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- Getting Started
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- Home

## Improving the CG-5 Equatorial Mount

 [Also available in German](#)



To see labels, touch the image with your mouse cursor.

### Introduction

These web pages describe and illustrate how I improved my CG-5 German Equatorial Mount. I did this by disassembling its equatorial head; removing the existing grease; cleaning, smoothing, and polishing internal bearing surfaces; regreasing with a good-quality synthetic grease; and carefully adjusting the worm and other components.

**NEW!** These instructions are now available in PDF format.

 [Click here](#) [627KB].

The project required about nine hours to complete, and the final results are well worth the effort. I can now turn the RA and Dec worm shafts with my thumb and index finger without using the knob. I hope the pictures and

#### CG-5 INFORMATION

<a href="#">Introduction</a>
<a href="#">Preparation</a>
<a href="#">Getting Started</a>
<a href="#">Declination Axis</a>
<a href="#">Right Ascension Axis</a>
<a href="#">Tripod Tips</a>
<b>ASTRONOMY INFORMATION</b>
<a href="#">Barn Door Camera Mount</a>
<a href="#">Equatorial Mount Animation</a>
<a href="#">Comet Hale-Bopp Photos</a>
<a href="#">Constellation Portraits</a>

### What Is a CG-5?

The CG-5 is a popular medium-duty equatorial telescope mount available from several manufacturers. Actually, "CG-5" is Celestron International's name for its version of this mount, but other manufacturers sell what appears to be the same mount, and some of them have "borrowed" the CG-5 name. The same mount is sometimes sold as the "EQ-4."

The CG-5 is a copy of the well-known Vixen Great Polaris (GP) mount. The Vixen GP apparently proved so popular that other manufacturers decided to clone the GP and sell it under the CG-5 name. The two mounts are nearly identical in appearance.

Owners of both the Vixen GP and the larger Vixen GP-DX mount have informed me that the descriptions which follow were useful to them in dismantling and improving their mounts. It should be noted that, compared to the CG-5, the Vixen mounts usually perform well without extensive refurbishing.

### Room for Improvement

By all accounts, one area in which the CG-5 suffers in comparison to the Vixen GP is the smoothness and ease of movement of the Right Ascension (RA) and Declination (Dec) axes. This is attributed to the thick grease used in the CG-5 and the rough finish of its internal mechanical parts. Some users report that motor drives do not work well with the CG-5, due to the stiffness of the moving parts.

CG-5 owners report a marked improvement in the performance of the mount can be realized by disassembling the equatorial head, cleaning out the old grease, cleaning and polishing all internal bearing surfaces, and regreasing. Both of my CG-5s were very stiff, resulting in jerky movements when slewing the telescope by hand. Since I wanted to add motor drives to the mounts, refurbishing the equatorial heads seemed like a good idea.

I searched the web for instructions on how to disassemble the equatorial head but found nothing. Postings in the [sci.astro.amateur](mailto:sci.astro.amateur) newsgroup provided some very helpful information, as did private correspondence with other CG-5 owners. In the end, I plunged ahead and dismantled my first CG-5, documenting the experience with a digital camera. These web pages are the result.

### The "New" CG-5

In mid-1999, a new and improved version of the CG-5 mount began to appear. The CG-5 was improved with the addition of two ball bearings in the RA axis. Celestron apparently initiated the improved design, so that the mount could better carry the company's 9.25" SCT.

[📄 Comparison photos: Old and New CG-5 Mounts](#)

[📄 Photo of New CG-5 RA Components](#)

Owners of the improved CG-5 report better performance, especially with larger telescopes. I have no personal experience in disassembling or refurbishing the improved mount, but based on correspondence from owners, the procedures presented here should still constitute a useful guide.

### Other Improvements

*I Fixed My CG-5 at ...*  
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Once you've fixed your CG-5, announce it proudly to the world with Astronomy Boy's official "I Fixed My CG-5" t-shirt! [Click here.](#)

CG-5 owner Robert Burns has documented a number of modifications that improve the performance of the mount. These include reducing backlash in the motors, adapting the controller for autoguiding, modifying the worm gear, adding wooden tripod legs, and more. I urge you to check out Robert's Souped Up CG-5.

[📄 Robert Burns' Souped Up CG-5](#)

Pawel Lancucki is an amateur astronomer and CG-5 owner from Warsaw, Poland. Pawel has made extensive modifications and improvements to his CG-5, including enhancements to the drive controller and a better tripod. He also created some easy to follow instructions for the poorly-documented polar alignment scope. Since Pawel does not yet have a web site of his own, I am providing space at AstronomyBoy.com where he can share his work.

[📄 Pawel Lancucki's CG-5 Pages](#)

I have not yet tried Pawel's modifications and instructions, but I think you will find his ideas interesting and useful.

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**DISCLAIMER:** If you decide to disassemble your CG-5, it is entirely YOUR responsibility. The purpose of these pages is to show how I refurbished my own CG-5. I am not a machinist or a mechanic – I have no idea whether any of the procedures I used are "correct" in any sense of the word. Everything I accomplished was achieved through trial and error. You may or may not have the same success I had.

If you wish to use my experience as a guide, you are welcome to do so, but I take no responsibility for the success or failure of your efforts, or for errors and omissions in my descriptions and photos. I am not available to rebuild your mount should you have problems, but I will be happy to answer questions via e-mail.

Also, be aware that some of the materials I used for cleaning and lubricating my CG-5 are hazardous if used improperly. You must take appropriate precautions when using materials such as mineral spirits and synthetic grease. Heed ALL manufacturer's warnings regarding proper ventilation and exposure to these materials. Your safety is YOUR responsibility.

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[Preparation »»](#)

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[Getting Started](#) | [CG-5 Mount](#) | [SAA 100 List](#) | [Constellation Portraits](#) | [Barn Door Tracker](#)  
[Comet Hale Bopp](#) | [Homemade Eyepieces](#) | [EQ Mount Tutorial](#) | [Millennium Rant](#) |  
[Biography](#) | [Home](#)



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- Getting Started
- CG-5 Improvements
- SAA 100 Deep Sky List
- Constellation Portraits
- Barn Door Tracker
- Comet Hale-Bopp
- Homemade Eyepieces
- EQ Mount Tutorial
- Millennium Rant
- Who Is Astronomy Boy?
- Official Gear !
- Home

## Improving the CG-5 Equatorial Mount

### Preparation

Taking a CG-5 equatorial head apart and putting it back together again requires a few basic tools and a modest set of mechanical skills. If nuts, bolts, set screws, worm gears, Allen wrenches, and retaining rings make you nervous, you may be wise to find someone else to do the job.

### Tools and Materials

You will need the following items:

- **Allen (hex) wrenches.** Most of the screws holding the equatorial head together have hex heads and require Allen wrenches (also known as hex drivers) to remove or loosen. There are several sizes of these. Discussion with other CG-5 owners has revealed that some mounts are assembled with metric hardware, while others use English sizes. Be prepared for either type.
- **Small slotted screw driver.** There are a few tiny slotted screws for which a suitable screwdriver is required.
- **Sharpening stone.** To smooth and deburr some of the metal parts, I used a sharpening stone. One suitable type is a so-called "Arkansas" stone.
- **Crocus cloth.** This is a cloth-backed abrasive sheet, similar to sandpaper, but much finer. It can be found in the sandpaper section of a good hardware store or home center. You will need the Crocus cloth (along with the sharpening stone) to smooth and polish the internal metal parts of the equatorial head. Although I used crocus cloth, sandpaper will also work. Some rebuilders have reported good results through wet sanding with a very fine grit sandpaper.
- **Utility knife.** I used a sharp, flat bladed knife to scrape rough spots off the many plastic washers inside the equatorial head.
- **Cleaning solvent.** You'll need a solvent to dissolve the old grease from the moving parts of the mount. I used 100% mineral spirits, sometimes sold as paint thinner. If you have a favorite solvent for cleaning greasy parts, by all means use it. One CG-5 owner recommends diesel fuel. NOTE: Mineral spirits can be hazardous to your health. Please follow the label warnings regarding ventilation, skin/eye contact, and ingestion.
- **Toothbrush.** This is an excellent tool for scrubbing in between gear teeth and other hard to reach places.
- **Cotton cloths.** Clean, lint-free cotton cloths are a must for cleaning parts and removing excess grease and solvent – and for keeping your hands clean.
- **Grease.** Once the old, sticky grease is removed, you should re-grease the equatorial head with a good quality synthetic grease. I used Quaker State Full Synthetic White Marine Grease, a lithium-containing grease purchased at my local Wal-Mart store. A mount rebuilder in the UK recommends "Weldtite" lithium grease, available from cycle shops for about £2 per tube. Also highly recommended by some is [Super Lube® grease](#), which sounds just about perfect for this application.

CG-5 INFORMATION
<a href="#">Introduction</a>
<a href="#">Preparation</a>
<a href="#">Getting Started</a>
<a href="#">Declination Axis</a>
<a href="#">Right Ascension Axis</a>
<a href="#">Tripod Tips</a>
ASTRONOMY INFORMATION
<a href="#">Barn Door Camera Mount</a>
<a href="#">Equatorial Mount Animation</a>
<a href="#">Comet Hale-Bopp Photos</a>
<a href="#">Constellation Portraits</a>
<a href="#">Home Page</a>

- **Containers.** You will want some clean jars or other containers; one to hold the cleaning solvent and others to hold small parts to prevent them from being lost.
- **Paper and pencil.** Make notes as you go along. Trust me: a set of detailed notes made during disassembly will be very helpful when you are reassembling the equatorial head. When I rebuilt my first CG-5, I made 10 pages of notes and sketches during disassembly.

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 [Send E-mail to Astronomy Boy](#)

---

[Getting Started](#) | [CG-5 Mount](#) | [SAA 100 List](#) | [Constellation Portraits](#) | [Barn Door Tracker](#)  
[Comet Hale Bopp](#) | [Homemade Eyepieces](#) | [EQ Mount Tutorial](#) | [Millennium Rant](#) |  
[Biography](#) | [Home](#)

---

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Getting Started

CG-5 Improvements

SAA 100 Deep Sky List

Constellation Portraits

Barn Door Tracker

Comet Hale-Bopp

Homemade Eyepieces

EQ Mount Tutorial

Millennium Rant

Who Is Astronomy Boy?

Home

## Improving the CG-5 Equatorial Mount

### Getting Started

Start the disassembly by removing and setting aside the manual slow motion knobs and the plastic RA motor cover. Remove the counterweight shaft.

Next, separate the RA and Dec sections of the equatorial head. I refurbished the Dec assembly of my CG-5 while it was still attached to the RA assembly. This was before I realized how much easier the job becomes when the two sections are separated.

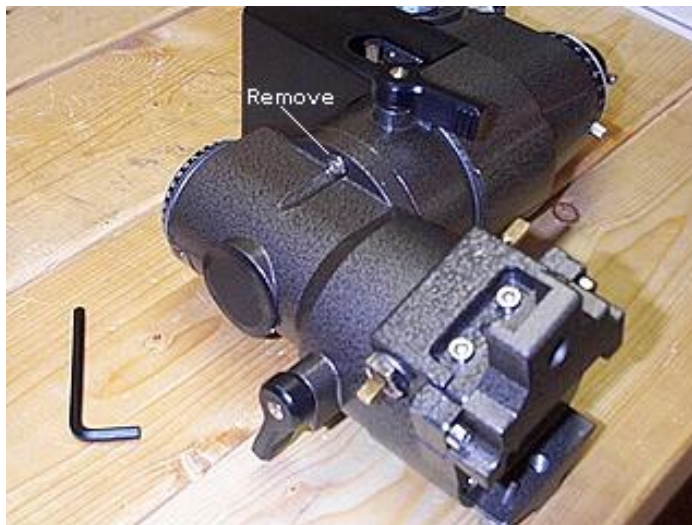
To separate the sections, remove the two large hex head screws which pass through the Dec housing and into the RA housing on either side of the opening for the polar alignment scope. The entire Dec assembly can now be removed from the rest of the equatorial head.

#### A Note About Plastic Washers

The inside of my CG-5 equatorial head contained more than a dozen friction-reducing clear plastic washers (or spacers). Your CG-5 may contain more or fewer of these parts.

Most of these washers are coated with grease. This makes them difficult to see, and also causes them to adhere to other parts. So check very carefully at each step to be sure you've found all the washers, removed them, and noted their locations for later re-assembly.

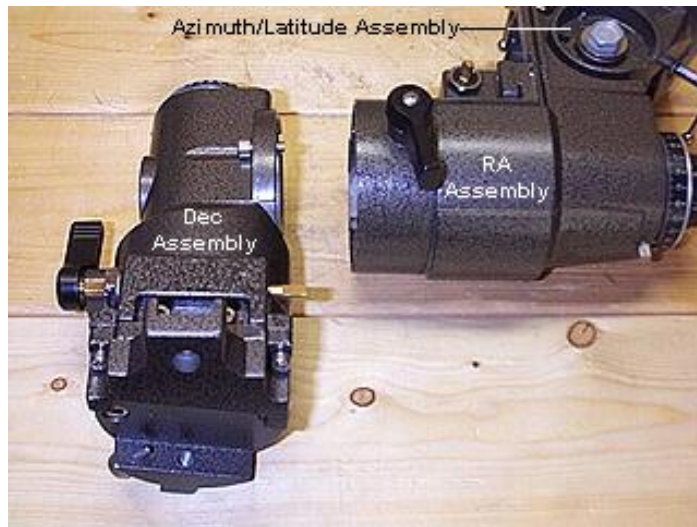
For the refurbished equatorial head to work properly, it is important that each washer be replaced in its correct location when you reassemble the head. So be sure you have some means for identifying the washers. This is a good reason to make notes and to keep several containers on hand for storing parts.



To separate the two parts of the head, remove the indicated screw and the matching one on the other side of the Dec housing.

#### CG-5 INFORMATION

Introduction
Preparation
Getting Started
Declination Axis
Right Ascension Axis
Tripod Tips
<b>ASTRONOMY INFORMATION</b>
Barn Door Camera Mount
Equatorial Mount Animation
Comet Hale-Bopp Photos
Constellation Portraits
Home Page



The equatorial head can be further subdivided by detaching the RA assembly from the azimuth/latitude assembly, but I did not do this.

[Declination Axis » »](#)

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---

[Getting Started](#) | [CG-5 Mount](#) | [SAA 100 List](#) | [Constellation Portraits](#) | [Barn Door Tracker](#)  
[Comet Hale Bopp](#) | [Homemade Eyepieces](#) | [EQ Mount Tutorial](#) | [Millennium Rant](#) | [Biography](#) |  
[Home](#)

---

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- CG-5 Improvements
- SAA 100 Deep Sky List
- Constellation Portraits
- Barn Door Tracker
- Comet Hale-Bopp
- Homemade Eyepieces
- EQ Mount Tutorial
- Millennium Rant
- Who Is Astronomy Boy?
- Official Gear !
- Home

## Improving the CG-5 Equatorial Mount

### Declination Axis, Part 1

Here is the step-by-step procedure I followed to disassemble the declination axis. Although these pictures show the Dec assembly joined to the RA assembly, you'll find it easier to perform these steps if you separate the two sections of the equatorial head as shown on the previous page.



Remove the two large hex head screws in the top of the dovetail bracket. This allows you to remove the bracket and an attached portion of the Dec housing.

CG-5 INFORMATION
<a href="#">Introduction</a>
<a href="#">Preparation</a>
<a href="#">Getting Started</a>
<a href="#">Declination Axis</a>
<a href="#">Right Ascension Axis</a>
<a href="#">Tripod Tips</a>
ASTRONOMY INFORMATION
<a href="#">Barn Door Camera Mount</a>
<a href="#">Equatorial Mount Animation</a>
<a href="#">Comet Hale-Bopp Photos</a>
<a href="#">Constellation Portraits</a>
<a href="#">Home Page</a>

Turn the Dec assembly upside down. Unscrew and remove the black retaining ring. Immediately under the retaining ring is a clear plastic washer, the first of many you will encounter. Remove the washer, and place it in a storage container. Mark the container or otherwise note where the washer came from, so you can put it in the correct location when you reassemble the equatorial head.

The setting circle can now be removed. In my CG-5 there was a stack of FOUR plastic washers immediately beneath the setting circle. One or more of these may adhere to the underside of the setting circle, so be sure you carefully remove and store each washer.



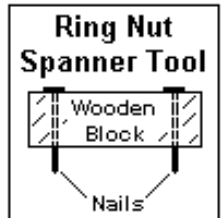


Removing the setting circle exposes the ring nut that holds the Dec shaft in its housing. The ring nut is secured by two small hex head set screws. These can be reached through a slot in the wall of the housing.



Rotate the Dec shaft until one of the set screws is visible through the slot. Loosen, but DO NOT REMOVE the set screw. Rotate the Dec shaft 180° to align the second set screw with the slot. Again, loosen, but do not remove the set screw. The set screws are deep in their threaded holes and are difficult to see. You'll have to probe around with your Allen wrench (hex driver) until it slips into place. Try a 1.5mm hex driver here.

The ring nut can now be unscrewed from the Dec shaft. If your CG-5 is anything like mine, the ring nut will be tight. I used a small piece of stiff wire placed into one of the two small indentations on the face of the nut to hold it in place while turning the Dec shaft by hand. Some CG-5 owners have found it necessary to make a "spanner tool" from two small nails (or better yet, drill bits) and a block of wood. The nails (or drill bits) are spaced to match the distance between the indentations. Insert the ends of the nails (or drill bits) into the indentations on the face of the ring nut to hold it firmly so it can be unscrewed from the Dec shaft.



There is a plastic washer under the ring nut. Carefully remove the washer, and set it aside.

The Dec shaft can now be removed from the Dec housing.

[Declination Axis, Part 2 »»](#)

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---

[Getting Started](#) | [CG-5 Mount](#) | [SAA 100 List](#) | [Constellation Portraits](#) | [Barn Door Tracker](#)  
[Comet Hale Bopp](#) | [Homemade Eyepieces](#) | [EQ Mount Tutorial](#) | [Millennium Rant](#) |  
[Biography](#) | [Home](#)

---

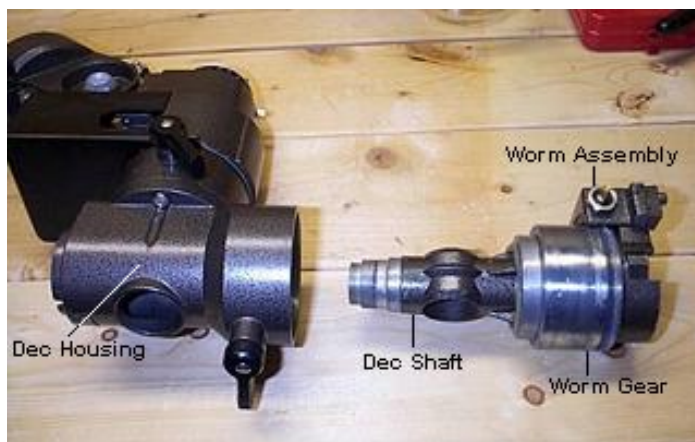
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- Getting Started
- CG-5 Improvements
- SAA 100 Deep Sky List
- Constellation Portraits
- Barn Door Tracker
- Comet Hale-Bopp
- Homemade Eyepieces
- EQ Mount Tutorial
- Millennium Rant
- Who Is Astronomy Boy?
- Home

## Improving the CG-5 Equatorial Mount

### Declination Axis, Part 2



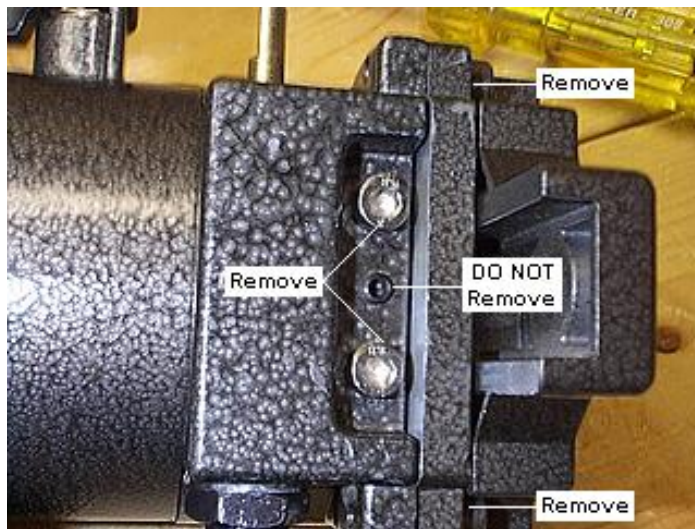
Here, the Dec shaft has been removed from the Dec housing. Some important components are identified.

With the Dec shaft removed, look down into the Dec housing. Note the small plastic button in the Dec lock mechanism. This button can easily fall out and become lost, so remove it and store it while refurbishing the equatorial head.

Also note that a large plastic washer may remain inside the Dec housing when the Dec shaft is removed. This washer should be removed from the housing.



CG-5 INFORMATION	
<a href="#">Introduction</a>	
<a href="#">Preparation</a>	
<a href="#">Getting Started</a>	
<a href="#">Declination Axis</a>	
<a href="#">Right Ascension Axis</a>	
<a href="#">Tripod Tips</a>	
ASTRONOMY INFORMATION	
<a href="#">Barn Door Camera Mount</a>	
<a href="#">Equatorial Mount Animation</a>	
<a href="#">Comet Hale-Bopp Photos</a>	
<a href="#">Constellation Portraits</a>	
<a href="#">Home Page</a>	



Unscrew and remove the four large hex screws that attach the worm assembly to the Dec shaft. DO NOT REMOVE the small set screw. Each pair of screws is a different length, so be sure to note which screws go in which holes.

The small set screw is used to adjust the tension of the worm drive. It should be left in place. You will likely need to adjust it after reassembling the Dec axis.

[Declination Axis, Part 3 »»](#)

 [Send E-mail to Astronomy Boy](#)

---

[Getting Started](#) | [CG-5 Mount](#) | [SAA 100 List](#) | [Constellation Portraits](#) | [Barn Door Tracker](#)  
[Comet Hale Bopp](#) | [Homemade Eyepieces](#) | [EQ Mount Tutorial](#) | [Millennium Rant](#) | [Biography](#) |  
[Home](#)

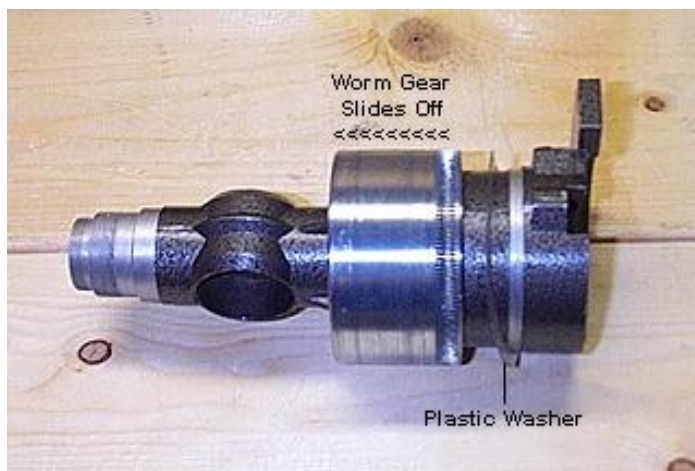
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- Getting Started
- CG-5 Improvements
- SAA 100 Deep Sky List
- Constellation Portraits
- Barn Door Tracker
- Comet Hale-Bopp
- Homemade Eyepieces
- EQ Mount Tutorial
- Millennium Rant
- Who Is Astronomy Boy?
- Home

## Improving the CG-5 Equatorial Mount

### Declination Axis, Part 3



With the worm assembly removed, the worm gear can slide off the Dec shaft. Note that there is a large plastic washer at both ends of the silver worm gear. When I disassembled my CG-5, one washer remained inside the Dec housing, stuck in the thick grease.

CG-5 INFORMATION	
Introduction	
Preparation	
Getting Started	
Declination Axis	
Right Ascension Axis	
Tripod Tips	
ASTRONOMY INFORMATION	
Barn Door Camera Mount	
Equatorial Mount Animation	
Comet Hale-Bopp Photos	
Constellation Portraits	
Home Page	

Here are the main parts comprising the declination axis. From left to right, we have the Dec housing, Dec shaft, worm and worm gear, setting circle, ring nut, and retaining ring.



#### Cleaning

Now that the declination axis is fully disassembled, it's time to clean. Using your solvent of choice, clean the old grease from the components. Pay special attention to the worm, which will require the toothbrush to scrub out the old, glue-like grease. Also use the brush to clean out the teeth in the worm gear.

Dip each plastic washer into the solvent and carefully wipe it clean using a cotton cloth. Do the same with the ring nut and retaining ring. The idea is to remove as much of the old grease as possible, along with

dirt and metal shavings left over from the manufacturing process.

### **Deburring and Polishing**

This part of the job is messy and time-consuming, but it's the main reason for the whole project. Take your time, and do it right.

There are numerous metal-to-metal and metal-to-washer bearing surfaces inside the Dec assembly. Run your finger across all of these surfaces, feeling for rough spots. To make the mount operate smoothly, you'll want to smooth out any rough spots you find.

It's sometimes difficult to determine whether or not a particular surface actually comes in contact with another surface. If in doubt, put a small dab of grease on a surface, slip the component into place, and rotate it. Then remove the component and see if the grease has been distributed across the surface. If it has, you can be fairly certain that the surface should be smoothed and polished. You don't want to waste time and effort on surfaces that don't make contact with anything.

Inside my CG-5, there were some very rough, almost jagged burrs. I used a sharpening stone to file them as smooth as possible.

Next, I used the Crocus cloth to polish all of the bearing surfaces. I spent a lot of time at this, perhaps more than necessary. I used small pieces of Crocus cloth so that I could reach into various nooks and crannies.

In my mount, some of the plastic washers had been roughened by contact with jagged metal. I used a hobby knife to gently scrap and shave off all rough spots I found on the washers. I was able to get them quite smooth. If you do this, use care not to cause further damage.

When everything is smoothed and polished to your satisfaction, clean the parts with your solvent and a clean cotton cloth.

### **Applying Grease**

You want a thin, even coat of grease on all bearing surfaces. As a non-expert in such matters, I can only guess whether I applied the correct amount of grease to my mount.

Apply grease to both sides of the two large washers that go on opposite ends of the worm gear. Put a few evenly-spaced dabs of grease on both sides of each washer. Grease the portions of the Dec shaft that bear on the inside of the worm gear. Slide the first large washer, then the gear into place on the Dec shaft. Place the second large washer into its location in the Dec housing.

Next, grease the bearing surfaces on the bottom end of the Dec shaft. Grease the entire outside of the worm gear (or the entire inside of the Dec housing). Make certain the gear teeth of the worm gear are completely greased. Put the Dec lock button into place, then slide the Dec shaft into the housing until the parts are fully seated.

To check whether the internal surfaces are sufficiently smooth, assemble the components, rotate the Dec shaft a few times, then pull the shaft from the housing. Examine the bearing surfaces and washers to see if the grease is evenly distributed, with no gaps. Pay special attention to the large washers on the worm gear. If the dabs of grease have been spread around the whole washer after a few turns of the Dec shaft, the bearing surfaces are probably smooth enough.

### **Adjustments**

There are three main areas of adjustment on each axis. They should be performed in the order listed below on both the Dec and RA axes:

- Ring Nut
- Worm Shaft End Play
- Worm Gear Mesh

#### **Ring Nut**

Screw the ring nut onto the bottom of the shaft. Don't forget the plastic washer that goes

between the ring nut and the shaft. Tighten the ring nut, using your spanner tool if necessary, until the shaft turns freely, but does not wobble or feel loose. Then, tighten the small set screws in the ring nut to hold it in place.

When adjusting the ring nut, bear in mind that the assembly will loosen up a bit after a period of use. If it is too loose now, it will only become looser later. There is a very fine line between too loose and too tight. You will find yourself making very small changes in the tightness of the ring nut to achieve the best compromise.

### **Worm Shaft End Play**

If either of the worm shafts is able to slide back and forth in its bracket (end play), you'll have excessive slop in the mount. To adjust the end play of either worm, start by removing the large silver nut on one end of the worm bracket. This reveals a threaded insert (or sleeve) through which the worm shaft passes. This insert can be turned to adjust the amount of end play in the worm. Too loose, and the axis will be very sloppy. Too tight, and the axis will be stiff. It may take several tries to find the happy medium.

On both of my CG-5s, there were several very small, very thin plastic washers in the worm assemblies. These washers are nearly invisible when buried in the thick factory grease, so it's easy to miss them. Look carefully!

Another description of this adjustment comes from fellow CG-5 owner [Jim McKay](#). Note that the worm assemblies on Jim's CG-5 contained no plastic washers! This is indicative of the variation you can expect between different examples of the CG-5.

I went ahead and removed the nut [on one end of the worm housing]. The nut holds a threaded sleeve in place. One end of the sleeve bears directly on the worm while the other end of the worm bears directly on the worm housing. There are no plastic washers on either end of the worm as there are inside the mount. The threaded sleeve can be threaded in and out of the housing thereby increasing and decreasing the amount of endplay in the worm. You then lock it in place with the hex nut. It would appear that you need a small amount of play otherwise the worm becomes very difficult to turn. I was able to take most of the play out and retighten the nut again. The nut is 16mm and is on fairly tight (I used a 1/4" drive metric socket set). I first took the worm housing off the mount and put it in a vise (with something to cushion the metal jaws of the vise), but I later found out that it can be loosened while the housing is still attached to the mount. Adjusting the sleeve made a BIG difference in the slop that I was experiencing in the RA axis. The DEC axis was fine and I didn't touch it. My guess is that without any washers between the worm and the housing, wear at the ends of the worm will necessitate adjustment at a later date.

Although I did not have any endplay in the worms of the first CG-5 I refurbished, my second CG-5 required this adjustment. Unlike Jim's mount, mine had plastic washers in both worm assemblies. I was able to remove the endplay almost entirely while maintaining very free movement of the worm.

### **Worm Gear Mesh**

This is the most tedious, but arguably the most important adjustment of all. Here, we are adjusting how deeply the worm meshes with the teeth of the large silver worm gear.

The small set screw between the two larger silver hex head screws on the worm assembly controls how deeply the worm meshes with the teeth of the worm gear inside the mount. If the gears mesh too tightly, the worm shaft will be stiff and difficult to turn. If the two gears do not mesh enough, the axis will have backlash and "slop."

Turning the set screw **clockwise** pushes the worm farther from the worm gear, **loosening the axis**. Turning the set screw **counter-clockwise** lets the gears mesh more deeply, **tightening the axis** and reducing backlash. Proper adjustment consists of making small

changes in the depth of the set screw until you achieve a good compromise between ease of motion and lack of backlash. Note that this sounds counter-intuitive (turning the screw clockwise to loosen up the axis), but it is correct.

Start by applying some grease to the worm and re-attach the worm assembly to the housing. Replace and tighten the four silver hex head screws, starting with the two on either side of the set screw. Try to tighten these two screws equally. Then tighten the other two hex head screws holding the worm assembly. Now grasp the upper end of the housing and turn the shaft.

**If it is too tight** and does not move freely, loosen the four silver hex head screws and turn the set screw a fraction of a turn **clockwise** to loosen up the axis. Re-tighten the four hex head screws and check the axis again.

**If it is too loose** and wobbly, loosen the four silver hex head screws and turn the set screw a fraction of a turn **counter-clockwise** to tighten up the axis. Re-tighten the four hex head screws and check the axis again.

As little as a tenth of a turn of the set screw can make a noticeable difference in the tightness of the gears. In addition, tightening the four hex head screws presses the gears together and causes them to mesh a little tighter. So you must use some trial and error to get it right. You want the worm tight enough against the worm gear so that the axis doesn't wobble, yet not so tight that the worm shaft is hard to turn.

Fellow CG-5 owner Bob Supler suggests lubricating some of the screws in the worm assembly:

As for the worm bracket screws, I lubricated all three on each axis – the center hex, as well as the two on either side. I also learned to put a dot of grease on the tip of the center hex because that grinds directly against the mount.

I didn't do this, but based on discussions with Bob, it seems like a good idea. When I need to adjust the worms again, I'll follow Bob's advice.

Between adjusting the tightness of the ring nut and adjusting the worm assembly, it's easy to spend an hour or more on each axis. That's what it takes to find the best compromise between stability and ease of motion. Don't skimp on this part of the project. Failing to properly adjust the mount can negate all the hard work you've done to clean, smooth and re-grease it. It's well worth your time.

### **Re-Assembly**

After adjusting the ring nut and worm, replace the setting circle and its retaining ring. Don't forget the washers here: four of them under the setting circle and one under the retaining ring. You may have more or fewer washers in your CG-5.

You've completed work on the declination axis. Congratulations!

[RA Axis »»](#)

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---

[Getting Started](#) | [CG-5 Mount](#) | [SAA 100 List](#) | [Constellation Portraits](#) | [Barn Door Tracker](#)  
[Comet Hale Bopp](#) | [Homemade Eyepieces](#) | [EQ Mount Tutorial](#) | [Millennium Rant](#) | [Biography](#) |  
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- Getting Started
- CG-5 Improvements
- SAA 100 Deep Sky List
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- Homemade Eyepieces
- EQ Mount Tutorial
- Millennium Rant
- Who Is Astronomy Boy?
- Official Gear !
- Home

## Improving the CG-5 Equatorial Mount

### Right Ascension Axis, Part 1

I learned a great deal by dismantling the Dec section of my CG-5, and so the RA section went more quickly. The techniques for cleaning, deburring, and polishing the RA components are the same as for the Dec section. We'll concentrate, then, on the disassembly of the RA axis and any unusual problems you might encounter.

**NOTE:** A new version of the CG-5 appeared in 1999 with a different internal design of the RA axis, including two ball bearings. According to owners of the new version, the disassembly procedure is not significantly different from the descriptions given here. However, I have no personal experience with the "new" CG-5.

[Photo of New CG-5 RA Components](#)

Start by removing the worm assembly from the RA housing. As with the Dec worm, remove the four large hex head screws, but leave the small set screw in place.



At the bottom of the RA assembly, remove the three knurled thumb screws that hold the polar axis scope, and also remove the setting circle lock screw. Then, find the two tiny slotted screws in the two circular collars beneath the thumb screws. Loosen, but do not remove the slotted screws. Unscrew and remove the first collar. The second collar can then be removed as well. Find and remove the plastic washer beneath the second collar.

CG-5 INFORMATION
<a href="#">Introduction</a>
<a href="#">Preparation</a>
<a href="#">Getting Started</a>
<a href="#">Declination Axis</a>
<a href="#">Right Ascension Axis</a>
<a href="#">Tripod Tips</a>
ASTRONOMY INFORMATION
<a href="#">Barn Door Camera Mount</a>
<a href="#">Equatorial Mount Animation</a>
<a href="#">Comet Hale-Bopp Photos</a>
<a href="#">Constellation Portraits</a>
<a href="#">Home Page</a>



Lift off the two settings circles. The RA shaft extension can now be unscrewed from the RA shaft, providing access to the ring nut. Remove the plastic washer under the shaft extension.



The RA ring nut is secured by three small hex head set screws (the Dec ring nut has only two set screws). These can be reached through the hole in the wall of the housing where the setting circle lock screw was removed.

Rotate the RA shaft until one of the set screws is visible through the hole. Loosen, but DO NOT REMOVE the set screw. Proceed to the second and third set screws, and loosen them.

The ring nut can now be unscrewed from the RA shaft. Refer to the [declination section](#) for more info about removing the ring nut and about the spanner tool that may be required.

There is a plastic washer under the ring nut. Carefully remove the washer, and set it aside. The RA shaft can now be removed from the RA housing.


[RA Axis, Part 2 »»](#)

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---

[Getting Started](#) | [CG-5 Mount](#) | [SAA 100 List](#) | [Constellation Portraits](#) | [Barn Door Tracker](#)  
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[Biography](#) | [Home](#)

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Getting Started

CG-5 Improvements

SAA 100 Deep Sky List

Constellation Portraits

Barn Door Tracker

Comet Hale-Bopp

Homemade Eyepieces

EQ Mount Tutorial

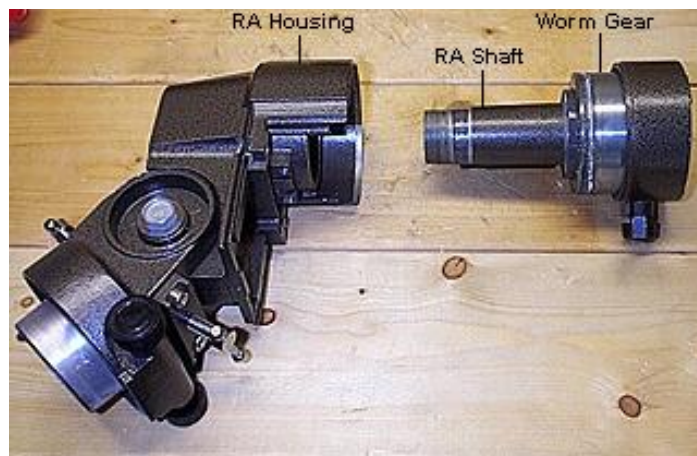
Millennium Rant

Who Is Astronomy Boy?

Home

## Improving the CG-5 Equatorial Mount

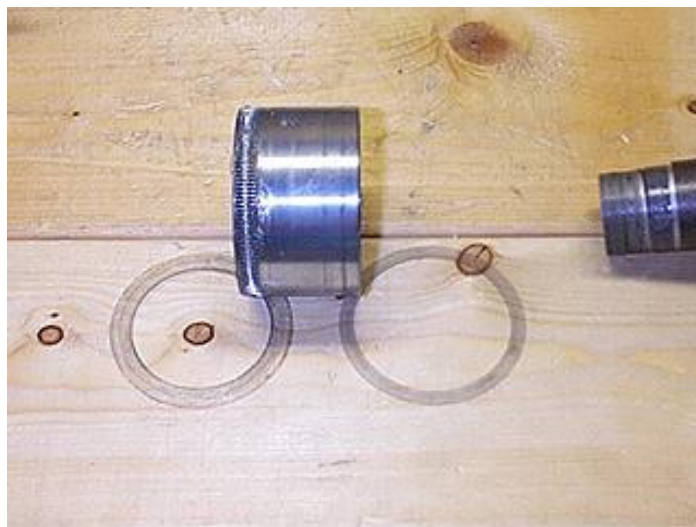
### Right Ascension Axis, Part 2



When the RA shaft is withdrawn from the RA housing, check to see whether the large plastic washer has adhered to the bottom of the silver worm gear or whether it is still inside the RA housing.

Slide the RA worm gear from the RA shaft. Be sure to note which plastic washer goes on which end of the gear; the washers have different cross sections. Don't lose track of the small plastic button in the RA lock mechanism, which is on the inside of the upper part of the RA shaft. See the [declination section](#) for a reminder of where this plastic button is located.

The RA worm gear can be difficult to remove from the housing, being virtually glued in place by the sticky grease. This seems to be a problem especially with newer versions of the mount. CG-5 owner [Ed Calvert](#) suggests using a hair drier to heat the R.A assembly. With his CG-5, this caused the factory grease to soften, and the RA gear was easily removed.



#### RA Fix-up

**Note:** Do not attempt to "dry fit" the worm gear on the RA shaft without some kind of lubrication. Keep the inside of the worm gear lubricated when checking the fit. Otherwise, it can easily bind on the shaft and be very difficult to remove.

Clean, smooth, polish, and re-grease the RA assembly as you did the Dec components. Pay lots of attention to smoothing all bearing surfaces and removing rough spots from the two large plastic washers on either end of the RA worm gear. Use your sharpening stone and Crocus cloth as necessary.

#### CG-5 INFORMATION

Introduction
Preparation
Getting Started
Declination Axis
Right Ascension Axis
Tripod Tips
<b>ASTRONOMY INFORMATION</b>
Barn Door Camera Mount
Equatorial Mount Animation
Comet Hale-Bopp Photos
Constellation Portraits
Home Page

Take care to grease all bearing surfaces, being especially careful to lubricate the portion of the RA housing into which the bottom of the worm gear seats. Grease the entire inside of the worm gear before slipping it over the RA shaft.

On the outside of the worm gear, you need grease on the gear teeth only. Most of the outside of the worm gear does not bear on anything and so needs no grease. The bottom end of the gear rests in a portion of the RA housing which must be greased as described above.

Put grease on both sides of each plastic washer. When reassembling the RA mechanism, be sure to replace all of the washers in their correct locations.

The RA axis of my first CG-5 seems to be inherently tighter than the Dec axis. Therefore, I tightened the ring nut only enough to prevent the RA shaft from moving up and down in the housing. After several months' use, the RA axis has NOT become noticeably looser.

The RA axis of my second CG-5 is inherently looser. I'll probably need to tighten it up after a few months of use.

As with the Dec axis, I devoted much time to adjusting the worm assembly, making it as loose and easy to turn as possible without allowing the RA shaft to wobble. I was successful in that I can turn the RA worm with my thumb and index finger without using the knob. Refer to the [adjustment instructions](#) in the Dec section.


### **Wrapping It Up**

The mount moves quite freely in both axes now, whereas it was very stiff before I cleaned, smoothed, and re-greased it. It's much easier to smoothly slew the scope by hand now; it was sometimes jerky before. And it is much easier to balance the scope properly.

I have added an inexpensive drive motor to the RA axis, and the mount tracks very well. With a Celestron C5 Schmidt-Cassegrain telescope, the CG-5 is just right for visual observing.

If you have questions, please e-mail them, and I will try to help.

«« **The End** »»

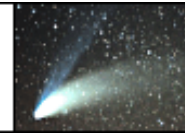
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[Getting Started](#) | [CG-5 Mount](#) | [SAA 100 List](#) | [Constellation Portraits](#) | [Barn Door Tracker](#)  
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- Homemade Eyepieces
- EQ Mount Tutorial
- Millennium Rant
- Who Is Astronomy Boy?
- Official Gear !
- Home

## Improving the CG-5 Equatorial Mount

### Tripod Tips

After you have improved the equatorial head of your CG-5, it's time to consider improvements to the tripod. The springy aluminum tripod that comes with most CG-5s is too flexible. The result is significant vibration, especially if you have a long and/or heavy telescope on the mount.

For a brief time, I owned a 120mm f/8.3 refractor, which I mounted on a CG-5. At magnifications greater than about 100x, vibrations took many seconds to damp out, and focusing at high power was nearly impossible. On the other hand, the standard tripod is perfectly steady with a short, lightweight scope such as a C5 5-inch SCT.

Below, in no particular order, is a brief list of tripod fixes for the CG-5, gleaned from the web, from newsgroups, and from private correspondence. I have not personally tested any of these remedies.

### 11 Tips for a Better Tripod

1. Replace the nuts and bolts connecting the tripod legs to the base. One suggestion is to get quality stainless steel hardware, so the nuts and bolts can be tightened down very tight without breaking. But be careful – you can break the tripod hub or deform the legs if you tighten the hardware too much.
2. Another idea is to drill out the legs and tripod hub to accept 3/8" shoulder bolts. The larger diameter bolts are alleged to help stabilize the tripod.
3. Buy or build a set of wooden legs for the tripod.
  - o [NatureWatch Tripod](#)
  - o Wooden tripod legs are sometimes available from: [TeleTrade](#)
  - o Pawel Lancucki describes how he converted a [used theodolite tripod](#) for use with his CG-5 equatorial head.
  - o Jim Mueller provides detailed instructions and excellent photos of his [homemade wooden tripod](#).
4. Put your CG-5 equatorial head on a pier. [Ken Dauzat](#) offers the KDPier, a portable pier for the CG-5.
5. Buy a surveyor's tripod. [Universal Astronomics](#) sells a variety of tripods and an adapter for attaching the CG-5 equatorial head to a surveyor's tripod.

CG-5 INFORMATION
<a href="#">Introduction</a>
<a href="#">Preparation</a>
<a href="#">Getting Started</a>
<a href="#">Declination Axis</a>
<a href="#">Right Ascension Axis</a>
<a href="#">Tripod Tips</a>
ASTRONOMY INFORMATION
<a href="#">Barn Door Camera Mount</a>
<a href="#">Equatorial Mount Animation</a>
<a href="#">Comet Hale-Bopp Photos</a>
<a href="#">Constellation Portraits</a>
<a href="#">Home Page</a>

6. Fill the aluminum legs with sand, lead shot, or expanding foam.
7. Fill the aluminum legs with tightly packed shredded newspapers. Use a wooden dowel to force the newspaper down the legs. Variation: Use wet newspaper, then bake the legs in an oven at 200°F to dry the newspaper. Supposedly, the newspapers dampen vibrations and make the legs less "springy." One guy swears this works!
8. Build a triangular wooden accessory tray/brace to replace the existing accessory tray. This has to be removed to fold the tripod but makes the tripod much more stable.
9. A variation on the two ideas above: Fill the hollow aluminum legs with cement, and add a plywood stiffener in place of or in addition to the accessory tray. You end up with a heavy – but very steady – tripod. (credited to Gary Hand, [Hands On Optics](#))
10. Suspend a weight from the center of the tripod base, hanging above the accessory tray.
11. Buy the Celestron vibration suppression pads. Nearly everyone agrees that these work well. [Read Ed Ting's review.](#)

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[Getting Started](#) | [CG-5 Mount](#) | [SAA 100 List](#) | [Constellation Portraits](#) | [Barn Door Tracker](#)  
[Comet Hale Bopp](#) | [Homemade Eyepieces](#) | [EQ Mount Tutorial](#) | [Millennium Rant](#) |  
[Biography](#) | [Home](#)

---

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- Getting Started
- CG-5 Improvements
- SAA 100 Deep Sky List
- Constellation Portraits
- Barn Door Tracker
- Comet Hale-Bopp
- Homemade Eyepieces
- EQ Mount Tutorial
- Millennium Rant
- Who Is Astronomy Boy?
- Home

## Improving the CG-5 Equatorial Mount



"Old" CG-5. Note the stepped RA housing.



"New" CG-5 with ball bearings. Note the tapered RA housing.

Photo courtesy of Kip Crawford.

## "Old" and "New" CG-5 Mounts

The "new" CG-5 has been improved with the addition of two ball bearings in the RA axis. There are two external differences that identify the "new" CG-5 with ball bearings in the RA axis. As you can see in the photos above, the "new" version has a smoothly tapered RA housing, where the "old" version has a stepped housing. The "new" CG-5 also has a differently shaped locking collar for the counterweight shaft. This is the conical component immediately above the counterweight in the lower photo.

I am not certain that this positively identifies every "new" CG-5, but it has proven correct so far.

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CG-5 INFORMATION
<a href="#">Introduction</a>
<a href="#">Preparation</a>
<a href="#">Getting Started</a>
<a href="#">Declination Axis</a>
<a href="#">Right Ascension Axis</a>
ASTRONOMY INFORMATION
<a href="#">Barn Door Camera Mount</a>
<a href="#">Equatorial Mount Animation</a>
<a href="#">Comet Hale-Bopp Photos</a>
<a href="#">Constellation Portraits</a>
<a href="#">Home Page</a>

---

[Getting Started](#) | [CG-5 Mount](#) | [SAA 100 List](#) | [Constellation Portraits](#) | [Barn Door Tracker](#)  
[Comet Hale Bopp](#) | [Homemade Eyepieces](#) | [EQ Mount Tutorial](#) | [Millennium Rant](#) | [Biography](#) |  
[Home](#)

---

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- Getting Started
- CG-5 Improvements
- SAA 100 Deep Sky List
- Constellation Portraits
- Barn Door Tracker
- Comet Hale-Bopp
- Homemade Eyepieces
- EQ Mount Tutorial
- Millennium Rant
- Who Is Astronomy Boy?
- Home

## Improving the CG-5 Equatorial Mount



Internal RA components of the "new" CG-5, with ball bearings.  
Photo courtesy of [Robert Burns](#)

### Ball Bearings in the "New" CG-5

The "new" CG-5 has been improved with the addition of two ball bearings in the RA axis. Should you disassemble the new version of the mount, these are the RA components you will find inside.

CG-5 INFORMATION
<a href="#">Introduction</a>
<a href="#">Preparation</a>
<a href="#">Getting Started</a>
<a href="#">Declination Axis</a>
<a href="#">Right Ascension Axis</a>
ASTRONOMY INFORMATION
<a href="#">Barn Door Camera Mount</a>
<a href="#">Equatorial Mount Animation</a>
<a href="#">Comet Hale-Bopp Photos</a>
<a href="#">Constellation Portraits</a>
<a href="#">Home Page</a>

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