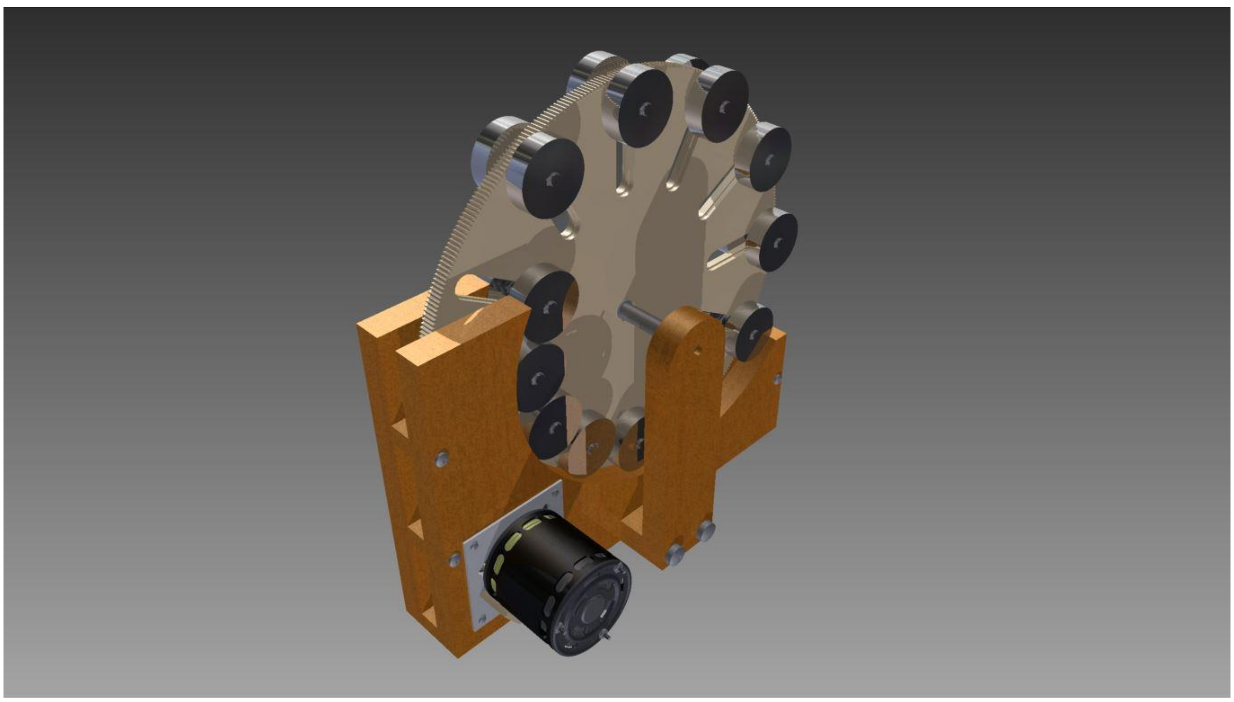
As it could be seen in the image above, in this curve, each weight's contact point with the CR's curve remain behind the slot limit line (see "color code" section in the image above). This irregular curve accomplishes all the request that you have given, it allows the weights at 2, 3 at 4 o'clock to be entirely inward, gives to the incoming weight a smooth entry, and remains the weight's contact point behind the slot limit lines, that is why, **this is which has been specified to the CRs**.

3. **Tweak 2**:

It have been generated three pinions with different diameters (1", 1.25" and 1.5"). Respecting the motor elevating system, it was made an investigation looking for a functional, simple and cheap configuration, among which were found elevating platforms, gear racks and hydraulic and neumatic systems, all them expensive options and difficult to build. Thus, it was designed the simpler system that will be described below:



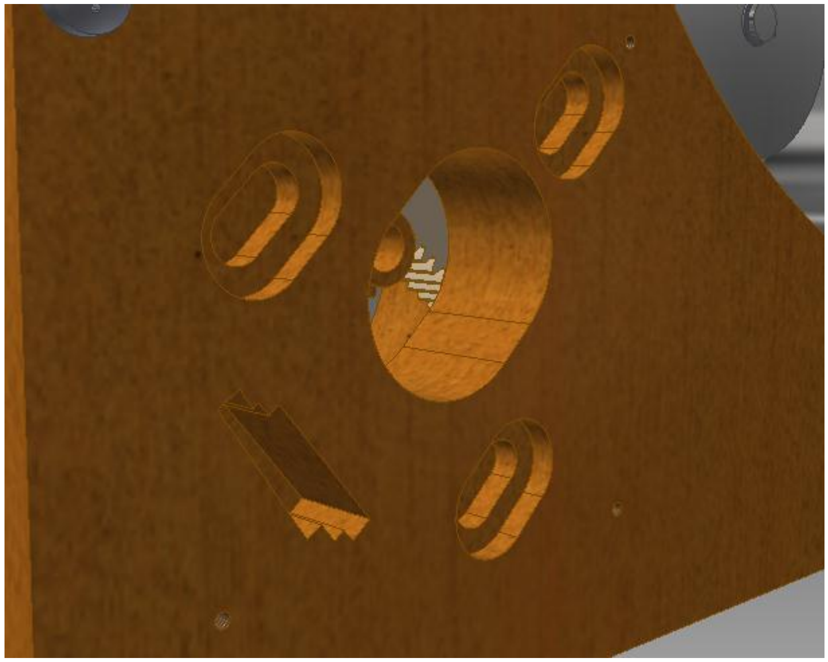
CCG Wheel’s front-left Isometric View (perspective view).



CCG Wheel’s rear-left Isometric View (perspective view).

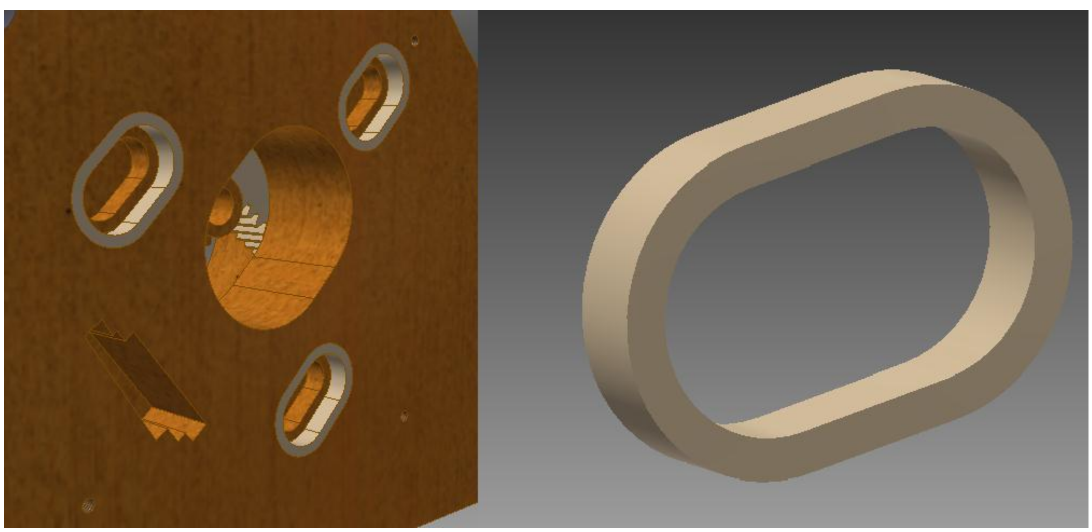
First, the CRs were resized and the pinion was located at 45° from its previous position, this helps the CRs to be shorter, reducing the size of the supports and the amount of spacer blocks needed.

Let’s detail the elevating system, as it is shown in the next image:



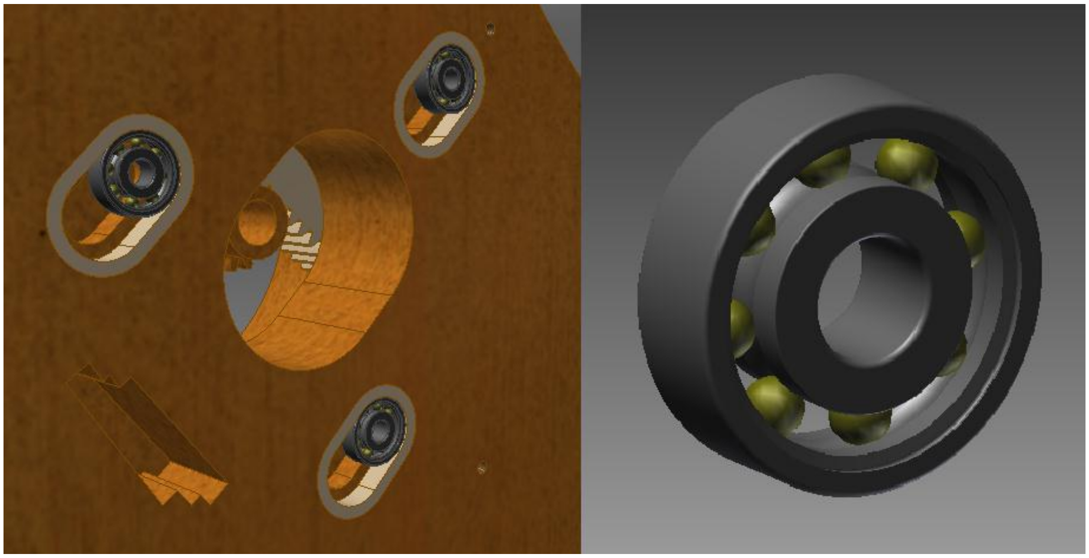
CRs’s primary grooves (perspective view).

Grooves for the supports, motor’s shaft and a pin have been built in the CR.



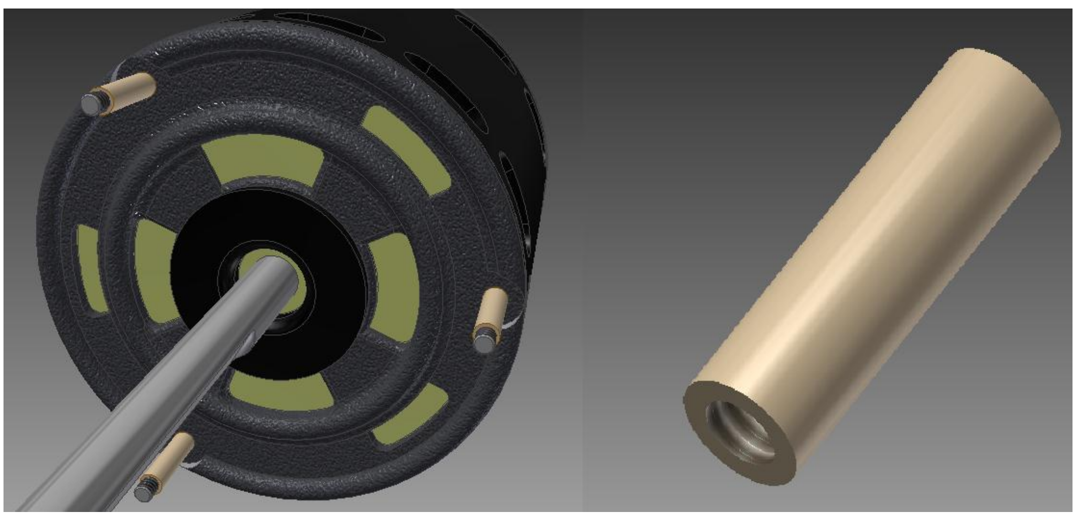
Bushings inserted (left), bushing geometry (right).

Plastic bushings are inserted in the grooves, these components are expected to be manufactured with the excess material left after manufacturing the main wheel.



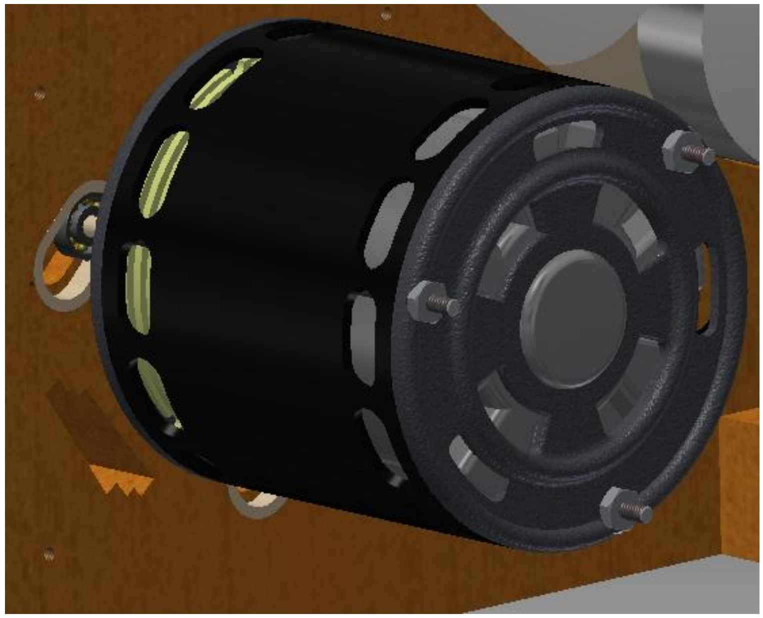
SKF 626 ball bearings inserted in the bushings (left), SKF 626 3D model (right).

Three SKF 626 ball bearings are seated into the bushings, they will let the motor to move upward or downward, as the case may be.



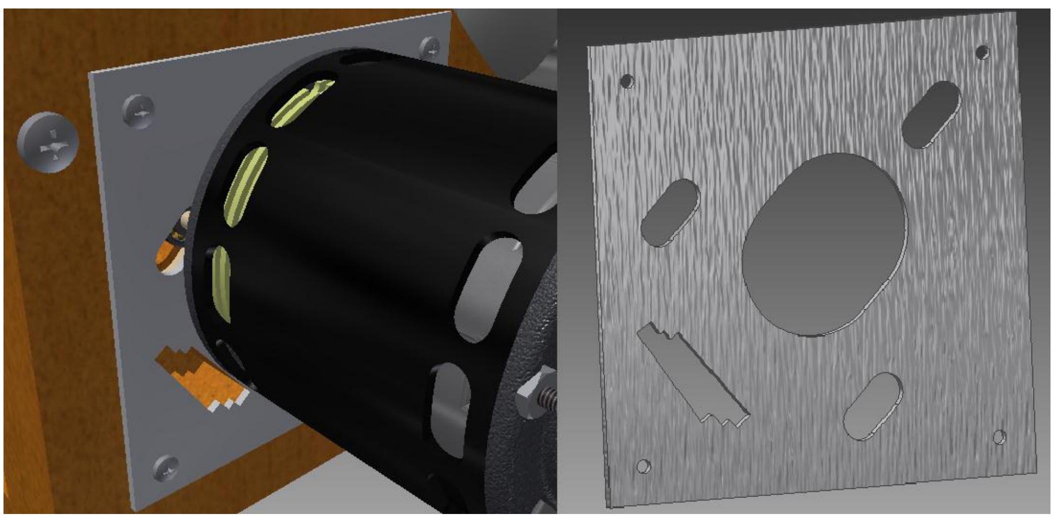
Threaded inside bushings inserted on the motor's supports (left), threaded inside bushings (right).

These bushings are inserted in the motor's threaded rods. This will let the motor to be supported by the bearings. These are also expected to be made of the excess material from the main wheel manufacturing.



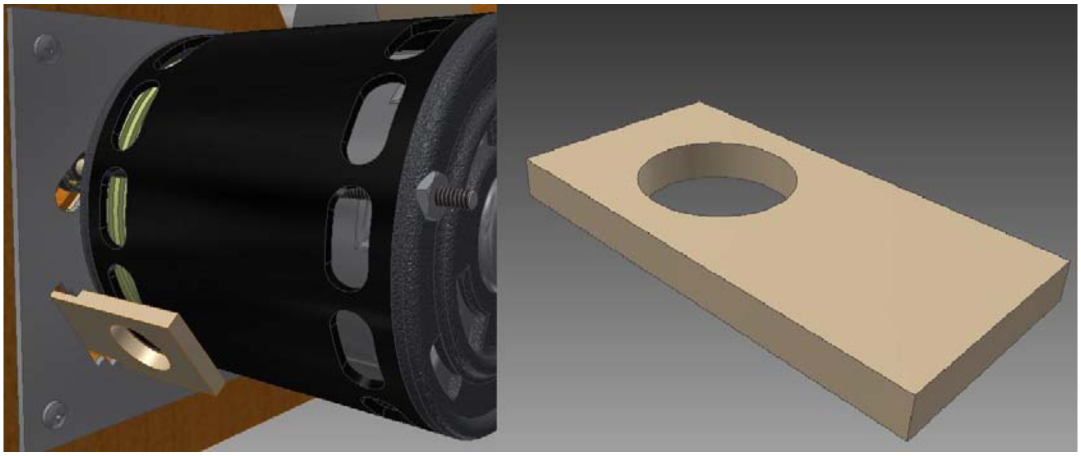
Motor mounted on the ball bearings.

The motor is placed on the ball bearing’s inner track.



Drilled sheet installed (left), drilled sheet (right).

A drilled sheet (no material specified, you could find a material which works) is located in front the motor by fasteners, and it retains the bearings into their bushings, so the bearings can slide in the groove, but cannot move axially.



Pin set in its groove, blocking the motor (left), pin (right).

It is necessary to place a blockage, to avoid the motor to go totally down (by gravity's action), that is why it was designed a pin to be inserted in the grooves. In there, the pin would be able to take three different positions according with the three different center distances needed between each pinion and the main wheel.

The pin would be also manufactured with the excess material from the main wheel manufacturing. The tolerances for the bearings to be able to slide in the grooves will be specified in the blue prints.

In the "Positions" folder, you could find some images that show the three different positions for the pin in the groove, and the motor's lowest position without the pin's blockage. If the pin is taken away, the center distance between the 1.5" diameter pinion and the main wheel will be 0.4" longer, this is for the user to have enough space to switch the pinions.

Important to clarify that the order in which have been described the elevating system is not the same of its assemblage. This system was thought to be as cheap and simple as possible.

These are the updates for this new CCG Wheel design, as usual, you could see images of the overall system from different views, in the "CCG Wheel renders" folder.

Best Regards.

Eddy R.

Revision Notes for New Gig of CCG Wheel
June 18, 2015 by George Wiseman

Eddy,
Thank you for all the great work you've done so far. We've come a long way from where we started.

I'm very happy with where we are at so far and I love your thinking (I was going to suggest that you move the Motor to the 45° position).

You did perfect on the CR curve, just what I was looking for.

I'm going to accept these last two Gigs 'as is' without CAD renderings yet, because I need more changes.
I figured out a way to get the Main Wheel manufactured relatively inexpensively. Machining the slots and gears gets pricy fast.

So please quote on a new Gig to go further on the CCG Wheel.

You'll continue to work on the same drawing as the last Gig.

I just need some additional changes before I submit to manufacturers and think it's fair to start a new Gig (rather than keep making revisions on the previous Gig). **You need to be paid for your work**. I appreciate the extra time you've already put in and I do not want to take advantage of your generosity.

Changes to quote for:

1. Please add a 'mounting plate' on the Main Wheel Axle. The round 1/8" thick and 3" diameter mounting plate will be welded to the axle and have 6 bolt holes (#8 drill bit size) for 10x24 thread 1" long bolts to go through.
The Main Wheel will have corresponding holes (#25 drill bit size) that will be tapped for 10x24 thread.
The Main Wheel will thus be solidly bolted to the axle (instead of interference fit).

2. Please move the Main Wheel supports inward so they can be fastened to the CRs. There should still be plenty of room for the Weight axles to slide by without hitting the supports because you've made the CRs wide enough.
There is going to be a fairly considerable side force on the Main Wheel supports as the weights are 'pushed' inward on the rising side and 'flung' outward on the downward side. We need to be sure the supports are not going to move.

3. Please make the Main Wheel in three parts (layers) of Delrin plastic. Two layers of ¼" and the middle layer to be 3/16".
I'm doing it this way because I've had good experience with getting plastic gears laser cut and layers make it easy to have the Main Wheel slot bearing retaining ridge without doing additional machining.

The three layers of the Main Wheel will be bolted together with 10x24 thread plastic (nylon) bolts.
Make a series of #25 holes spaced around the wheel in locations that will not interfere with the movement of the weights (I'll tap these holes to 10x24 thread).
Put holes on radius(s) of about every 2" and a circumference (at each radius) spacing of about 2".
I may have you put in more once we see what these look like.

Delrin (Acetal Homopolymer) Specifications
http://www.sdplastics.com/delrin/delrin[1].pdf

1/4”x24”x48” Delrin (for outside layers)
http://www.usplastic.com/catalog/item.aspx?itemid=29732&catid=439

3/16”x24”x24” Delrin (for center layer)
?? link??

Check out the laser cutting specifications (involving laser kerf) so that the ‘laser cut’ Main Wheel drawings can be drafted (modified) to get the correctly sized finished product.
https://www.pololu.com/product/749
https://www.pololu.com/docs/0J24
The laser cuts 'on the line', leaving a kerf on both sides of the line, that reduces the component size (or increases the size of holes).
We need the components and holes to be actual size, so have to ‘compensate’ by changing the drawing dimensions (that are sent to the laser cutter) a bit.

I know using three layers will cause the width of the center layer (3/16” for the bearing retaining ridge) to be slightly different than your original drawing. We’d reconfigure the Main Wheel axle clip grooves to still allow the bearings the 1/32” ‘axial clearance’ needed to slide freely up and down the Main Wheel slots.

4. Please redo the tops of the Main Wheel supports to have ‘bearing retaining caps’. The cap tops can be flat (instead of rounded like the original drawings) so a bolt will be properly supported.
This will allow us to undo four bolts (2 cap bolts per side) and lift the Main Wheel straight up out of the wheel support stands. Making assembly and disassembly quicker and easier.
Obviously this means drilling and tapping holes into the stands. I’m thinking ¼” bolts with 20 threads per inch (UNC) would work well.

You’ll just put clips on both sides of the Main Wheel axle bearings to hold them in place. The bearings will fit into slots in the stands / caps.

5. Please detail the specifications of the bearings you are using for the Main Wheel axle.

6. Mount the Motor on a ‘swinging’ bracket, so that it can be rotated (pendulum like) into place to engage the gears. We can ‘swing it out’ to make it easy to change gears and still have various sizes of Motor gears line up perfectly with the Main Wheel gearing. Obviously we then want a ‘locking’ bolt to hold the Motor in place once it is rotated into position.
Your Motor mount sliding in bearings and block idea is a workable one, but I think this will be simpler and less expensive to manufacture.

7. Design three different gear diameters 1”, 1.25” and 1.5”.
Obviously the sizes won’t be ‘exactly’ the diameter because their teeth need to match the Main Wheel ring gear teeth, but close is good enough.

I LOVE that you saw / thought to depict the weights in the 1 o’clock, 12 o’clock and 11 o’clock positions as ‘rising’ at about the rate that their opposite weights are being driven in by the CRs, makes it look ‘real’ ☺

Please quote me on the above, including doing the CAD renderings once we are done with these revisions.

I’m really excited ☺ Thank you again.

May the blessings be

George Wiseman

Date: 06/23/2015.

Resume-1

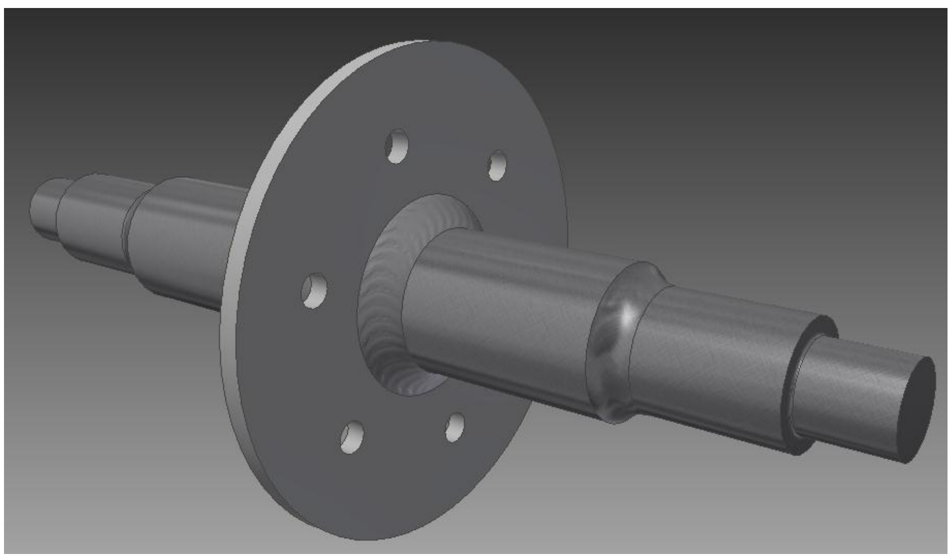
Greetings.

Dear Mr. Wiseman.

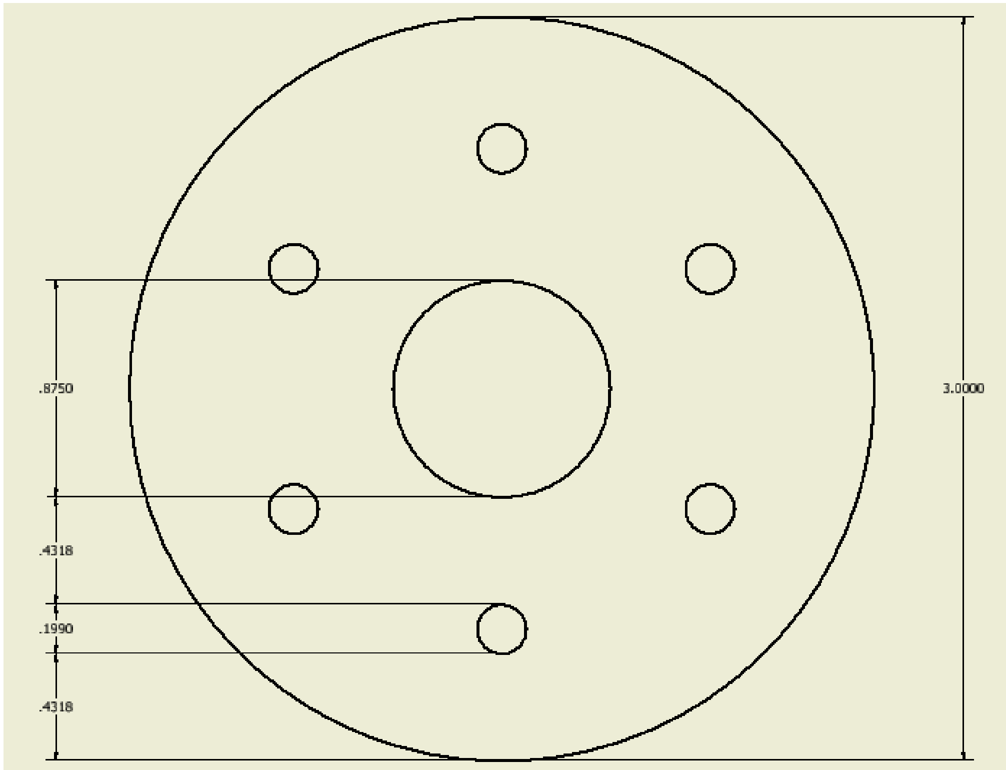
It is a great pleasure for us to greet you once again, and to communicate to you the last updates carried out in the CCG Wheel design. As the last time, we kindly hope you to be satisfy with these; please, notify if you do not.

Below, the updates will be presented, in the same order of request given to us in your last email

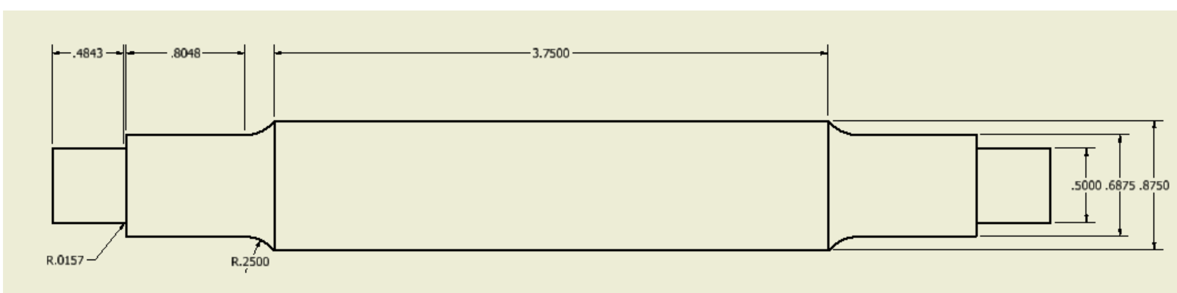
1. A 1/8” thickness mounting plate was provided to be welded to the main wheel’s axle. Below the details:



Mounting plate welded to the main wheel’s axle (perspective).

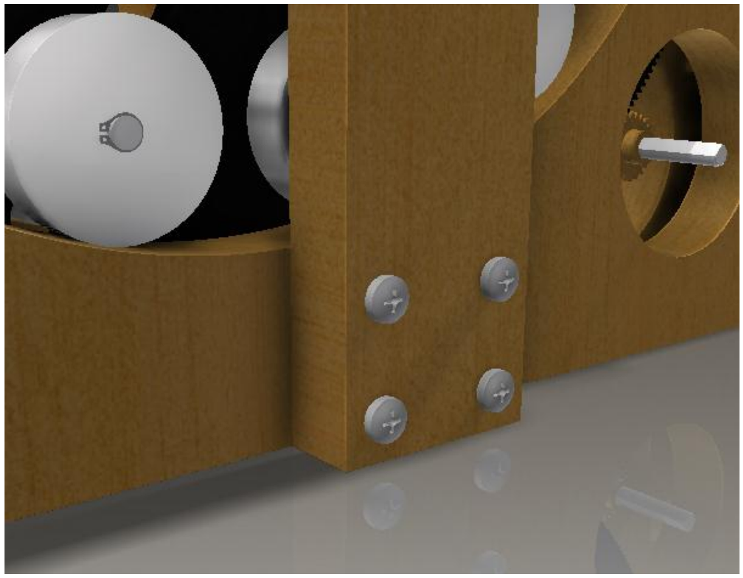


Mounting plate's dimensions.



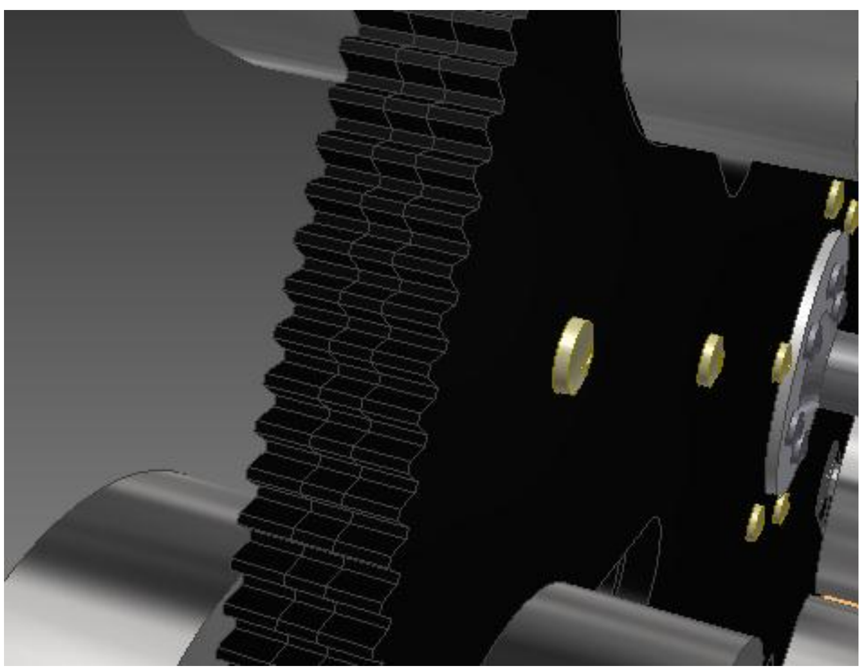
Main wheel axle's dimensions.

2. The Main Wheel's supports are now fastened directly to the CRs and two more fasteners have been added to each one, leaving 4 fasteners in each support, to improve the stability. Details below:



Support fastened directly to the CR (perspective).

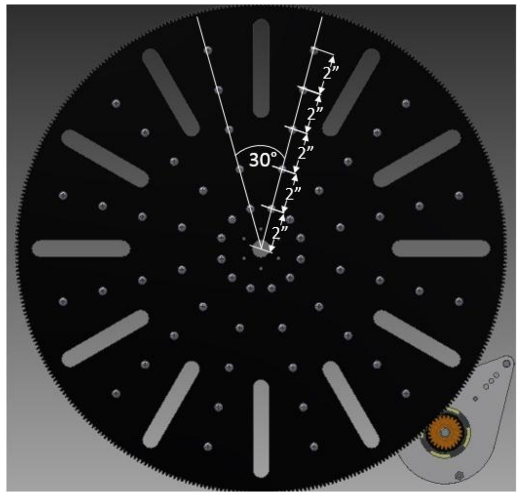
3. The main wheel consists of three Delran layers bolted together, one of 3/16" thickness and two of ¼" thickness.



The main wheel's three layers bolted together (perspective).

I'm trying to understand as best is possible the way how you want to place the bolts around the layers Below we present two options, so, we invite you to notify if one of them satisfies your request:

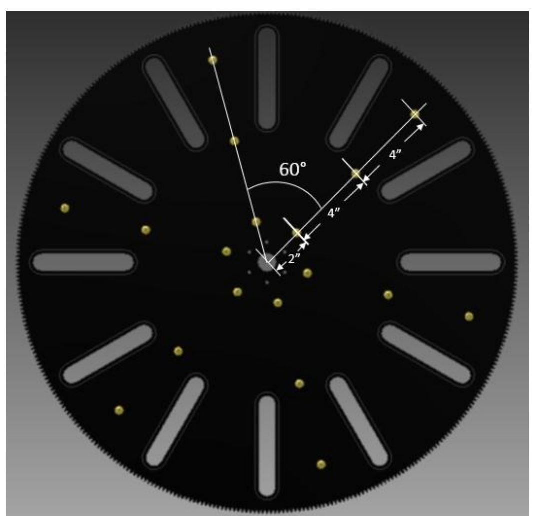
- ✓ 1st option:



First option.

In this case the bolts have been placed every 2" of radius from the center, and it was made the same every 30° in the main wheel, resulting in 60 bolts.

- ✓ 2nd option:

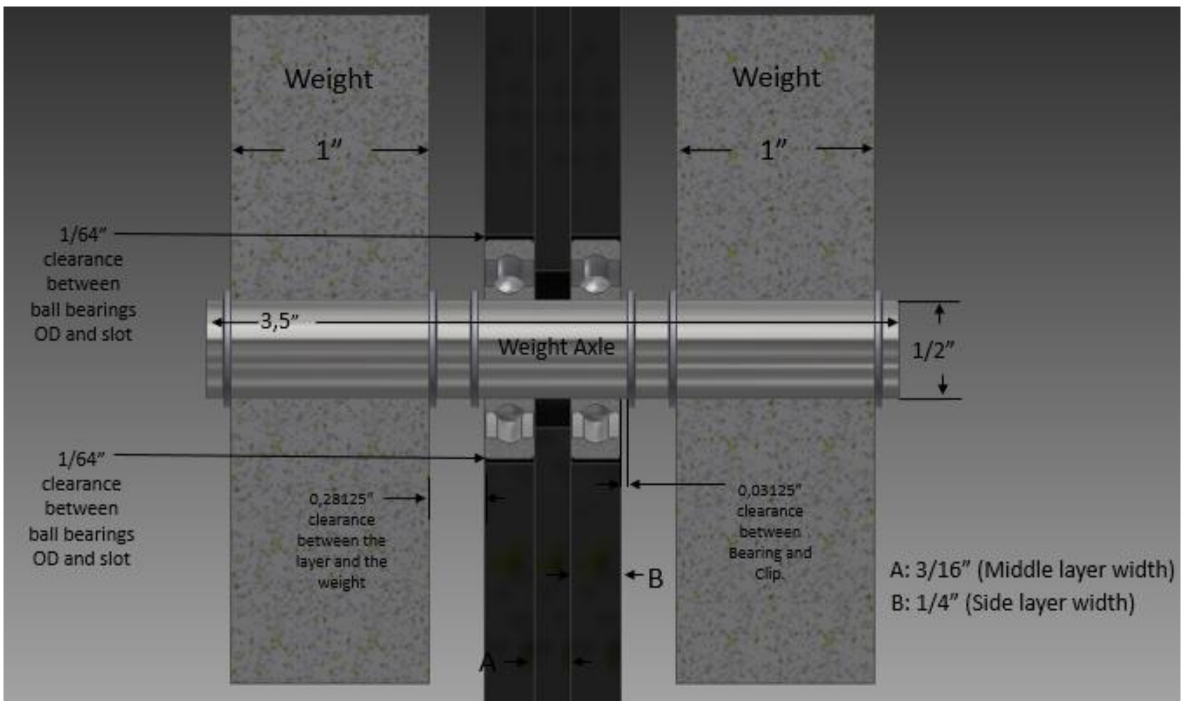


Second option.

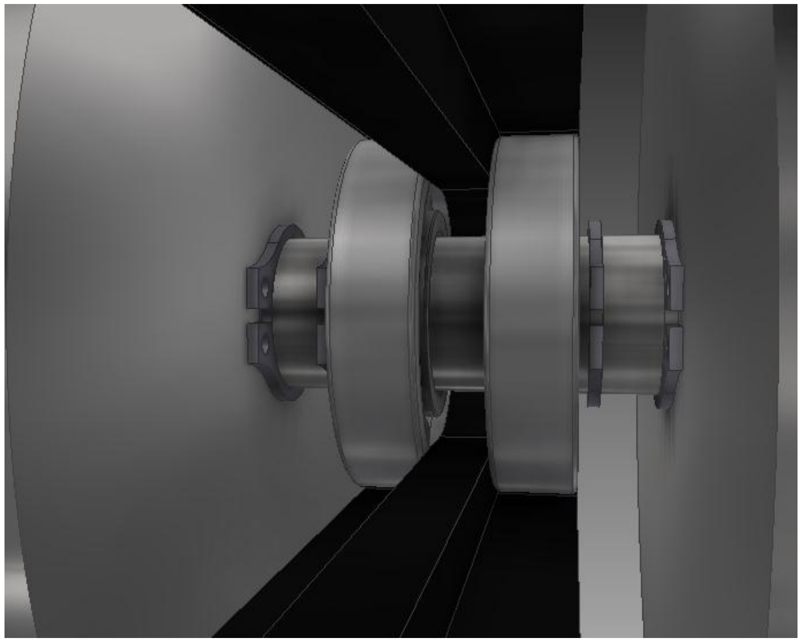
In this case the first bolt was placed 2” of radius from the center, but the followings at 4” of distance each other. It was made the same every 60°, resulting in 18 bolts.

On the other hand, we would like you to specify the length of these bolts and the method of fastening, if you will use nuts in the end of these or just keep them fastened by the thread. Please, also specify the method of fastening for the bolts (#10-24x1") at the mounting plate.

4. The clip’s groove in the weight axle has been reconfigured, leaving 1/32” side clearance for each bearing. Details:

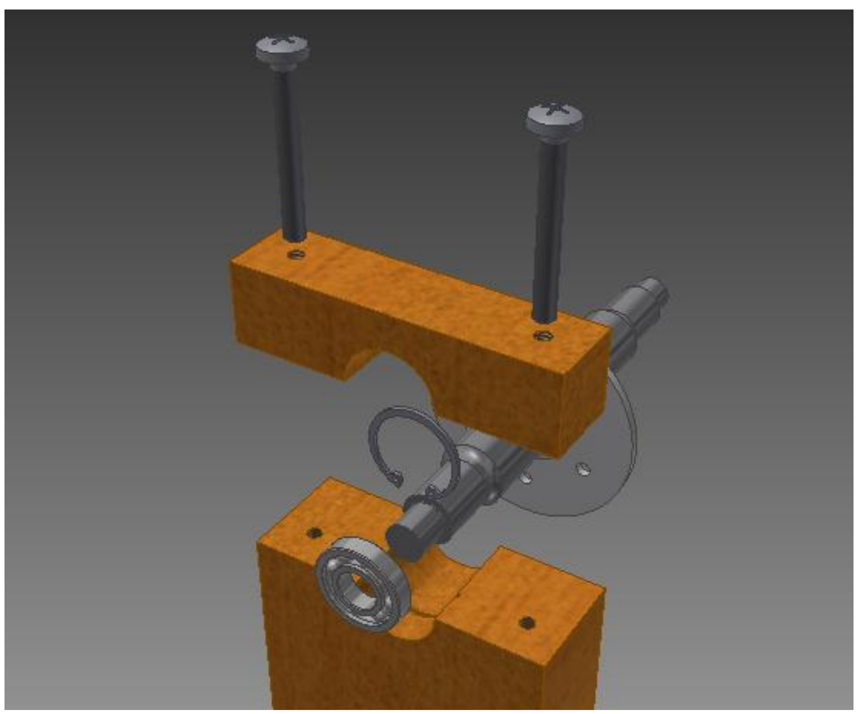


Weight set (sectional view).



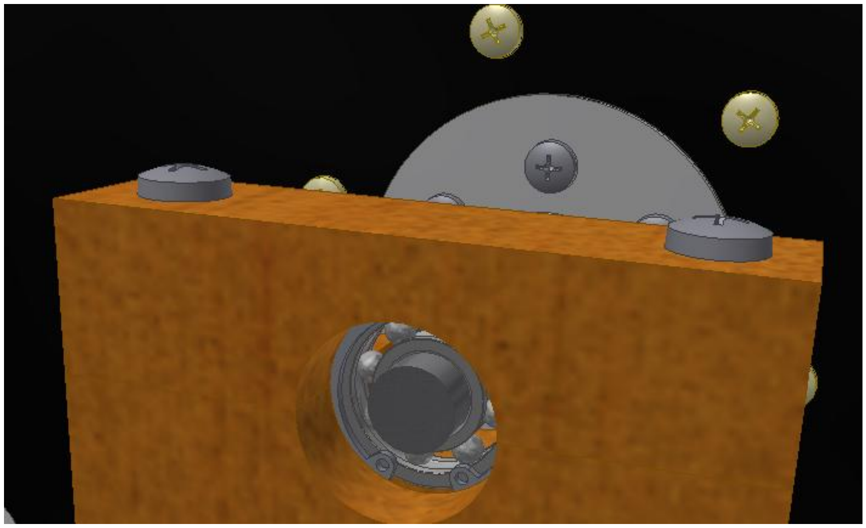
Weight set (from within the slot view-perspective).

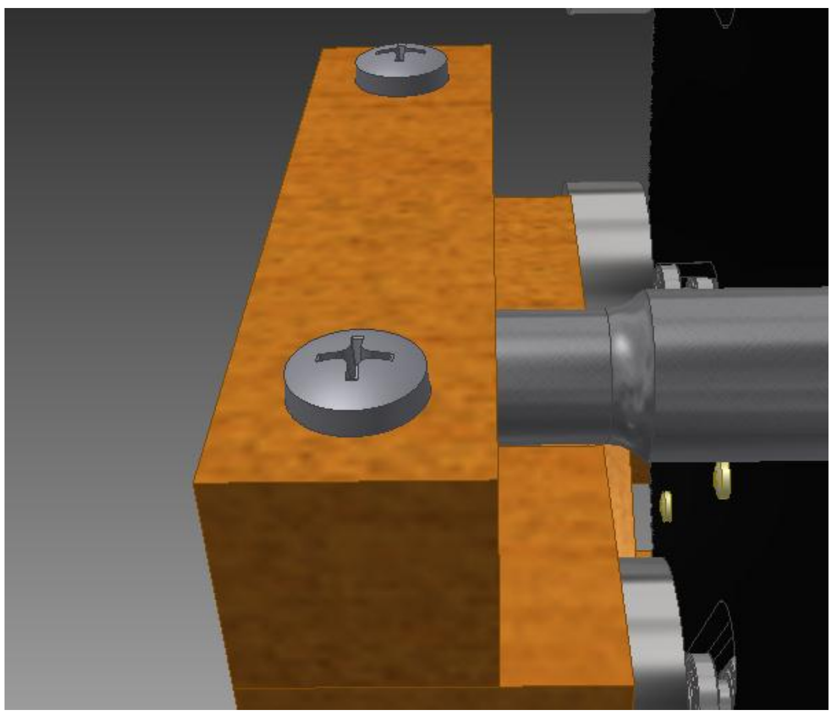
5. The support top have been modified, and a cap was designed, as you requested:



Top support unmounted (perspective).

There are two bolts (1/4-20x2" UNC) fixing the cap at the top, and one internal retaining ring for constraining axially the bearing.


Top support mounted (front view-perspective).

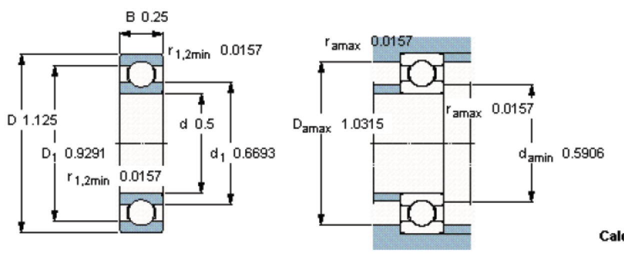

Top support mounted (side view-perspective).

6. The specifications of the bearing seated in the support are the same of the weight axle's bearing, and are shown below:

SKF

Deep groove ball bearings, single row

Principal dimensions			Basic load ratings		Speed ratings		Designation	
			dynamic	static	Reference speed	Limiting speed		
d	D	B	C	C0			* SKF Explorer bearing	
in			lbf		r/min		-	
0.5	1.125	0.25	1210	531	60000	38000	**R 8**	Aftermarket only

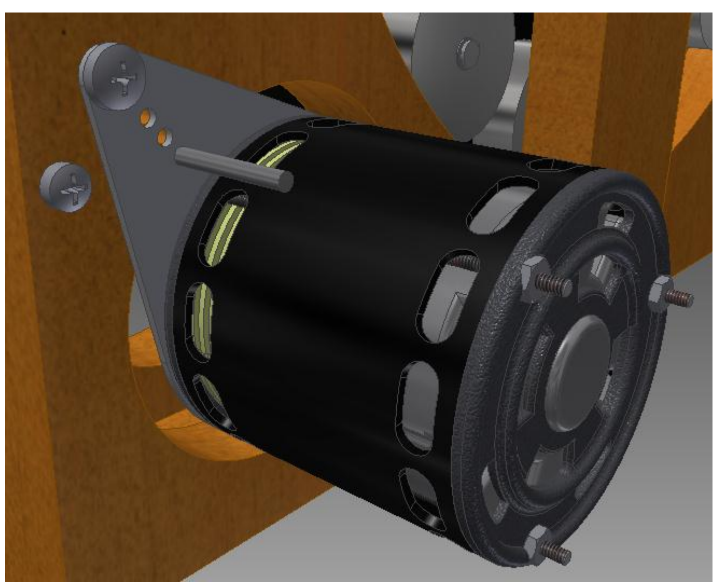


Calculation factors

k_r 0,025
f_0 13

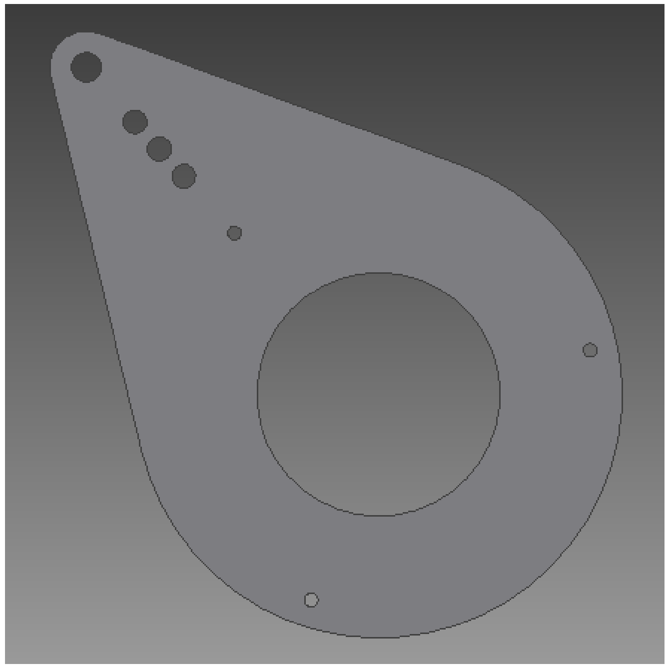
SKF R8's specifications.

7. A swinging bracket system was designed for mounting and unmounting the pinions in the motor shaft without disturbing the main wheel's spin:



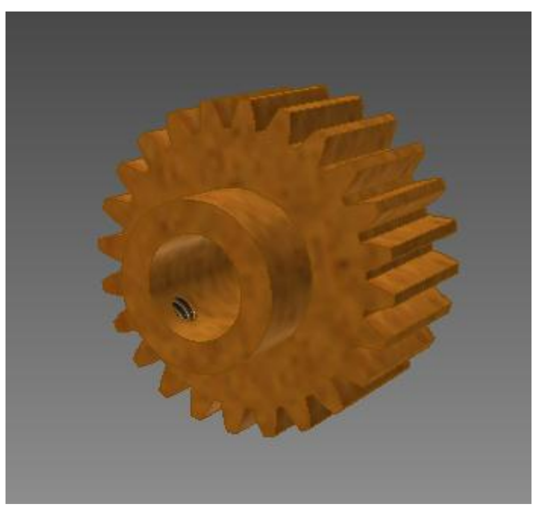
Swinging bracket system.

The system consists in one rigid sheet (whose material to be specified for the client) with holes bored for the motor mounting, the supporting bolt (5/16-18x1/2" UNC), and for the pin to be placed for controlling the center's distance between the main wheel and the three different pinion.

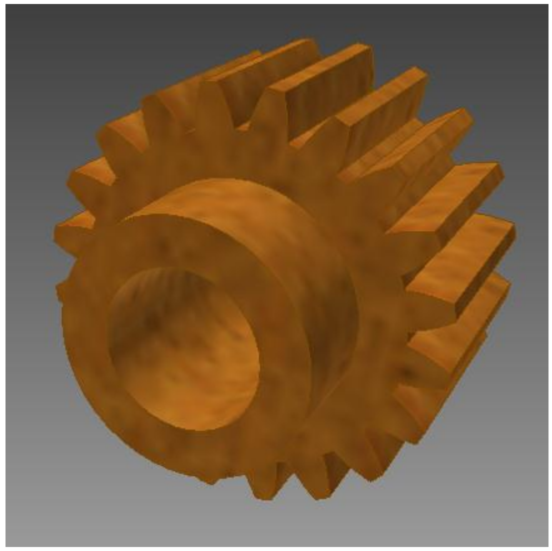


Rigid sheet of swinging bracket system.

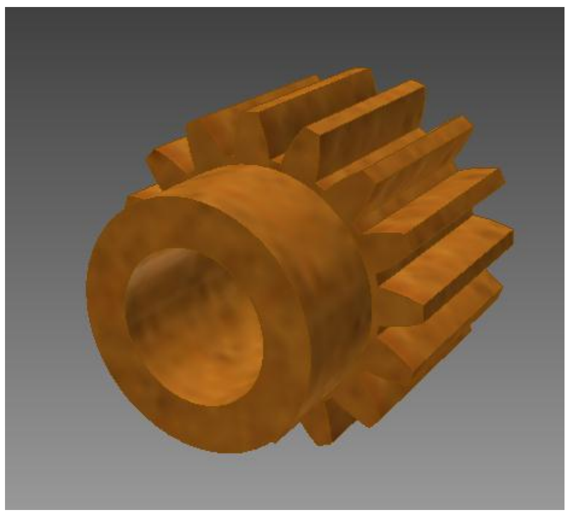
8. Three pinions with different diametric pitch (1", 1.25", and 1.5") have been generated. They can be seen in the next images:



1.5" diameter pinion.



1.25” diameter pinion.



1” diameter pinion.

As it is usual, you could see images of the overall system in the “CCG Wheel renders” folder. It was a great pleasure to present these updates to you. Please, notify any concern you have about them.

Best Regards.

Eddy R.

Revision Notes for Resume 1 of CCG Wheel
June 23, 2015 by George Wiseman

Eddy,
I am very pleased with this interim report. It is good to check to see if we are thinking the same.

1. The mounting plate is exactly what I was thinking.

2. The Main Wheel supports moved inward and fastened to the CRs exactly as I had envisioned.

3. The Main Wheel in three parts (layers) of Delrin plastic is perfect too.

3.1 You did a great job making the bolt pattern. I choose option # 1 (30°)

And we will use that pattern until we get to the Main Wheel weight slots. In between the Weight slots I'd like 6 bolts, spaced to help keep the three layers together between the weight slots. The weights will exert some force and I do not want the wheel to deform.

3.2 My intention is to clamp the three plastic pieces together and then tap the 10x24 threads through all the holes. Then screw in bolts (similar to what you've depicted), some from one side, some from the other; so, since the Wheel will be tapped, there won't need to be a nut on the other side (but it wouldn't hurt to depict one).

3.3 I'm assuming you've checked out the laser cutting specifications (involving laser kerf) so that the 'laser cut' Main Wheel drawings can be drafted (modified) to get the correctly sized finished product.
https://www.pololu.com/product/749
https://www.pololu.com/docs/0J24
The laser cuts 'on the line', leaving a kerf on both sides of the line, that reduces the component size (or increases the size of holes).
We need the components and holes to be actual size, so have to 'compensate' by changing the drawing dimensions (that are sent to the laser cutter) a bit.

3.4 I know I asked for 1/32" 'axial clearance' for the bearings to slide freely up and down the Main Wheel slots. I meant for that to be a total, for both bearings.
We can reduce the clearance to 1/64" on each side (just move the retaining clip a bit closer to the bearing.

4. You did a good start on designing the Main Wheel support caps.
I'm thinking that I'd like the bearings to fit into slots in the stands / caps. The slots are just sized to accept the bearings. Then add a bearing retaining clip onto the axle on the outside of the bearing on each side. I'm thinking that the main bearings should be placed in the center of the stands / caps.

5. I think using the same bearings / clips on the Main Wheel as you used on the weights was a good idea.

6. Good job on mounting the Motor on a 'swinging' bracket. I like it but not the retaining pin. I think I'd like the mounting plate to extend past the hole far enough that we could have a second bolt (maybe with a wingnut) that we could loosen to move but tighten to hold the motor in place.

Maybe have the motor bracket rotate on the lower bolt and have the upper bolt slide in a slot (could be a carriage bolt with a wing nut) so that we can have infinite adjustment for nearly any size of motor gear.

7. Designed for three different gear diameters 1", 1.25" and 1.5".

I’m assuming that the gears you have depicted (looking good BTW) are the ones I specified and that the teeth on the Main Wheel will mesh with them?

Spur Gears
http://www.emersonindustrial.com/en-US/documentcenter/PowerTransmissionSolutions/Catalog/Form_8586E_Sec_F.pdf
Refer to Page F6 Table#1

1” NSS16F16
https://www.motioncanada.ca/productDetail.jsp?sku=00374553

1.25” NSS16F20

1.5” NSS16F24

8. I’m assuming you extended the Mail Wheel slots by 1/16” toward the center of the wheel; to prevent any possible binding as I explained on Fiverr comment.

The pictures of the CCG Wheel look really good ☺ It’s a pleasure working with you. Thank you again.

May the blessings be

George

Date: 06/24/2015.

Information-06/24

Dear Mr. Wiseman.

As always, it is a great pleasure for us to greet you, and at this time, we would like to give you some information about the pinions and the main wheel's bolts distribution that you requested.

First:

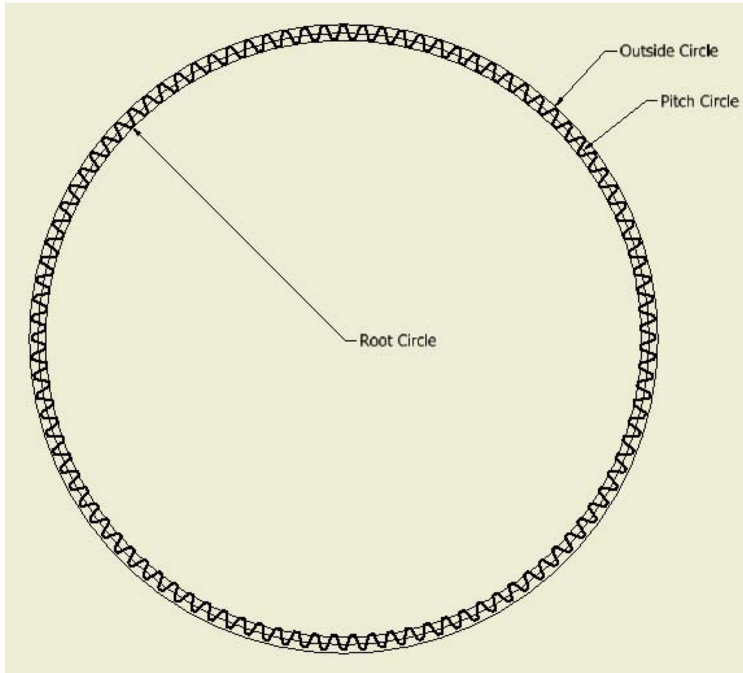
We have noticed that you have some concern about the gears we generated. That is why we consider appropriate to let you know with more detail how we carried out the design of these. Always, in order to give a more efficient and better service to you.

First, we had a request from you about the main wheel's outside diameter to be not larger than 24", and then, an additional request for designing three pinions of different diameters (1", 1.25"and 1.5" respectively). The three pinions were expected to being able to mesh with the same gear (the main Wheel). The warranty for the three pinions to have an appropriate mating with the main wheel is having the same diametric pitch (amount of teeth by diameter's unity). This diametric pitch is 16 teeth/in.

Below we present to you the main features for the Main Wheel and the pinions:

1. Gear (Main Wheel):
   - ✓ Diametric pitch (P_d): 16 in^{-1}.
   - ✓ Outside diameter (D_o): 24 in.
   - ✓ Pitch diameter (D): 23.875 in.
   - ✓ Root diameter (D_R): 23.719 in.
   - ✓ Number of teeth (N): 382.
   - ✓ Pressure angle (Ø): 20°.
2. 1.5" diameter pinion:
   - ✓ Diametric pitch (P_d): 16 in^{-1}.
   - ✓ Outside diameter (D_o): 1.625 in.
   - ✓ Pitch diameter (D): 1.5 in.
   - ✓ Root diameter (D_R): 1.344 in.
   - ✓ Number of teeth (N): 24.
   - ✓ Pressure angle (Ø): 20°.
3. 1.25" diameter pinion:
   - ✓ Diametric pitch (P_d): 16 in^{-1}.
   - ✓ Outside diameter (D_o): 1.375 in.
   - ✓ Pitch diameter (D): 1.25 in.
   - ✓ Root diameter (D_R): 1.094 in.
   - ✓ Number of teeth (N): 20.
   - ✓ Pressure angle (Ø): 20°.
4. 1" diameter pinion:
   - ✓ Diametric pitch (P_d): 16 in^{-1}.
   - ✓ Outside diameter (D_o): 1.125 in.
   - ✓ Pitch diameter (D): 1 in.
   - ✓ Root diameter (D_R): 0.844 in.

- ✓ Number of teeth (N): 16.
- ✓ Pressure angle (Ø): 20°.



Gear circle's nomenclature

- Note: The calculus for gear ratio or speed ratio is based in the teeth's number or the pitch diameter.

As you could see, every gear (gear and pinions) have a diametric pitch equal to $16\ in^{-1}$, this give us warranty of meshing between all the pinions and the main wheel.

With the information that we have of each component, it can be calculated the angular velocity (rotation velocity) for the main wheel according the pinion which it is mating with, and the angular velocity of the motor. For example, for the main wheel and the 1.5" diameter pinion it would be:

- ✓ Gear ratio:

$$R_G = \frac{N_1(Main\ wheel's\ teeth\ number)}{N_2(Pinion's\ teeth\ number)};$$

$$R_G = \frac{382\ teeth}{24\ teeth} = 15.917.$$

- ✓ Main wheel's angular velocity:

$$\omega_G = \frac{\omega_p\ (Pinion's\ angular\ velocity)}{R_G\ (Gear\ ratio)};$$

$$\omega_G = \frac{1000\ rpm}{15.917} = 62.826\ rpm.$$

- Note: There is not relative movement between the pinion and the motor shaft, that is why the minimum motor speed given by its the manufacturer was taken for the calculus above.
- ✓ Linear velocity at any point in the main wheel's radius:

  It is possible to calculate the linear velocity at any point of the main wheel if we know the distance in which this point is located from the main wheel's center. For example, the outer weight radius is 10.781", which means the linear velocity at this point for the Main wheel mating with the 1.5" diameter pinion, and this motor's minimum angular velocity would be:

$$V_{@outer\ weight\ radius} = \omega_G * r$$

  Angular velocity's unit conversion:

$$\omega_G = 62.826 \frac{1\ Rev}{1\ min} * \frac{1\ min}{60\ s} * \frac{2\pi\ rad}{1\ Rev} = 6.579\ s^{-1}$$

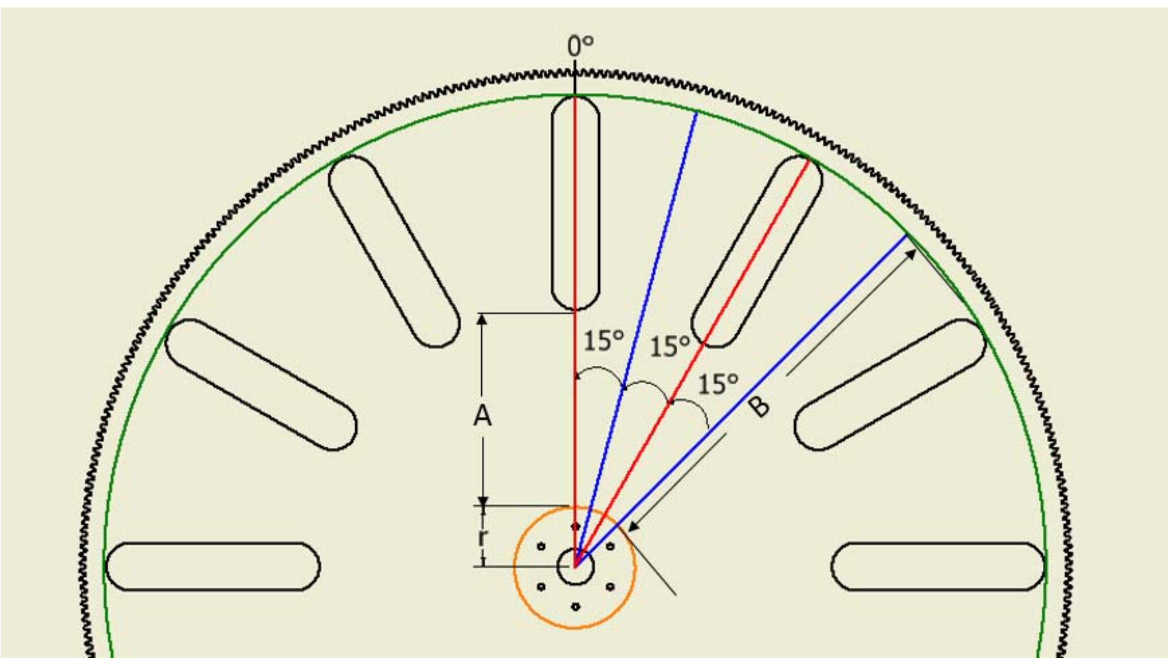
  Now, V can be calculated:

$$V_{@outer\ weight\ radius} = 6.579\ s^{-1} * 10.781" = 70.928 \frac{\text{in}}{\text{s}}.$$

We hope this information can help you a little in your searching for an appropiate pinion for the system. We kindly have provided to you a spreadsheet named "Gear calculus", located in the main folder.

Second:

In relation to the main wheel's bolts distribution, we would like to give a sort of method in which you can communicate us more exactly how you prefer the distribution:



Bolt's distribution diagram

The green circle in the diagram represents the limit in which the bolts can be placed, the orange circle's radius represents the distance in which the first bolt will be placed, the red line over the 0° reference represents the imaginary line which pass over the slots and the blue line (at 15° from the red line) represents the imaginary line passing between the slots. "A" is the functional distance on the red line for placing bolts and "B" is the functional distance for placing bolts on the blue line. The bolt pattern in the red line will be repeated every 30°, and the same will be done for the bolt pattern on the blue line. Please, Let us know your desire for:

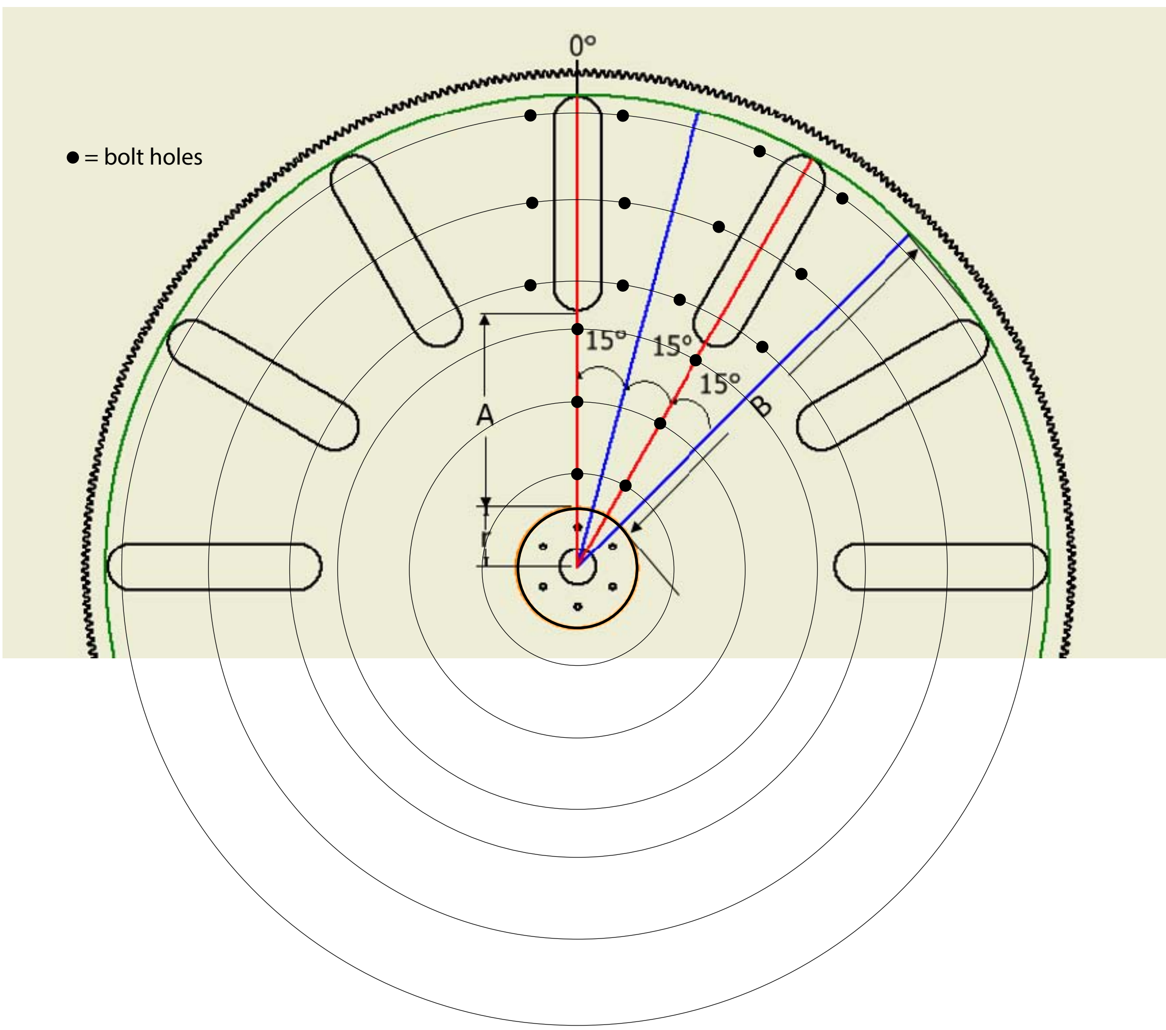
- ✓ Orange circle's radius (r).
- ✓ Number of bolts over the "A" segment.
- ✓ Number of bolts over the "B" segment.

With that information, we will be able to know more exactly the bolt's pattern in the main wheel that you expect.

We would like you to know that we are working right now on the others requests you have given. In this way, we are trying to improve the way how you communicate your desires to us. As always, it was a great pleasure for us to write you.

Best Regards.

Eddy R.



0°
● = bolt holes
15°
15°
15°
A
B
r

Revision Notes for Resume 1 of CCG Wheel
June 24, 2015 by George Wiseman

Eddy,

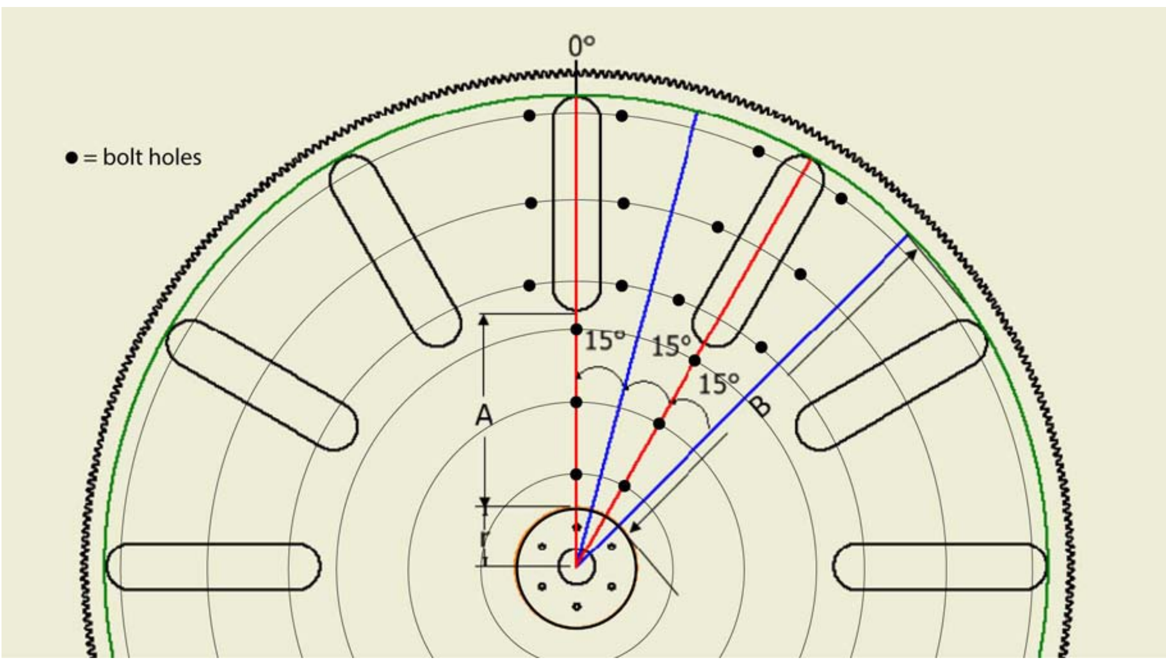
1. I have absolutely no doubt that the gears you've designed are perfect. That isn't the issue. If I have to have the gears manufactured, I will… But custom manufacture of such gears cost a LOT of money, as much as $400 each.

Whereas if I can buy the gears 'off-the-shelf' like the ones I spec'd for you, the price is in the $20 to $30 range.

The Main Wheel teeth is not a price issue because the laser will inexpensively cut them to whatever we design.

So I'm really hoping that you can engineer the Main Wheel gear teeth to match 'off-the-shelf' gears.
But if you cannot, it's not a deal breaker; I'll just have to have the gears custom manufactured.

2. Find below a drawing indicating what I want for the bolt pattern. It is not to scale and the bolts are not placed exactly, the drawing is just to give you an idea of what my ideal would be.



It's a pleasure working with you. Thank you again.

May the blessings be

George

Date: 06/25/2015.

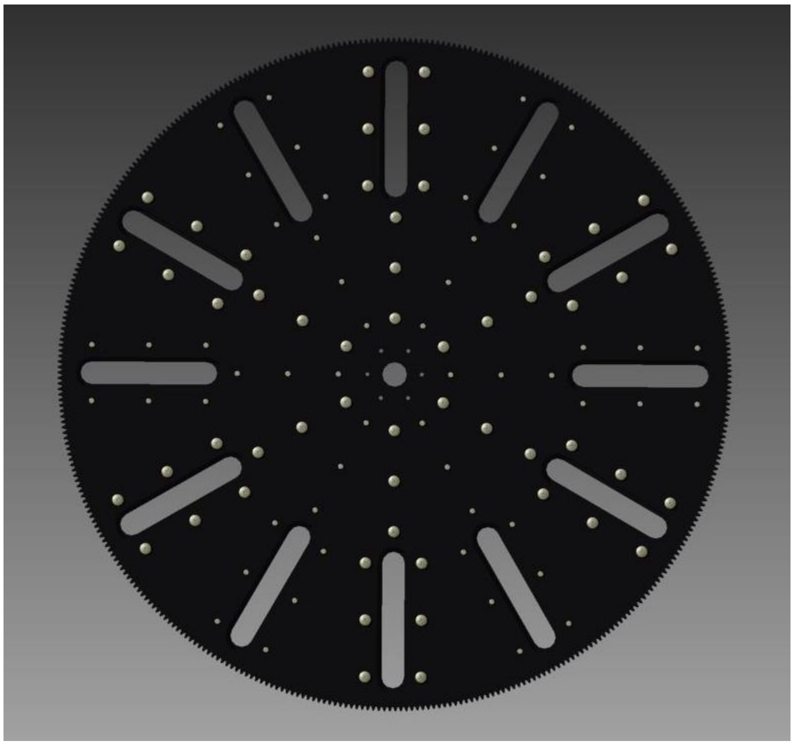
Resume-2

Dear Mr. Wiseman.

It is a great pleasure for us to greet you once again, and to communicate to you the last updates carried out in the CCG Wheel design. As the last time, we kindly hope you to be satisfy with these; please, notify if you do not.

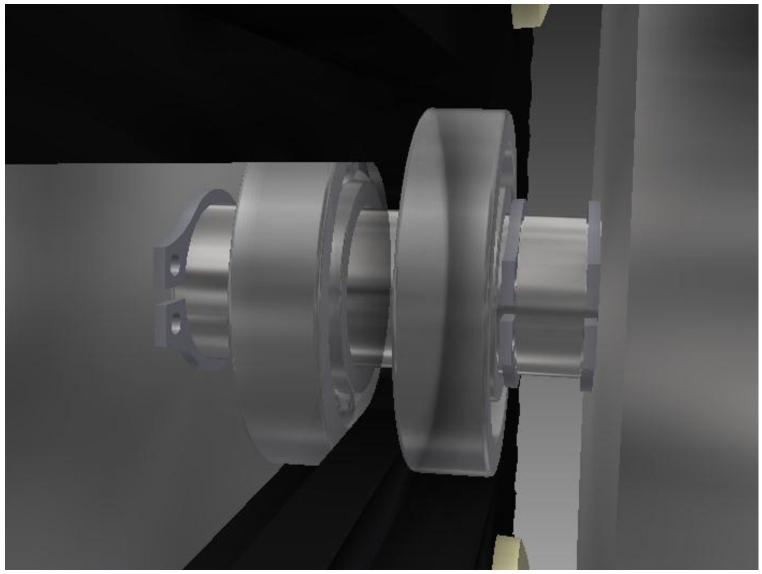
Below, the updates will be presented, in the same order of request given to us in your last email

1. The bolts pattern has been generated in the main wheel according with your indications, and a half was bolted from one side, and the other half from the opposite side. Below the details:

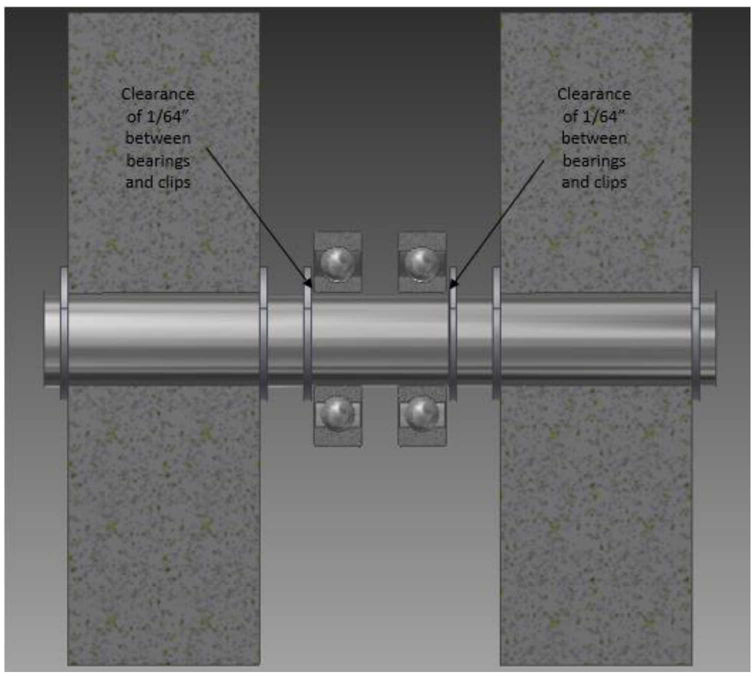


Bolts pattern in the main wheel.

2. The clips' grooves in the weight's axle have been reconfigured, leaving a clearance of 1/64" between the bearing's side and the clip's side. Details below:

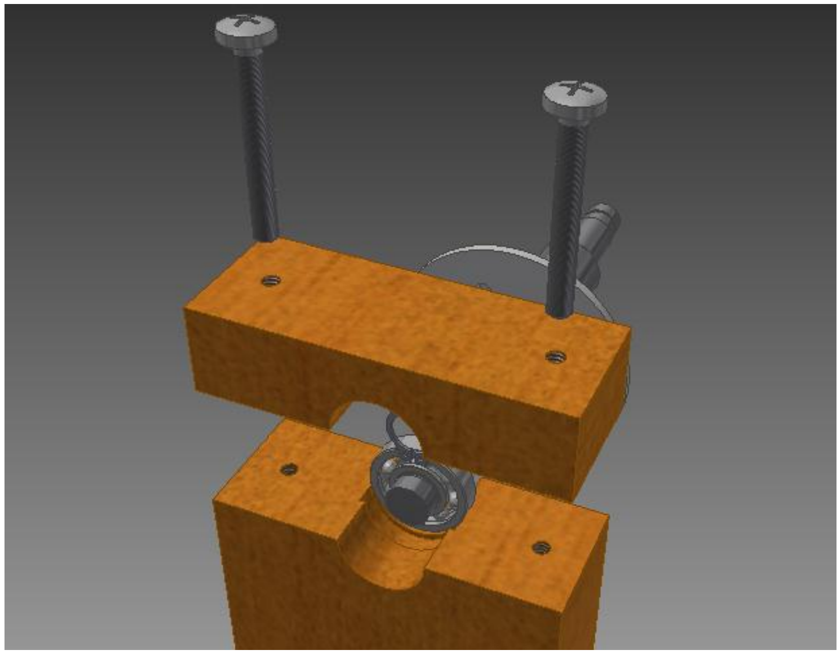


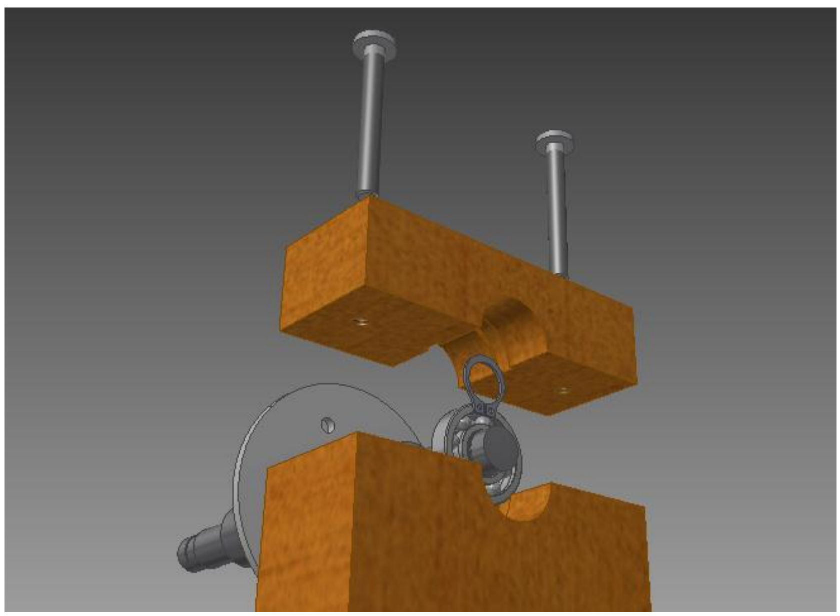
Weight set (from within the slot view-perspective).



Clearance between bearings and clips.

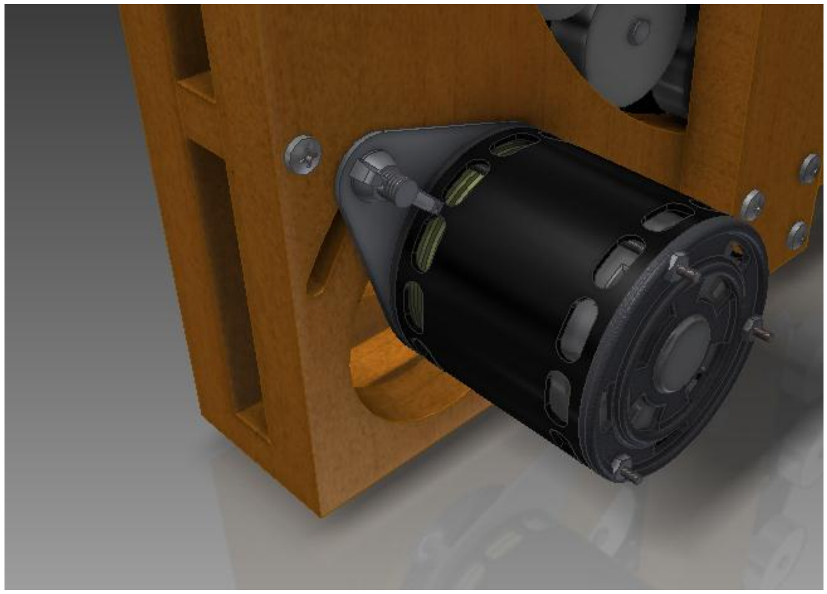
3. The top of the main wheel's support have been modified according with your indications:


Support’s top (top isometric view-perspective).

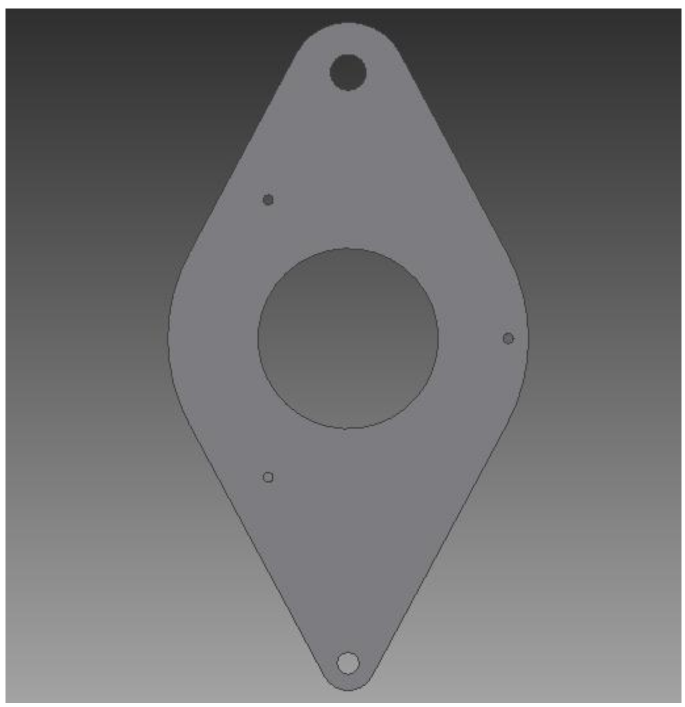

Support’s top (bottom isometric view-perspective).

The bearing fits in the stand/cap's groove, being fixed axially and an external retaining ring (clip) is installed in the main wheel’s axle, just in the bearings outside.

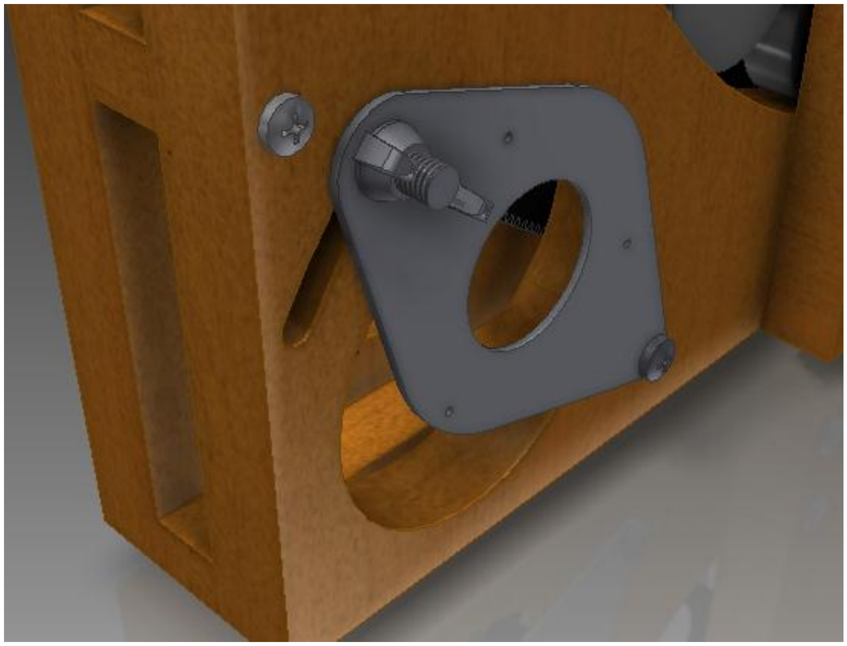
4. The Swinging bracket system has also been modified, the pin was eliminated, and it was provided of a carriage bolt and a wing nut. The bolt moves in a slot changing the swinging bracket’s inclination in a range from 0° to 20°. Details:

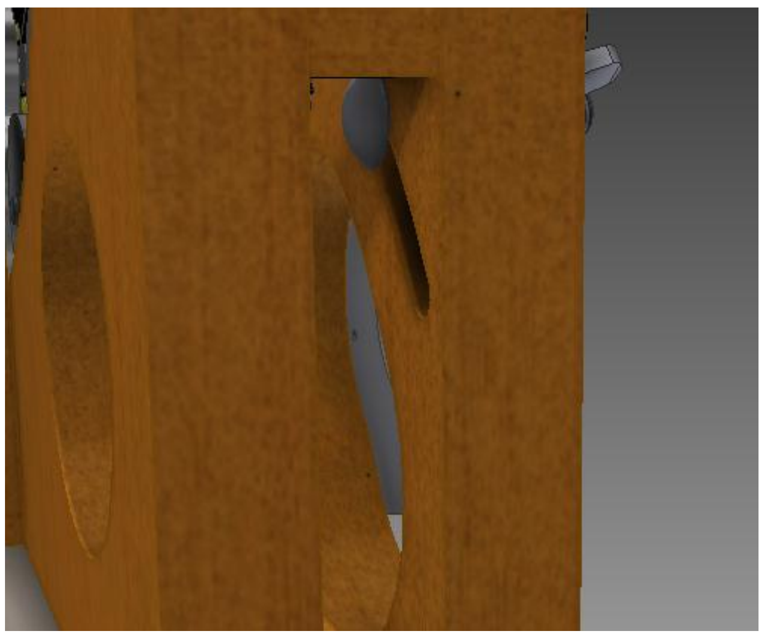


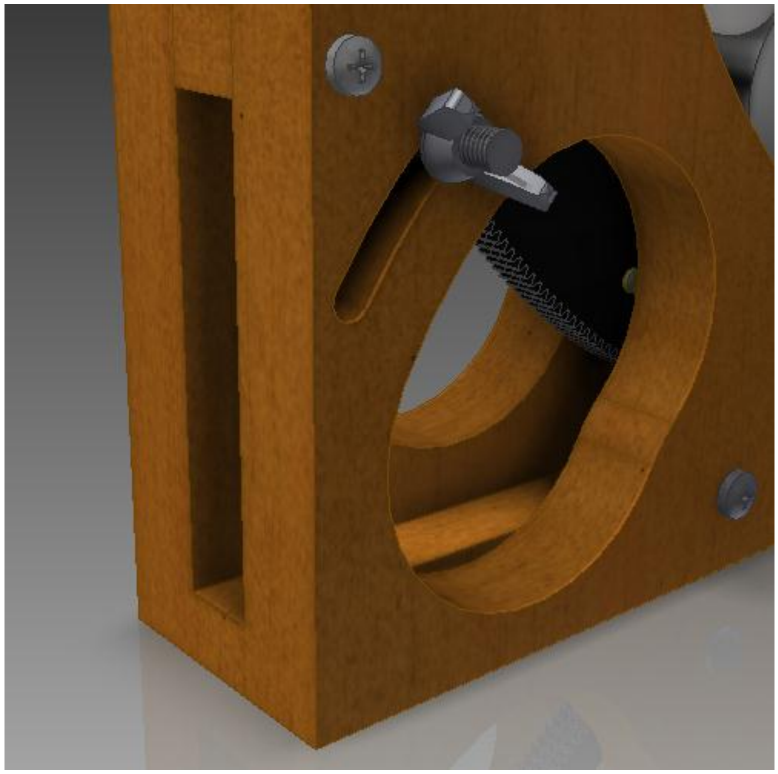
Swinging bracket system (perspective).



Swinging bracket.

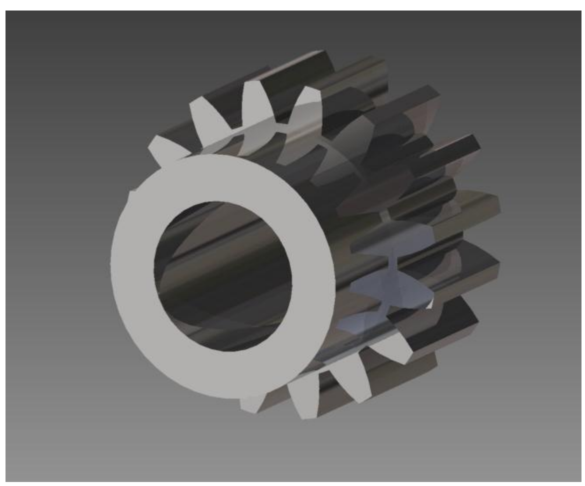

Swinging bracket system without motor.


Carriage bolt’s view from the opposite side.

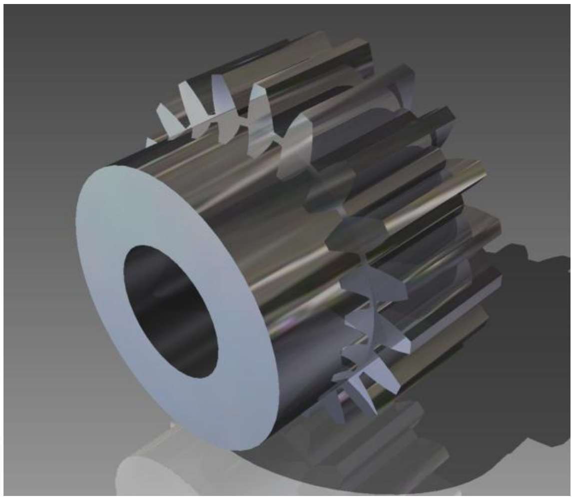


Swinging bracket system without motor and swinging bracket.

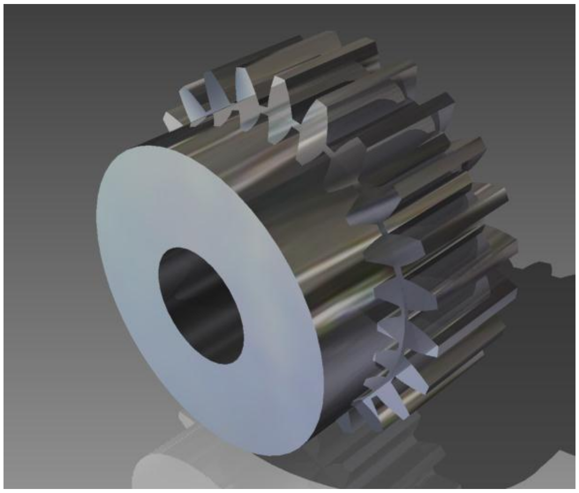
5. The tooth’s pressure angle of the main wheel was modified from 20° to 14.5°, which means that it can mesh perfectly with the Emerson pinions that you have specified. For two gears to mesh the main requirement is that they must have the same diametric pitch and the same pressure angle. We have also modeled those pinions according with the features given in the catalogue:



1” diameter pinion.



1.25” diameter pinion.



1.5” diameter pinion.

Finally, we would like to let you know that the main wheel’s slot have been extended 1/16” inward. Cordially, we also would like to invite you to indicate which elements are expected to be cut by laser, so we can take the necessary precautions in generating the CAD files that you will give to the manufacturer. As every time, you could find images of the overall system in the “CCG Wheel renders” folder. It has been a great pleasure for us to communicate to you the actual design’s resume.

Best Regards.

Revision Notes for Resume 2 of CCG Wheel
June 25, 2015 by George Wiseman

Eddy,
Thank you, a few tweaks and we'll be done with this Gig.

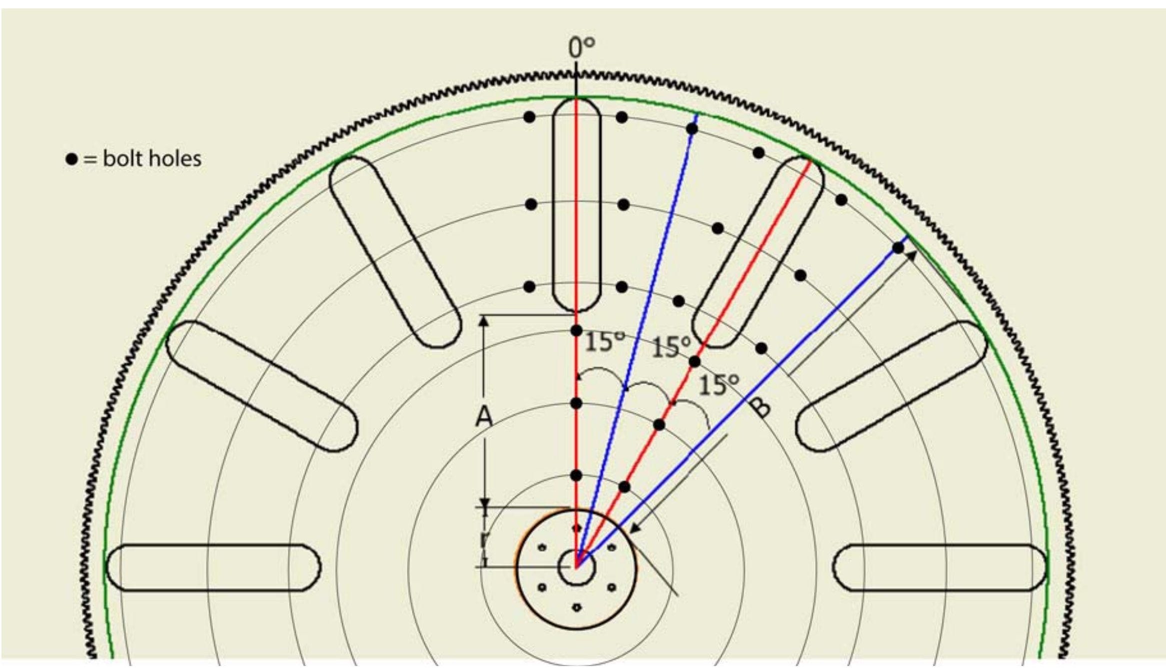
1. I just want to be sure that the weights have plenty of room to swing past the Main Wheel supports. In the rear view you sent (Figure 8) it looks like the supports are inset into the CRs and thus getting quite close to the weights.

2. In Figure 6 I notice that there aren't any bolts holding the CRs to the baseboard. Likely be a good idea to put some in. Three should do it. The bolts would be long enough to go all the way through.
Same with all the bolts that are holding the CRs spacer blocks.

3. The Motor mounting bracket is PERFECT! Thank you ☺

4. The Main Wheel (holding together) bolts are perfect as far as I told you. I now see we should add 12, one between each weight slot on the outer bolt radius. Just to hold the gear teeth together a little stronger.

Find below a drawing indicating what I want for the bolt pattern. It is not to scale and the bolts are not placed exactly, the drawing is just to give you an idea of what my ideal would be.



5. The weight axle / bearing clearances look perfect ☺

6. The Main Wheel support top looks very good. I'd make the cap holes large enough so that the bolts could slide through them to screw into the threaded holes in the support.

7. Thank you for modifying the Main Wheel gear teeth to fit the spec'd gears, I really appreciate that.

8. The Main Wheel is to be cut with the laser. So each of the three Delrin 'gears' with slots and bolt holes need to have two Drawings.
One set as if they were manufactured by CNC (machined out of material) and
one set as if cut by laser (with appropriate compensation for laser kerf).

9. Thank you for extending the Main Wheel slots 1/16" inward.

It's a pleasure working with you. Wow, we're almost done ☺

May the blessings be

George

INV.
LATIN TECHNOLOGIES

Date: 06/26/2015.

Resume-3

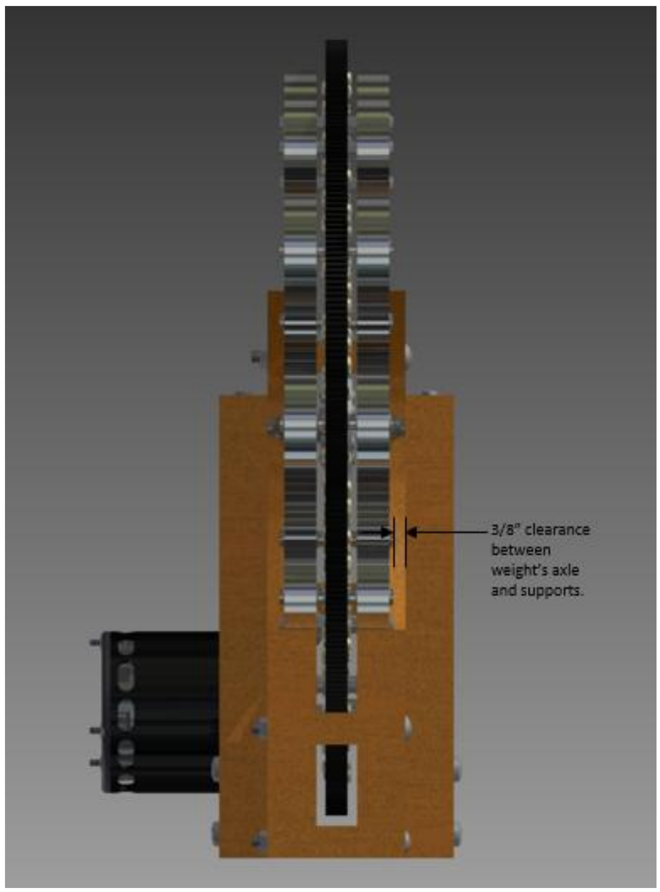
Greetings.

Dear Mr. Wiseman.

Once again we communicate to you the updates carried out to the CCG Wheel.

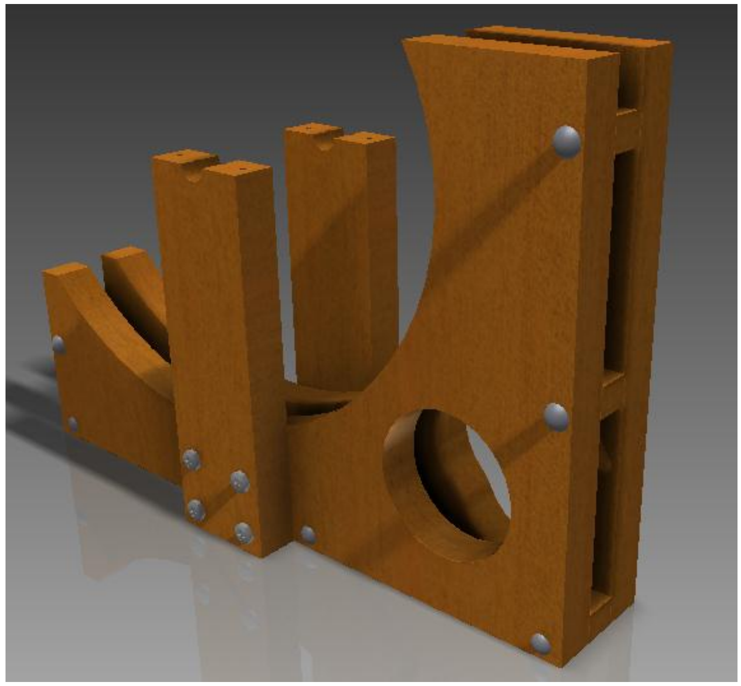
Below, the updates will be presented, in the same order of request given to us in your last email

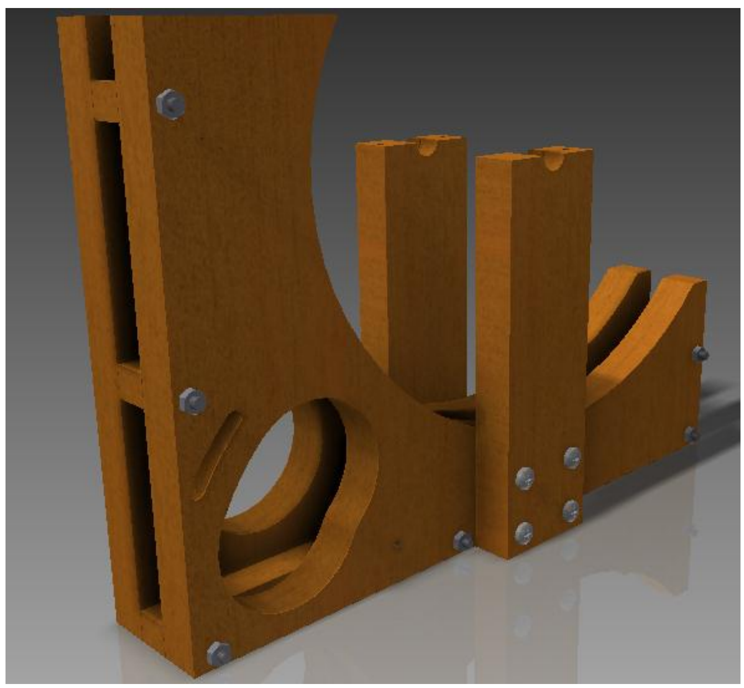
1. The closeness perceived in the “Figure 8” is due to the perspective of the image, below we present an orthographic image from the same angle, to show the space between the weights and the support:

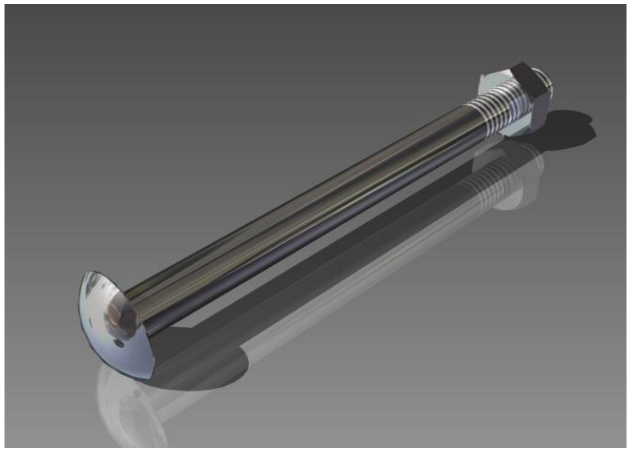


Clearance between the weight’s axle and the support.

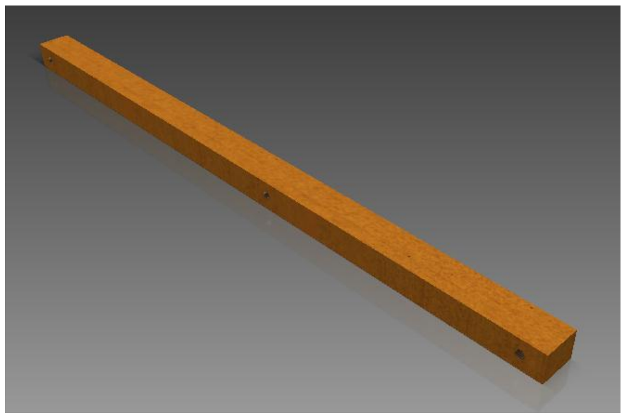
2. As you requested, passing bolts were provided to hold the CRs to a baseboard, and to hold the spacer blocks to the CRs:


CRs assembly-(right-front, perspective).


CRs assembly-(right-back, perspective).

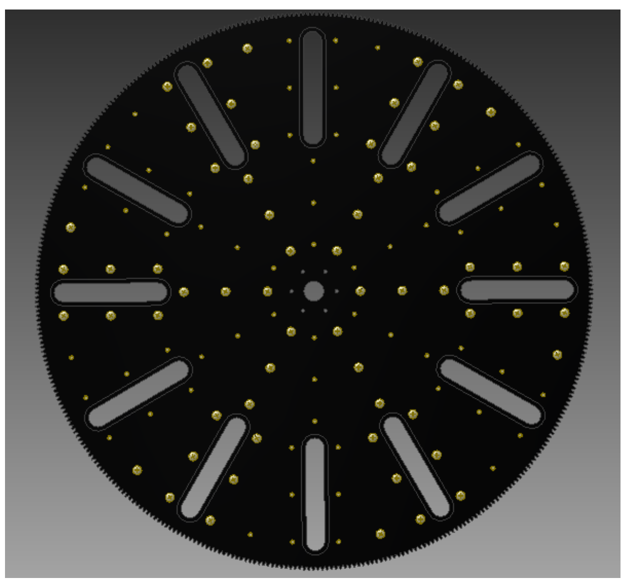


Carriage bolt (3/8-16x4.75” UNC) and Chamfered Bottom Hex Machine Screw Nuts (3/8-16 UNC).



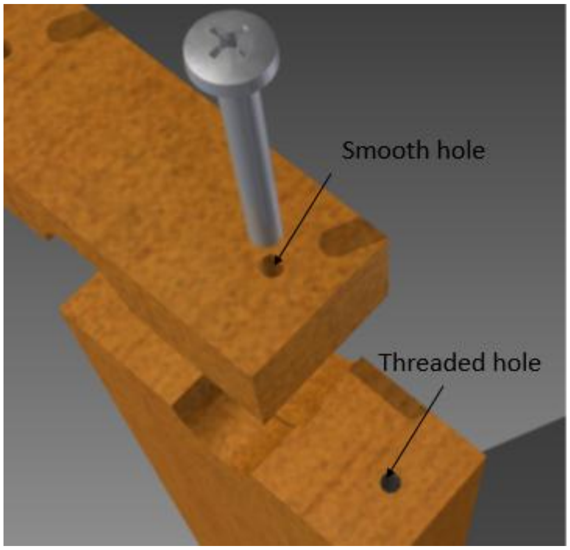
Baseboard.

3. Twelve bolts were placed in the Main wheel’s layers, where you indicated:



Main Wheel with the 12 added bolts.

4. Smooth holes were provided to the support’s cap for the bolts to pass through:



Smooth hole (cap)-threaded hole (support) (perspective).

These are the last tweaks that you sent to us. Once you confirm that you are pleased with the design achieved, we will begin to generate the files for its manufacturing. As always, you can find images of the overall system in the “CCG Wheel renders” folder. It has been a great pleasure presenting to you the last updates of the design.

EDDY R.