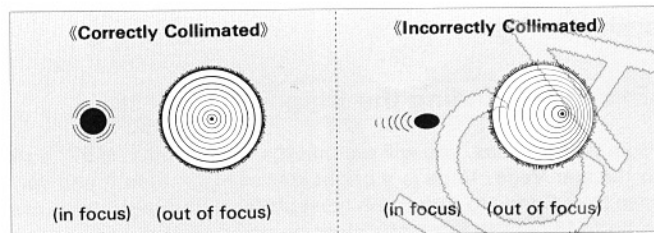


# HOW TO COLLIMATE THE OPTICAL SYSTEM OF A NEWTONIAN REFLECTOR

The optical performance of your telescope is directly related to its collimation. Your Newtonian reflector was collimated at the factory before shipment. However, if the telescope is roughly handled or jarred severely, it may have to be collimated.

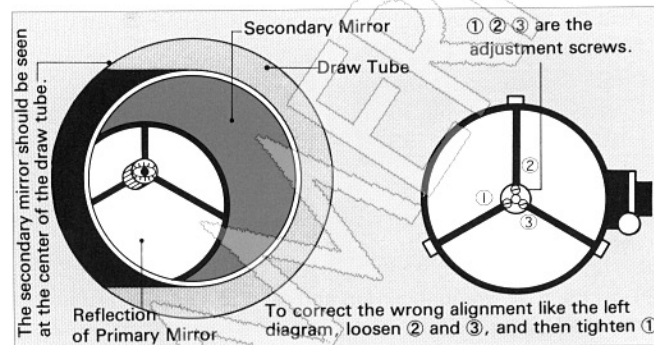
## Checking the Collimation of Your Telescope

Look at a bright star through the telescope. If the star is seen as a small dot at the center of the field of view, it is collimated correctly. You can also check the collimation by getting out of focus a little to enlarge the image. See the illustrations.



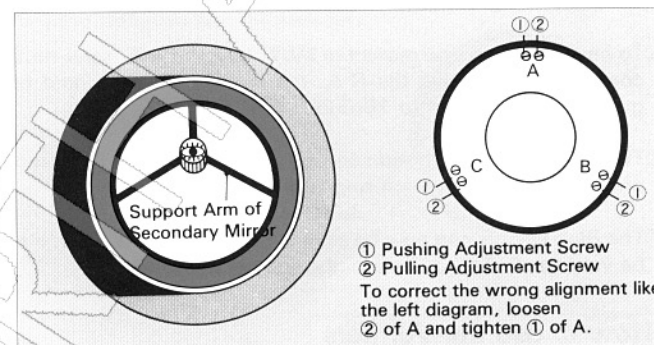
## Adjusting the Secondary Mirror

Point the telescope toward a brightly lighted area and look into the draw tube without attaching any eyepiece. If it looks like the diagram (right), both the primary and secondary mirrors need adjustment. First, adjust the secondary mirror. Loosen three adjustment screws on the secondary mirror holder. Adjust the aspect of the secondary mirror so that it faces toward the draw tube correctly, and center the reflection of the primary mirror in the secondary mirror with the three adjustment screws while fastening.



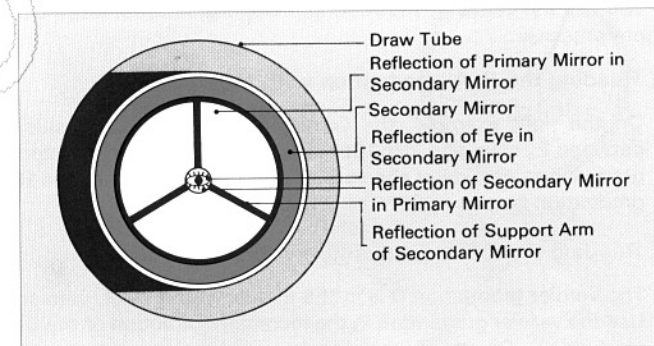
## Adjusting the Primary Mirror

If the reflection of the secondary mirror is not centered like the diagram (right), the primary mirror needs adjustment. There are three pairs of adjustment screws behind the primary mirror frame. One of the pair screws is for pushing adjustment and the other is for pulling adjustment. Loosen one first and then tighten the other to take up the slack. With these adjustment screws, center the reflection of the secondary mirror in the primary mirror. If you hold out your hand on the opening of the tube so that it is reflected on the primary mirror, you will quickly find which screws should be adjusted.



## Collimated Optical System

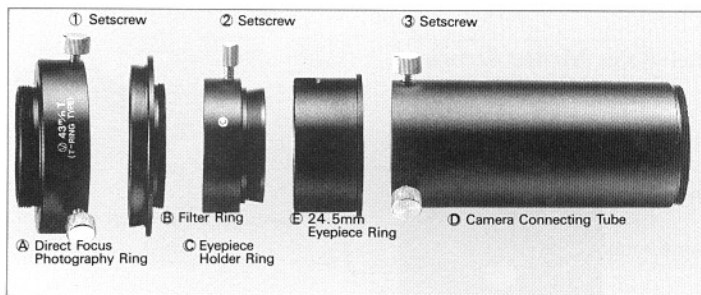
On the collimated optical system, you can see a set of concentric circles with the reflection of your own eye in the middle when looking into the draw tube. See the diagram. It would be difficult to have the optical system collimated perfectly the first time. It becomes easier with practice.



# CAMERA ADAPTERS

A camera adapter allows you to attach your camera to the draw tube of your telescope. Optional 36.4mm and 43mm camera adapters are offered. Select what fits your telescope.

## Components of the Camera Adapters



## Direct Focus Photography

- Mount the **A** direct focus photography ring on the draw tube.
- Mount the camera body to the **B** filter ring with the proper T-ring.
- Insert the camera body into the **A** direct focus photography ring and lock it with the **1** setscrew.
- Filters on the market can be mounted to the **B** filter ring. The 36.4mm camera adapter accepts one 34mm or 40.5mm filter and the 43mm camera adapter accepts one 49mm filter.
- If you use a filter when taking black and white photographs of the Moon or planets, the contrast will be improved. Photographic exposure times will be increased using the filters. The filters listed below are commonly used for astrophotography.

Code	Colour	Object
Y-2	Yellow	Moon, Venus
G-1	Green	Sun (coming close to the horizon)
R-1	Red	Sun, Mars

- To change the photographic angle, rotate the camera after loosening the **1** setscrew or the **2** setscrew.

Note: In case of the direct focus photography with a Newtonian reflector, remove the extension tube from the draw tube, or it can not be focused.

## Telescopic Photography

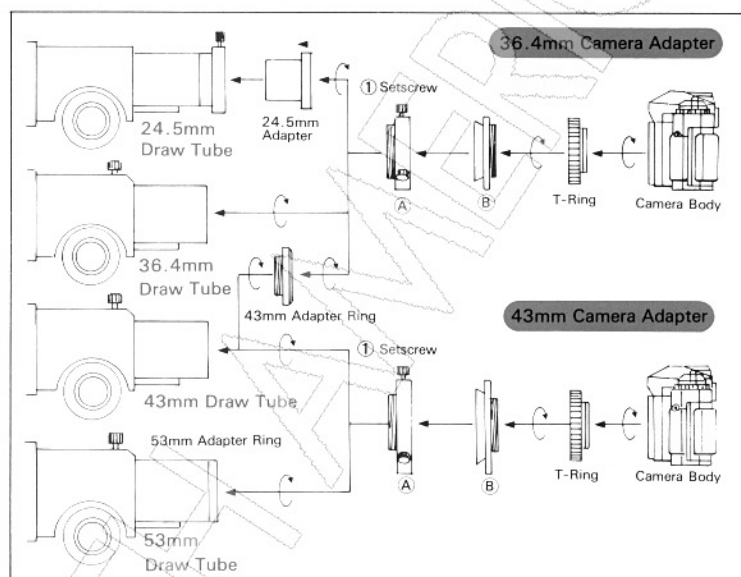
- Mount the **A** direct focus photography ring on the draw tube.
- Screw the **C** eyepiece holder ring onto the **B** filter ring.
- Insert the coupled **B** and **C** into the **A** direct focus photography ring and lock them with the **1** setscrew.
- When using a 31.7mm eyepiece, insert it into the **C** eyepiece holder ring and lock it with the **2** setscrew.
- When using a 24.5mm eyepiece, insert the **E** 24.5mm eyepiece ring into the **C** eyepiece holder ring first and then insert the eyepiece into the **E** 24.5mm eyepiece ring. Lock it with the **2** setscrew.
- Attach the **D** camera connecting tube to the camera body with the proper T-ring.

Note: In case of the telescopic photography with a Newtonian reflector, attach the extension tube to the draw tube, or it can not be focused.

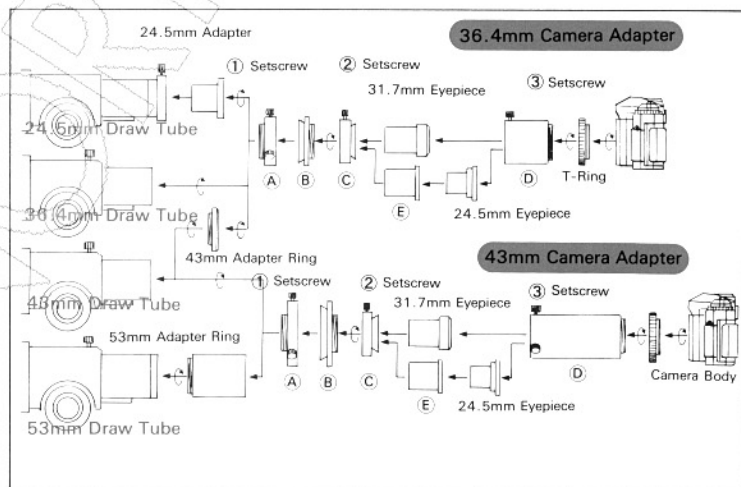
## Attaching the Camera Adapters

When attaching the camera adapters, keep in mind the following.

- To attach the 36.4mm camera adapter to a 36.4mm draw tube, an eyepiece holder has to be removed from the draw tube. To a 43mm draw tube, the 36.4mm camera adapter can be attached after removing an eyepiece holder from the draw tube, and the 43mm camera adapter can be also attached if a 43mm adapter ring is removed further from the draw tube. If you use the larger 43mm camera adapter on the 43mm draw tube, the edges of a photograph will be less darkened.
- For a 24.5mm draw tube, use an optional 24.5mm adapter and attach the 36.4mm camera adapter to it.
- An optional T-ring is needed to couple your 35mm camera body to the 36.4mm or 43mm camera adapter. Attach the proper T-Ring for your camera (see below).



Note: For the refractors 80M, 90M, 102M, FL70S, FL80S, FL90S and FL102S, the 43mm camera adapter is recommended not to darken the edges in the photograph.



## T-Rings

The T-ring couples your 35mm camera body to the camera adapters.

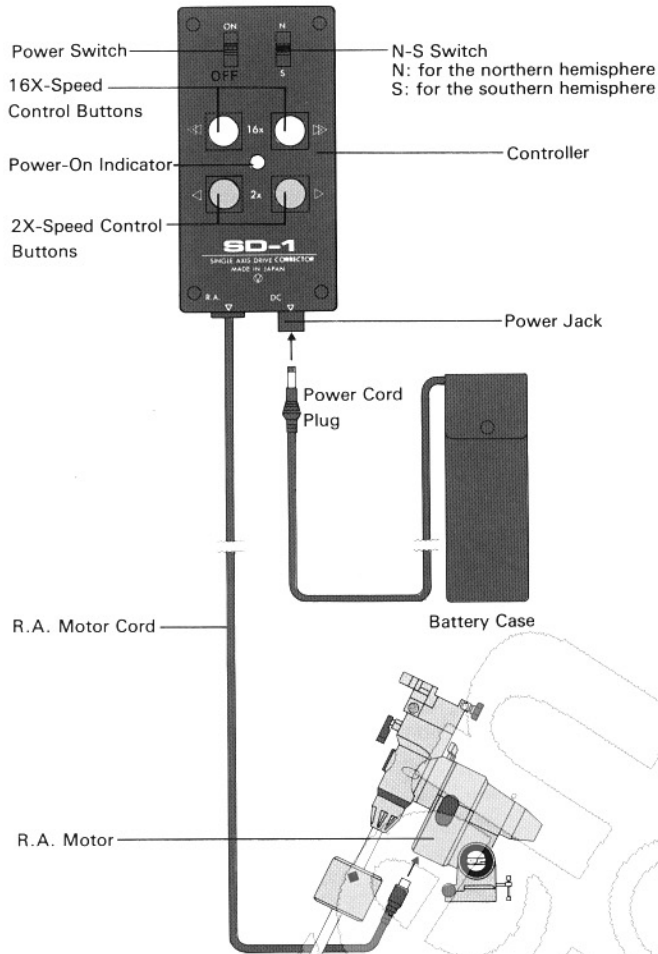
T-RING TYPE	CAMERA MODELS
<b>Nikon</b>	F2-Photomic, F2-Photomic (A, AS, SB), F2, F3, FE, FM, EM, Nikomart (EL, EL2, FT, FT2, FT3), FE2, New FM2, FG, FG-20, FA, F4, F4S, F4E, F801S, F-801, F-601, F-601M
<b>Canon</b>	AE-1, EF, A-1, AV-1, F-1, FTb, FT, T80, T70, T50, AE-1 Program, T90
<b>Minolta</b>	X-1, XG-(S, E), XD, XD-S, X-7, XE, SR505, SR101, SRT Super 101, X-700, X-600, X-500
<b>Olympus</b>	OM (1, 2, 3, 4, IN, 2N, 10, 20, 30, 40, 101)
<b>Pentax K</b>	ME, MX, K2, KX, KM, MV-1, LX, Super A, AE-F, ME Super, MG, A3 Date, SFXW, SF7, P30N, Ricoh (XP-P, XR-3, XR-7, XR500 Auto, XR-1, XR-2, XR-500), VX-1
<b>Konica</b>	FS-1, ACOM-1, T3, FTA, New (T3, FTA), TC-X

T-RING TYPE	CAMERA MODELS
<b>Contax</b>	RTS, 139 Quartz, 137MD Quartz, 137MA Quartz, 167MT, 159MMRTSII Quartz, FR-1, FR-II, FX-D Quartz, FX-3, RTS-III
<b>Practica</b> (thread mount)	Pentax (ES, ES-II, SPF, SP-II), Yashica (Electro X, TTS, FFT), Fujica (ST901, 801, 701, 605), Mamiya (Secor 500DTL, 1000DTL, MSX500), Ricoh (TSL401, TL-S, XR-10M, Auto), Petri MF-1, Practica LLC
<b>Minolta α</b>	α 5000, α 7000, α 9000, α 7700i, α 8700i, α 5700i, α 3700i
<b>Yashica AF</b>	Kyosera (230-AF, 210-AF)
<b>Canon EOS</b>	EOS (650, 620, 1HS, 1, 10QD, 1000QD, 630QD, 700QD, RT)
<b>T-C Ring</b> (for camcorder)	Sony EVC-X10 CCD Camera Canon C1-20R

# MOTOR DRIVES

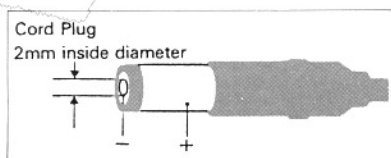
Motor drives allow you to track celestial objects easily. There are two types of optional motor drives. One is a single-axis motor drive and the other is a dual-axis motor drive.

## Single-Axis Motor Drive

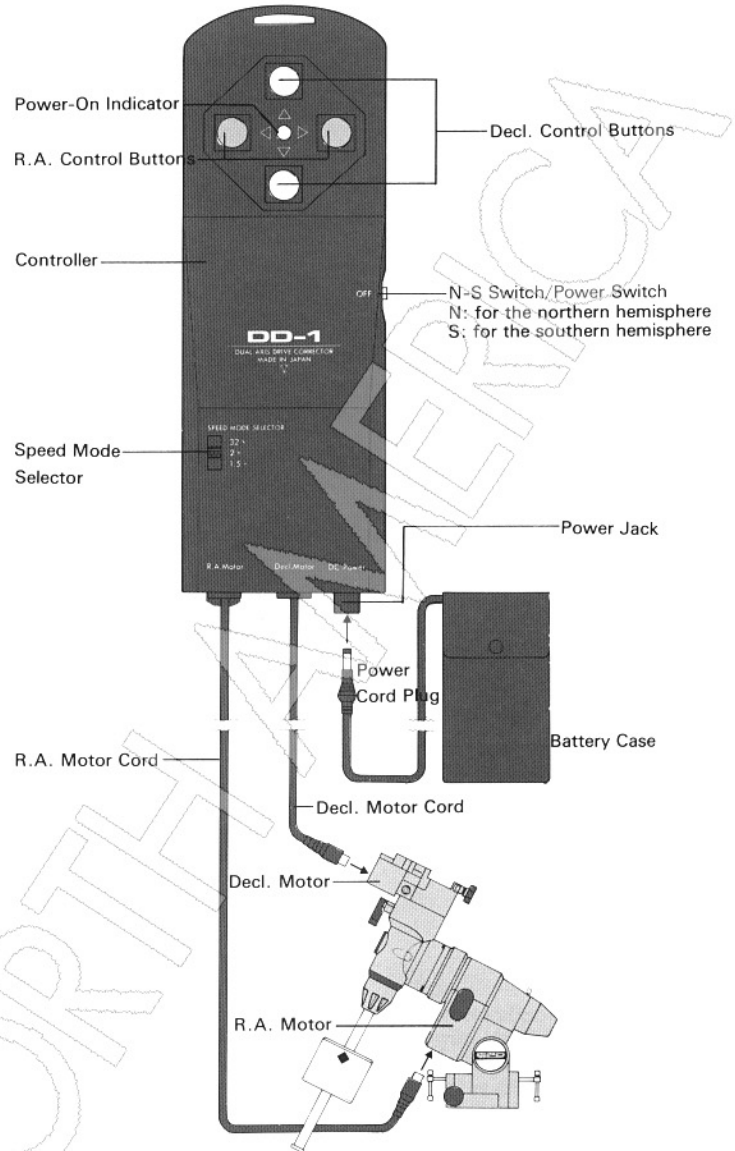


### 《Power Source - DC6.5V to 12V》

- ① Dry Cell Battery  
Place 6 C-size batteries into the battery case, making sure not to put them in the wrong way.
- ② Car Battery  
To get power from a cigarette lighter receptacle, use a car battery cord with a cord plug illustrated below.
- ③ Household AC Outlet  
An adapter is needed to plug into an AC outlet. Use an AC adapter with an output of DC6.5V to 12V and with a cord plug illustrated below.



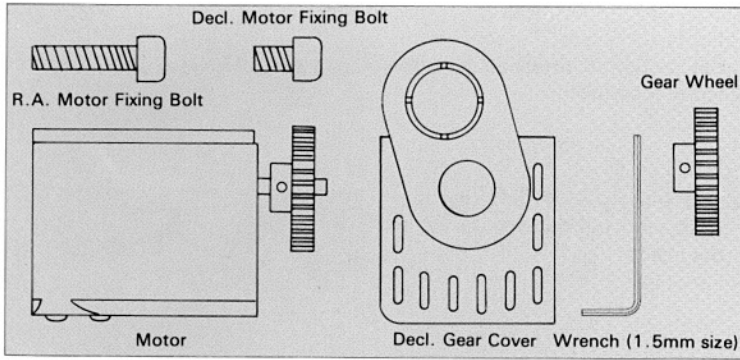
## Dual-Axis Motor Drive



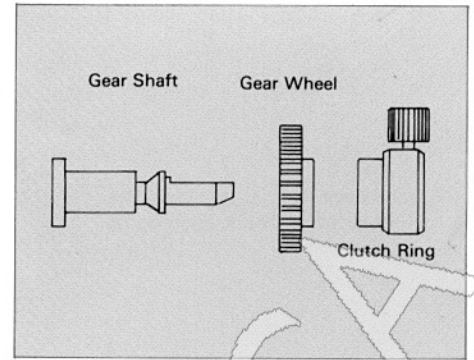
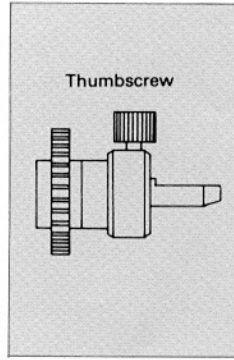
### 《Power Source - DC9V to 12V》

- ① Dry Cell Battery  
Place 8 D-size batteries into the battery case, making sure not to put them in the wrong way.
- ② Car Battery  
To get power from a cigarette lighter receptacle, use a car battery cord with a cord plug illustrated below.
- ③ Household AC Outlet  
An adapter is needed to plug into an AC outlet. Use an AC adapter with an output of DC9V to 12V and with a cord plug illustrated below.

## Motor

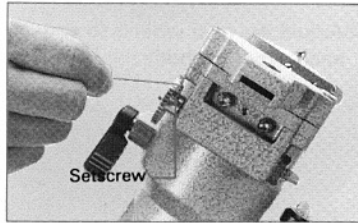
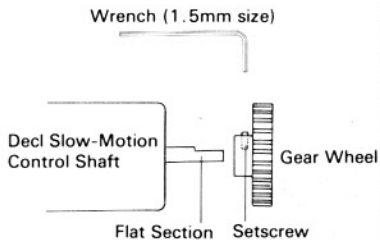
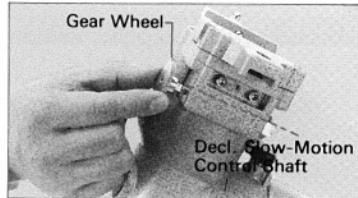


## Manual Operation Clutch

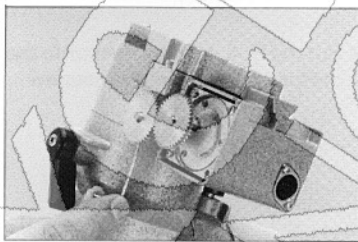
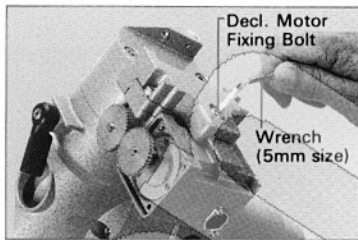


## Installing the Decl. Motor

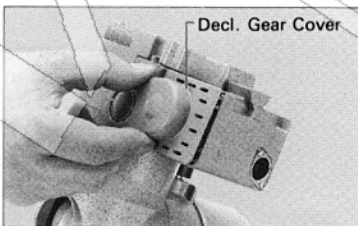
- Put the gear wheel onto the Decl. slow-motion control shaft and tighten the setscrew against the flat section of the shaft with the wrench supplied.



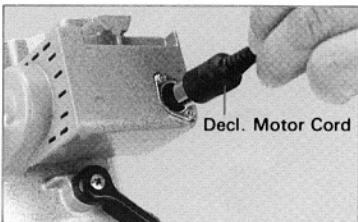
- Install the motor on the mount with the Decl. motor fixing bolt while setting the gear wheels to engage each other properly. The wrench (5mm size) to tighten the bolt is supplied for your telescope.



- Put the snap-on Decl. gear cover over the gears.

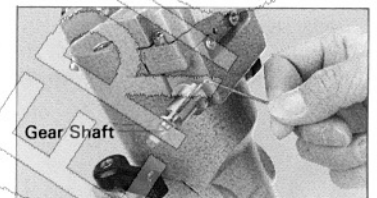


- Connect the Decl. motor cord to the motor.

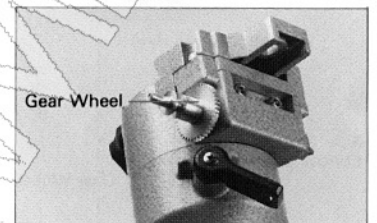


## Installing the Decl. Motor and Manual Operation Clutch

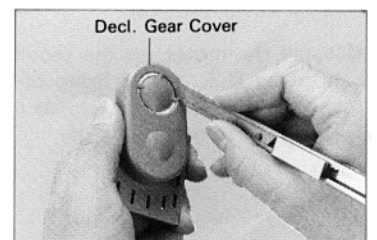
- Put the gear shaft onto the Decl. slow-motion control shaft and tighten the setscrew against the flat section of the shaft with the wrench supplied.



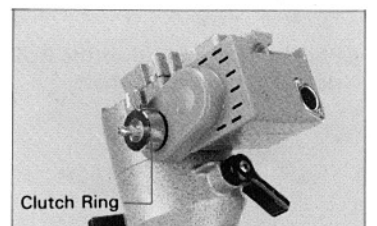
- Attach the gear wheel to the gear shaft with the flat side facing to the outside.
- Install the Decl. motor as described.



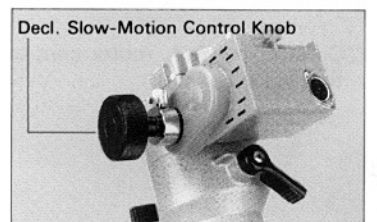
- Cut out the outlet for the gear shaft from the Decl. gear cover and put it over the gears.



- Attach the clutch ring to the gear shaft and fasten it.

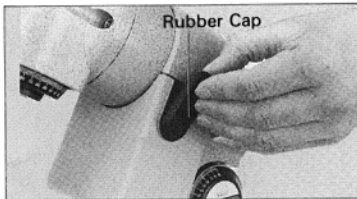


- Attach the slow-motion control knob to the gear shaft. When using the slow-motion control knob, loosen the thumbscrew on the clutch ring.

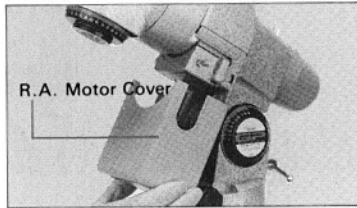


## Installing the R.A. Motor

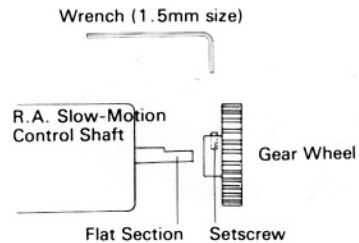
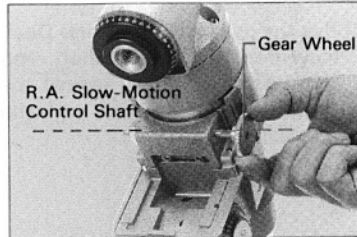
- ① Take off the rubber cap covering the R.A. slow-motion control shaft.



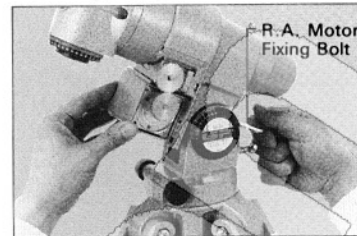
- ② Remove the R.A. motor cover by pulling it down after loosening its setscrew.



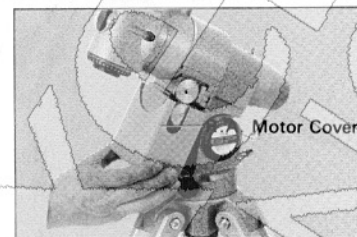
- ③ Put the gear wheel onto the R.A. slow-motion control shaft and tighten the setscrew against the flat section of the shaft with the wrench supplied.



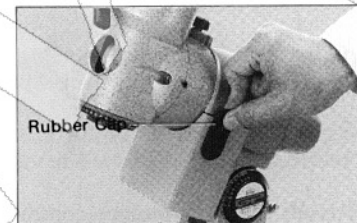
- ④ Install the motor on the mount with the R.A. motor fixing bolt while setting the gear wheels to engage each other properly.



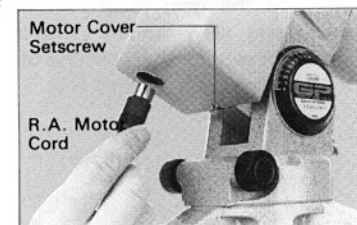
- ⑤ Put the R.A. motor cover onto the motor and tighten its setscrew.



- ⑥ Put the rubber cap over the R.A. slow-motion control shaft.

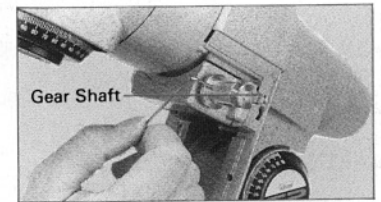


- ⑦ Connect the R.A. motor cord to the motor.

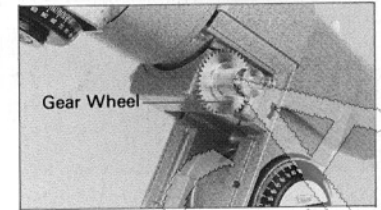


## Installing the R.A. Motor and Manual Operation Clutch

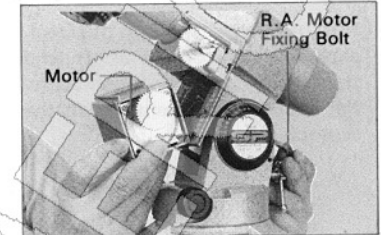
- ① Put the gear shaft onto the R.A. slow-motion control shaft and tighten the setscrew against the flat section of the shaft with the wrench supplied.



- ② Attach the gear wheel to the gear shaft with the flat side facing to the inside.



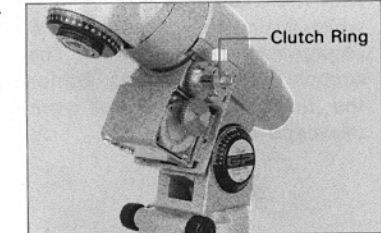
- ③ Install the motor on the mount with the R.A. motor fixing bolt.



- ④ Adjust the gear wheels to engage each other properly.



- ⑤ Attach the clutch ring to the gear shaft and fasten it.



- ⑥ Put the R.A. motor cover onto the motor and tighten its setscrew.



- ⑦ Attach the slow-motion control knob to the gear shaft. When using the slow-motion control knob, loosen the thumbscrew on the clutch ring.

