Newtonian Cassegrain

CN-212

Instruction Manual

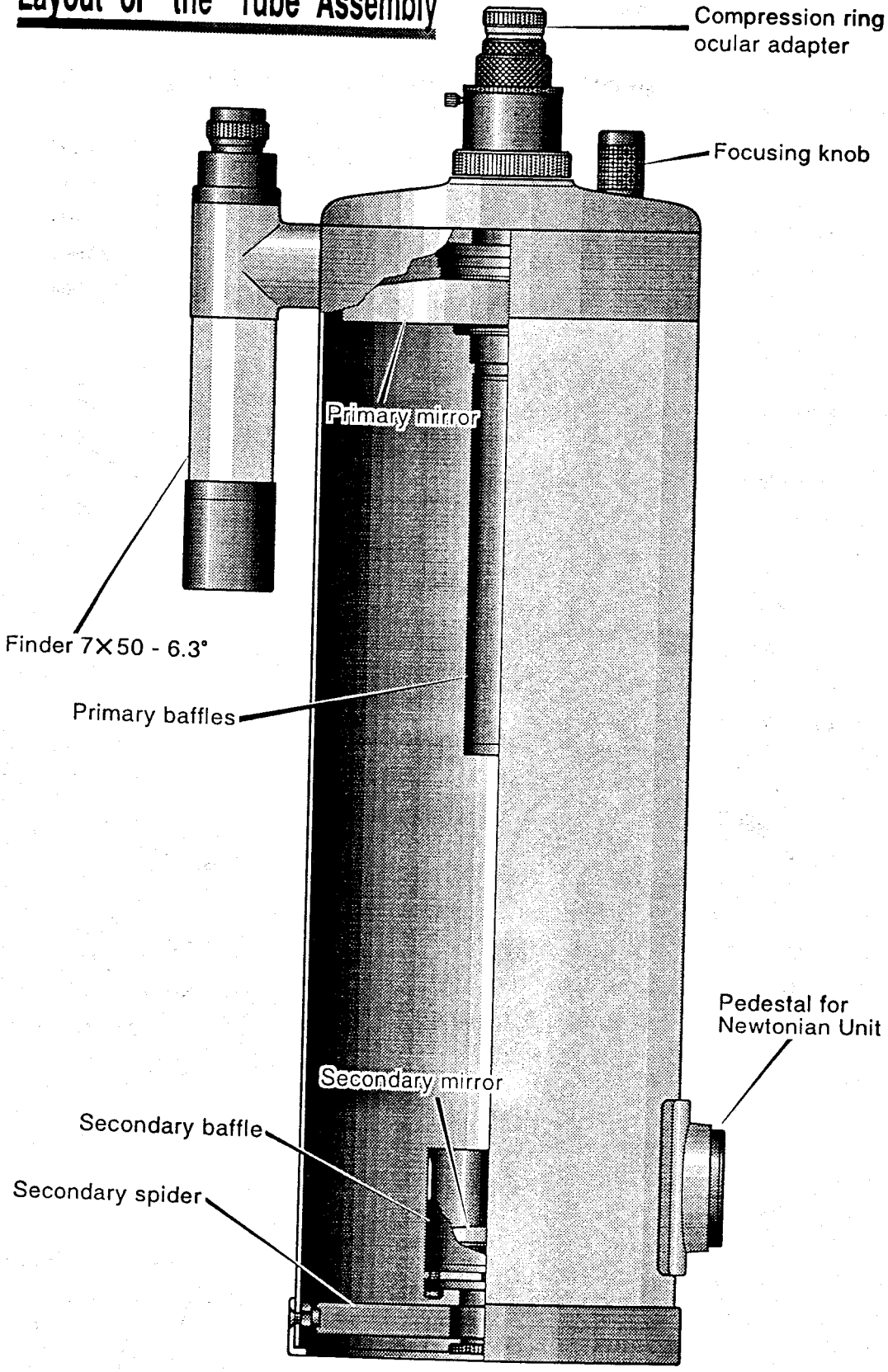
TAKAHASHI

General Specifications

Effective aperture	ϕ212mm
Effective focal length	2160mm
Effective focal ratio	F/12
Primary mirror	ϕ212mm
Focal ratio	F/3.9
Secondary mirror	ϕ68mm
Resolving power	0.55″
Limiting magnitude	13.4
Tube diameter	ϕ243mm
Tube length	855mm
Tube weight	8.4kgs - 18.5lbs.
Focus mode	Main mirror movement
Finder	7×50 - 6.3°

Specifications subject to change without notice.

Layout of the Tube Assembly



4. Try to view some objects with a low power ocular (an ocular with a long focal length), setting it into the ocular adapter. At first, images in the view field may be seen vague because they may be out of focus. Turn the focusing knob clockwise first. If the images will be sharply focused. Now, confirm if the object centered at the cross point of the finder reticle is the same one at the center of the view field of the main scope. If not, align the optical axis, referring to the "finder alignment".

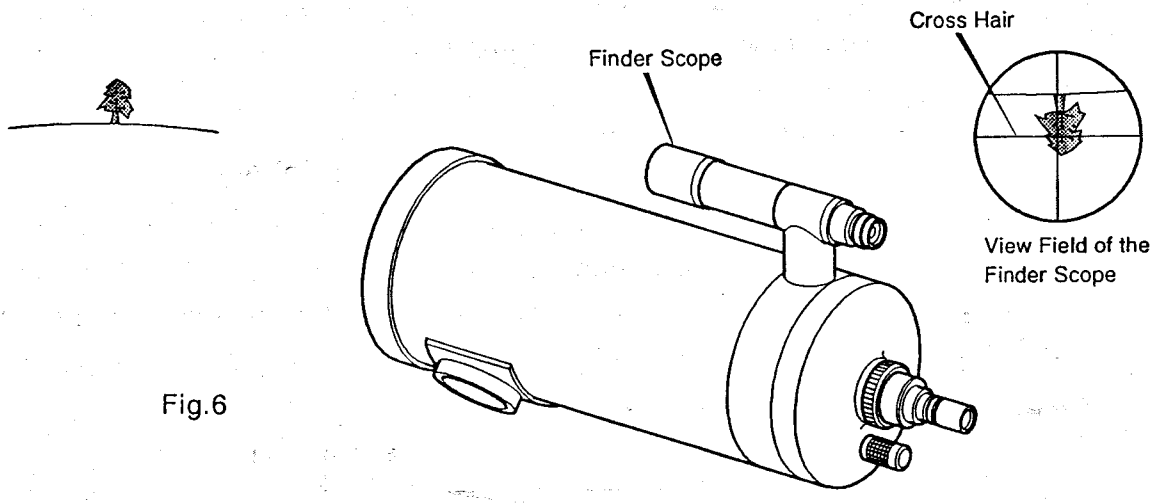
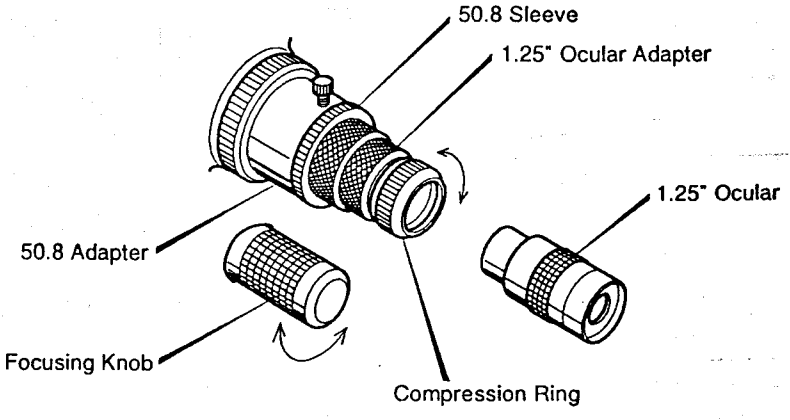


Fig.6



⚠ CAUTION

NEVER ATTEMPT TO LOOK AT THE SUN.
INTENSE LIGHT OF THE SUN WILL BURN YOUR EYE.

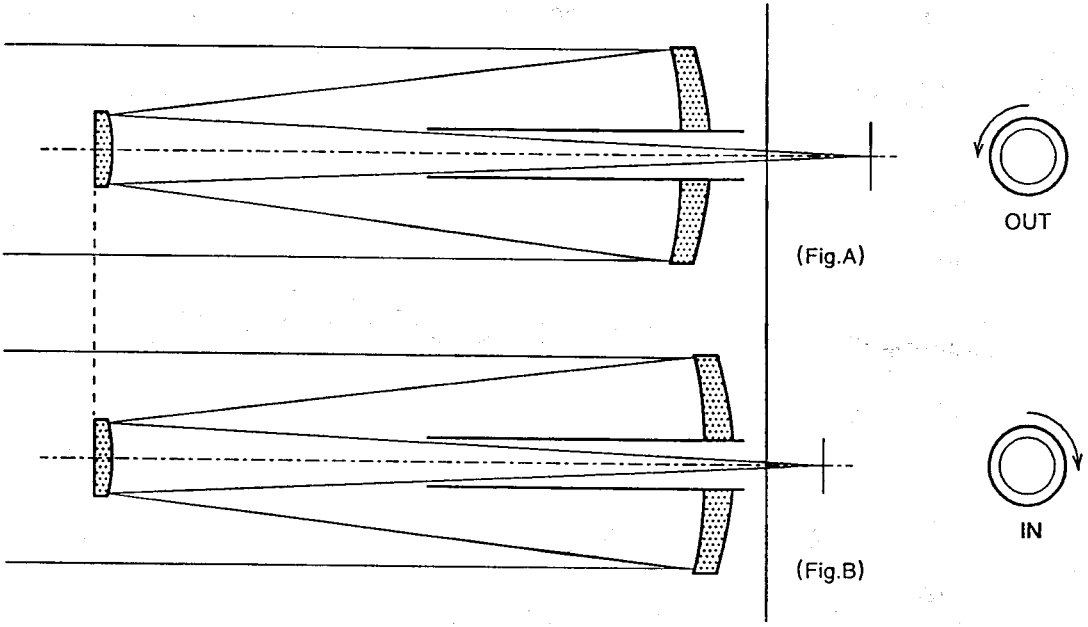
Visual Back

◆Focusing

Focusing of this optical system made by moving the primary mirror forward and backward with the focusing knob. The focal point has relation with the moving direction of the primary mirror as shown in the the diagram below.

When the focusing knob is turned clockwise (IN), the primary mirror is moved toward its cell and then, the focal point is moved inward. (Fig.B) When the focusing knob is turned counter-clockwise (OUT), the primary mirror is moved toward the secondary one and then, the focal point is moved outward. (Fig.A)

Focusing varies the distance between the primary mirror and the secondary one, making the effective focal length altered. When you calculate magnification, however, you can use the effective length of 2630mm.



ow to use visual back (50.8 adapter)

inside diameter of the 50.8 adapter is 50.8mm (2") so that a 2" ar can be set. You can set a 2" ocular in and out quickly just by ening the locking screws of the adapter. The system parts of the al back are shown in the chart below.

he inside edge of the 50.8 sleeve. 43mm thread is provided to nect a prime focus ring and other accessories. The 50.8 sleeve is able optionally. So if you would use the adapter with an acces- you will be able to set the accessory to the visual back quick- henever you like to use it. A lock ring is provided with the 50.8 pter. You can turn the adapter, loosening the ring. It is conve- t to set the camera angle in astrophotography and to change the ing angle of a diagonal prism, etc. Be careful not to drop out 50.8 sleeve with an accessory, loosening the locking screw too n.

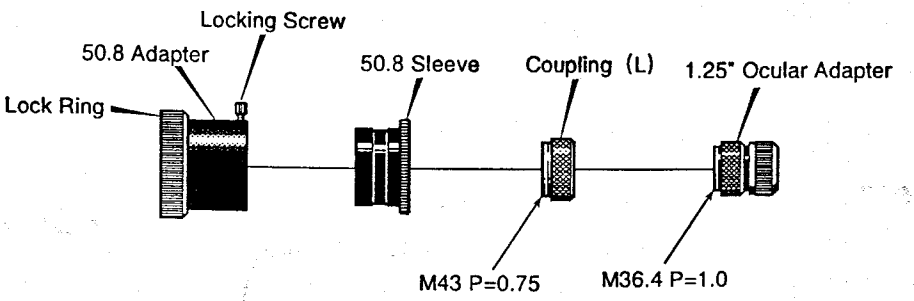


Fig.7

Aligning the finder scope

The view field of a telescope is so highly magnified and narrow that you can hardly catch, in the fiew field, the object you like to see. To help you to find the object at ease in the view field of your telescope, the finder scope with wide view field is provided with your telescope.

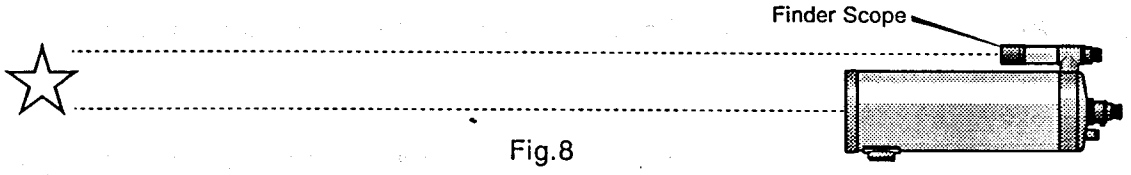


Fig.8

To see the same object in the view fields of the main scope and the finder scope, you must align the optical axes of the main scope and of the finder scope. They must be parallel each other as shown in the Fig.8. The finder of the Newtonian Cassegrain CN-212 is so made that it can be used for carrying handle permanently fixed on the main tube. Because of this structure, the optical alignment for the finder can be made by shifting the visual back of the finder with the adjusting screws. Once aligned, the optical axis of the finder scope will not become out of order.

◆The procedures for alignment

1. Set a low power ocular into the ocular adapter of your telescope and catch, in the center of the view field, the object in the distance of at least 100m away (otherwise not focused).

2. At first, loosen the lock ring and then loosen all three adjusting screws well enough so as to move the visual back freely.

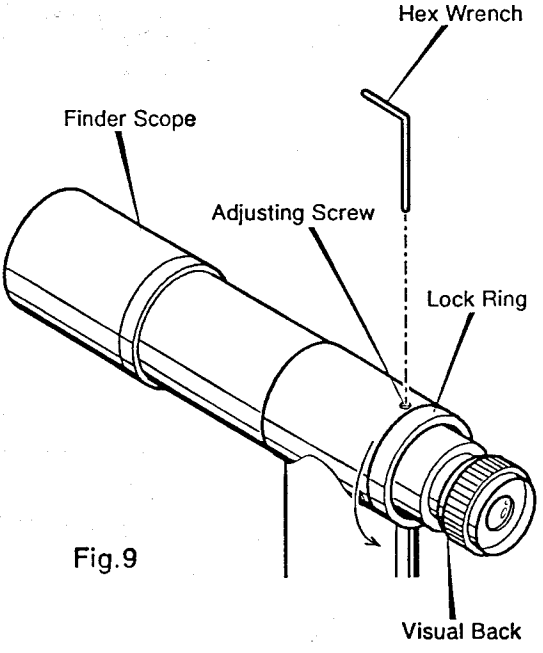


Fig.9

Collimating the optical axis

Your telescope can be used in two ways: One is a classical Cassegrain and the other is a Newtonian telescope, using a Newtonian unit optionally available. So these optical systems must be collimated separately whenever used. To make the collimation for the optical axis, some tools are optionally available.

◆Collimating the optical axis of the Cassegrain

Necessary tools: Allen rench 1.5, 2.5; spanner 8mm (standard)
Collimating scope, Allen rench 3; spanner l4mm (optional tools)

Note: A center mark (a black dot at the center) is provided on the secondary mirror.

1. Preparation for the collimation

1) Locate a bright place like a white wall and point the tube to the bright place.

2) Take out the 3l.7mm ocular adapter from the visual back and attach the collimating scope. See the fig.14.

3) Point the diffusion plate (white plastic plate) of the collimating scope to the light source. Set the focusing tube of the scope at its original position.

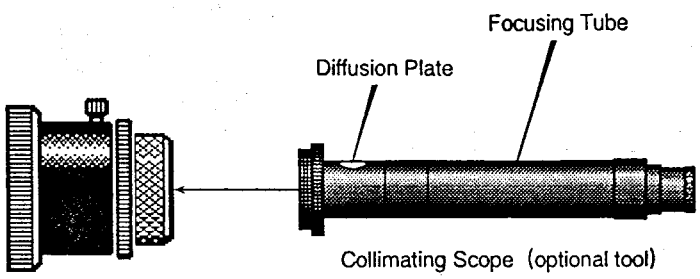


Fig.14

2. Collimating the optical axis of the secondary mirror

(place the center mark on the secondary mirror to the center of the collimating scope)

1) When you look through the eyepiece of the collimating scope, you can see the spider and the secondary mirror dimly in black at the center of the view field.

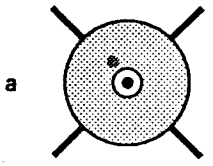
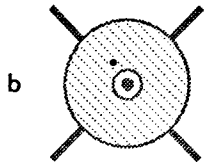


Fig.15

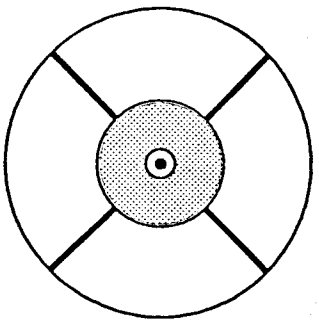
2) Set the focusing tube of the collimating scope at such position that you can see the spider clearly, sliding the focusing tube. Refer to the fig.15-a.



Check the black circle at the center of the collimating scope. If the optical axis is in order, the black circle is seen as shown in the fig.16. (The center mark is seen dimly overlapped on the center of the collimating scope.)

3) Slide the focusing tube of the collimating scope a little off from the position where the spider is clearly seen, and then the center mark of the secondary mirror will be focused as shown in the fig.15-b. If the center of the collimating scope, reflected on the secondary mirror, is just laid on the center mark, the optical axis is well collimated. If it is off, the optical axis of the secondary mirror must be collimated. Refer to the fig.15.

Fig.16



4) At first, loosen the lock nut of the adjusting screw. If the center mark of the secondary mirror is off from the center of the collimating scope as seen in the fig.15, Loosen the adjusting screws A and C, but pusing the screw B as shown in the fig.17. Then, the center mark of the secondary mirror comes close to the center of the collimating scope. Keep this procedure until the mark is just laid over the center of the collimating scope.

Note: The collimation for the secondary mirror is made with the three sets of the push screws. They are not only pushed but pulled (loosened) to make the collimation. Never touch the pull nut at the center. Doing so makes the distance between the secondary mirror and the primary one varied and it will change the focal point. At the result, some system parts will be unable to focus.

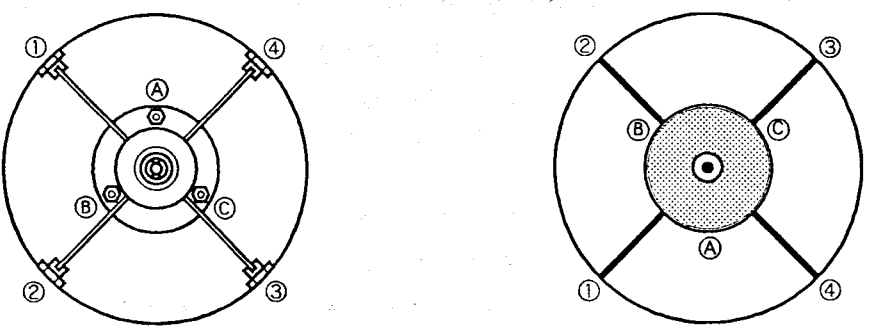


Fig.17

3. Adjusting the spider

1) Focus the spider with the collimating scope. Carefully look at the outer circle of the buffle of the secondary mirror and you see a circle in thin white a little bit inward as shown in the fig.16. This is the outer circle of the baffle of the primary mirror. If this is seen in a concentric circle with the baffle of the secondary mirror, the spider is in no need to be adjusted. If not, the spider must be adjusted.

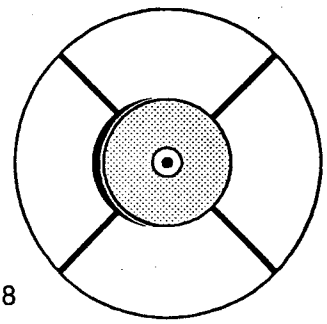


Fig.18

2) For example, take the case as shown in the fig.18 where the outer circle of the buffle of the secondary mirror is shifted to the left side. Loosen with an Allen rench the pull screws ① and ② in the fig.17 and tighten the screws ③ and ④.

3) When the outer circles of the buffles of the primary and the secondary mirror are seen largely in a concentric circle, check the collimation for the optical axis of the secondary mirror. Adjustment for the spider will make the optical axis of the secondary mirror out of order. So in turn adjust the secondary mirror again. Repeat this procedure until the optical system is seen as shown in the fig.16. Then, tighten the secondary miror lock nuts and the spider lock nuts, checking the optical axis is in order.

◆Optical axis alignment for the Newtonian system

This will be made with a collimating tube and a collimating eyepiece. These are optionally available. Besides these tools, Allen renches (l.5mm,2.5mm, and 3mm), spanners (8mm and l4mm) and screw driver are necessary to do this alignment.

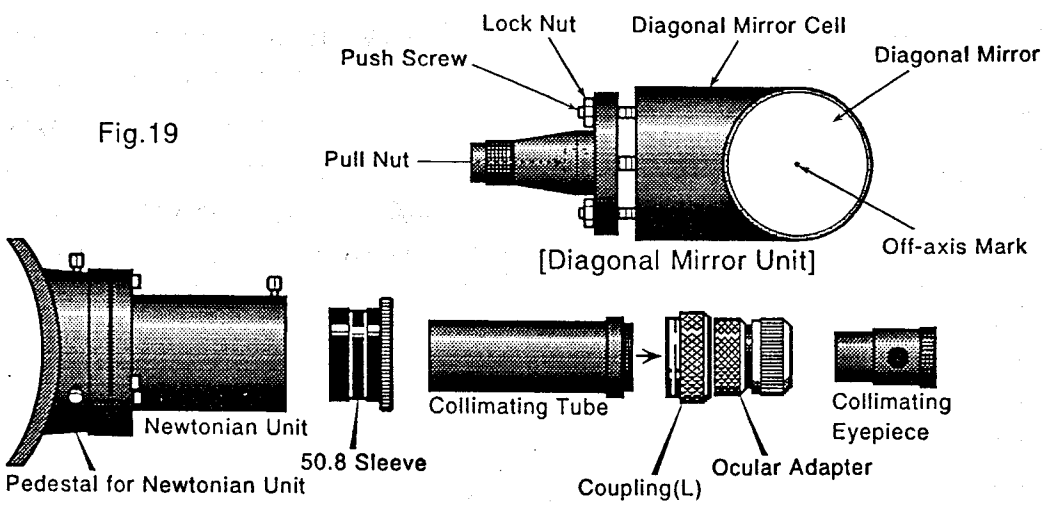
The optical axis adjustment for the diagonal mirror will be made at its position. The adjustment includes turning the mirror (by loosening the pull screw), shifting back and forth (by loosening the pull screw and by pushing it with 3 push screws or by reverse action), tilting (by loosening one or two push screws and by pushing other screw(s).

* As a reference, off-axis mark(4.7mm off from the center to the left) is provided on the diagonal mirror. This mark shows the actual center of the optical axis.

1. Preparation for the optical axis alignment

◇ Attach the Newtonian unit to the base of the visual back and connect the collimating tube to the coupling(L).
◇ Attach the collimating eyepiece to the ocular adapter.
◇ Take out the flattener and in exchange attach the 50.8 sleeve, the collimating tube with the coupling(L), and the ocular adapter.
◇ Take out the secondary mirror of the Cassegrain and in exchange attach the diagonal mirror in place. Refer to the fig.24.

Fig.19



1) Loosen the lock nuts on the visual back and turn the 50.8 sleeve so as to make the crossline of the collimating tube horizontal and perpendicular. Place the tube assembly on such position that both of the edge of the tube is faced to a plain and bright place like a white wall.

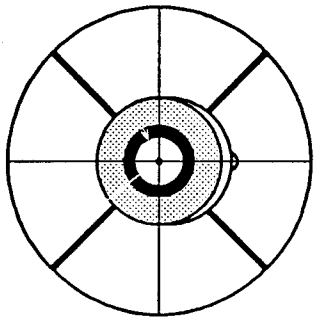


Fig.20

2) Loosen the pull nut to turn the diagonal mirror tube until the inside of the 50.8 adapter (attached to the visual back of the Cassegrain telescope) reflected on the diagonal mirror is shifted on the horizontal line as shown in the fig.21 (a) to (b).

3) Bring the center of the 50.8 adapter at the cross, adjusting the push screws of the diagonal mirror. When the A screw shown in the fig.22 is screwed in, the 50.8 adapter will be moved to the cross as shown in the fig.(b) to (c). In the fig.(c)-1 the center of the 50.8 adapter is positioned at the cross, but the mark on the diagonal mirror will be at the upper left. Now the diagonal mirror must be moved toward the primary mirror and be faced downward.

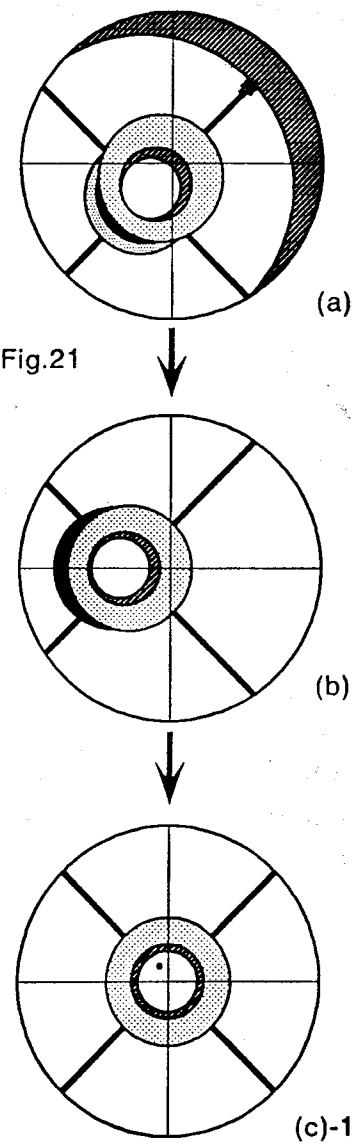
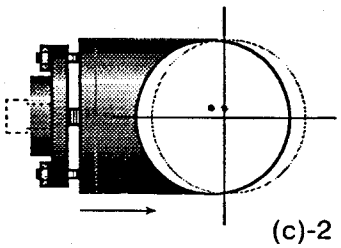
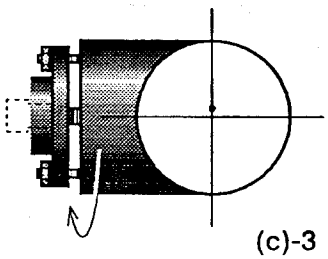


Fig.21

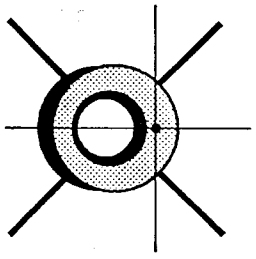
4) Loosen the pull nut of the diagonal mirror by a driver and screw in all the adjusting screws. When the mark on the diagonal mirror comes on the perpendicular line as shown in the fig.(c)-2, adjust the push screws to bring the mark at the cross. Then, turn the 50.8 adapter, loosening the pull screw and move the center of the 50.8 sleeve on the horizontal line as shown in the fig.(c)-3,fig.(d).



(c)-2



(c)-3



(d)

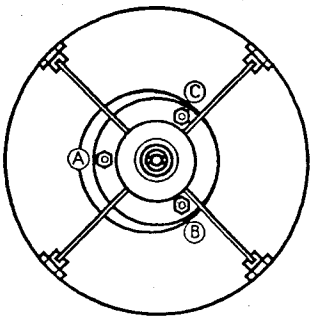


Fig.22

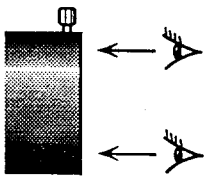
5) As shown in the fig.(d), when the center of the 50.8 adapter is seen at the left, check the movement of it by screwing the adjusting screw A and if necessary with the other screws. By doing so, place the mark and the center of the 50.8 adapter on the horizontal line as shown in the fig.20.

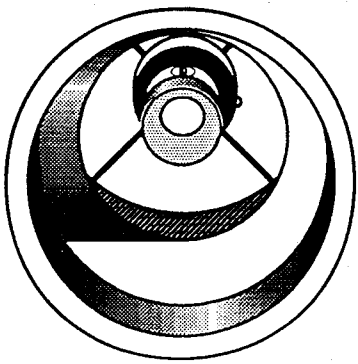
⚠ CAUTION

In case the spider is moved to align the optical axis of the Cassegrain telescope after the optical axis of the diagonal mirror has been adjusted, the optical axis of the diagonal mirror must be adjusted again for use of the instrument as a Newtonian telescope.

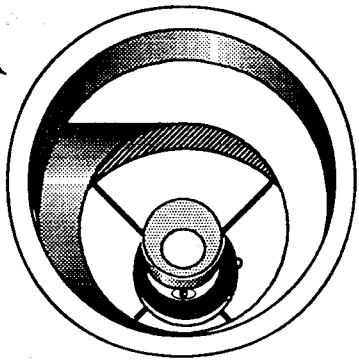
If you could not have the optical axis correctly aligned, try further according to the following procedures.

6) Take out the 50.8 sleeve from the visual back. Take a look at the side wall of the diagonal mirror holder through the 50.8



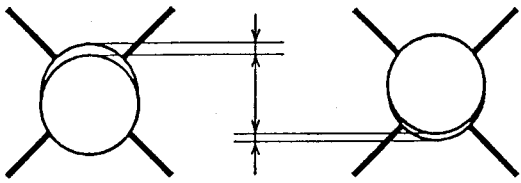


(e)

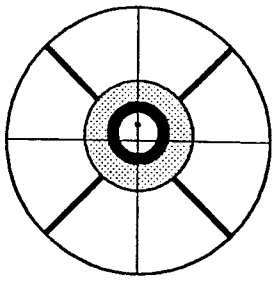


adapter and check the width of it viewed from the upper edge of the 50.8 adapter and from the lower edge as shown in the fig.(e). In the fig.(f), the holder is viewed better and positioned lower. If the width viewed in both case is equal, the alignment is finished.

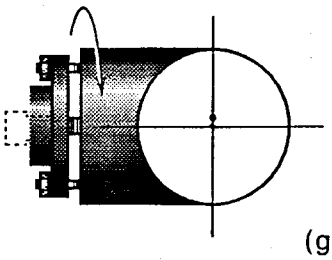
7) Loosen the screw C and push the screw B to adjust the position of the diagonal mirror holder so as to be seen its side in equal width from the both edge of the 50.8 adapter.

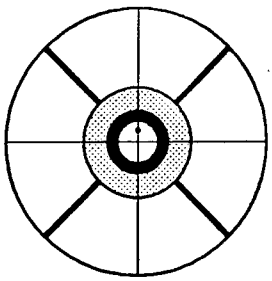


(f)



(g)-1





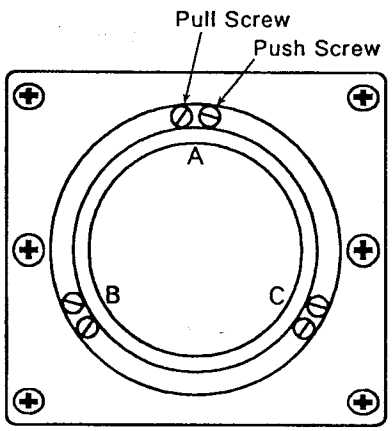
(g)-2

8) Next check again the position of the mark on the diagonal mirror and you can see the center of the inside diameter of the 50.8 adapter is positioned above the cross line. Refer to the fig.(g)-1.

Loosen the pull nut of the diagonal mirror and turn its holder. Then, the center of the inside diameter of the 50.8 adapter will come close to the cross line. When it comes to the cross point, tighten the pull nut.

Once more be certain that the cross point, the mark on the diagonal mirror, and the center of the 50.8 adapter are positioned on a concentric point. If they are not on it, adjust the screws to position them as seen in the fig.20. Then, the optical alignment has been finished.

9) As the procedure No.8 has been finished, the center of the inside diameter of the 50.8 adapter is positioned at the cross point, but sometimes the mark on the diagonal mirror is positioned above or below the concentric point. In these cases, adjust its position with the pull and push screws provided on the visual back.



(h)

In the case shown in the fig.(g)-2, if the mark is off from the cross point, loosen the pull screw in the fig.(h) and push the push screw gradually. At the same time, loosen the other pull screws a little and push the pull screws so that the visual back is a bit floated. As the A screw is pushed, the mark will come to the cross.

When the mark is just on the cross, check the center of the inside diameter of the 50.8 adapter and the cross. If they are off each other, readjust it back to the procedure No.2.

◆Checking the star image

After having finished the optical axis alignment, check if the optical axis is adjusted correctly, viewing a star. Before doing this, leave your instrument in the outside for more than 1 hour to make it adapted to the outside temperature.

Pick up the brighter star (2nd or 3rd magnitude) in the high latitude and bring it to the center of the view field. From the focal point, move the star image in and out. Then, you can see the star image in and out as the diffraction rings shown in the fig.23.

In case the optical axis is in order, the center, the inner ring, the middle ring, and the outer ring are all on the concentric circle both in the image in and out. If not in order, the centers of these rings are our of order. Then, the readjustment is required. When the focuser knob is turned counter-clockwise (OUT) from the focal point, the inner image can be seen and turn it clockwise, the outer image can be seen. The off-centering of these rings can be easily check just in and out of the focal point.

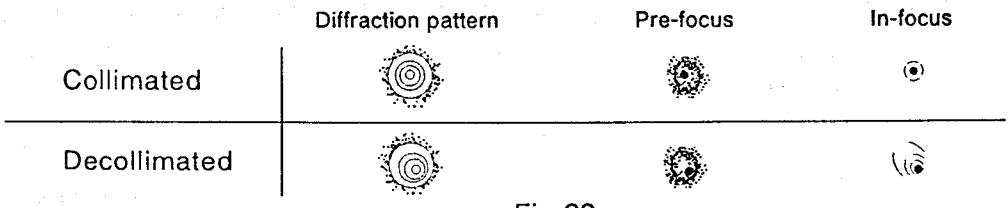


Fig.23

* The center of the diffraction ring can be seen not so easily due to the shadow of the secondary mirror.

* While the air in the tube is moving, the diffraction rings can be seen as if the optical axis is out of order.

* The instrument can not perform as it should be, while the optical axis remains out of order. Start your observation after you have checked that the optical axis is in order, using a star image.

◆Exchange for the secondary mirror and the diagonal mirror.

When the instrument is used as a Newtonian system, the secondary mirror must be exchanged to the diagonal mirror. The optical axis adjuster screws are provided independently on these mirrors. So, once the optical axis of both mirrors has been adjusted in order, the optical axis will not be out of order whenever the mirrors are exchanged each other. See the fig.24.

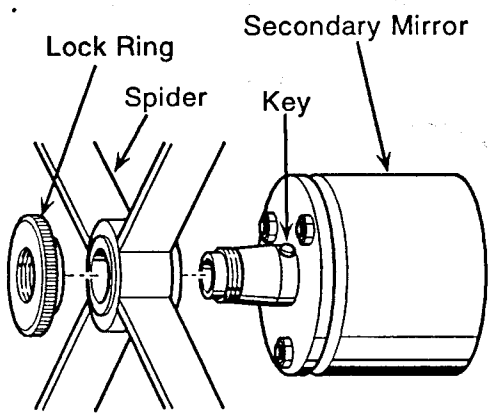
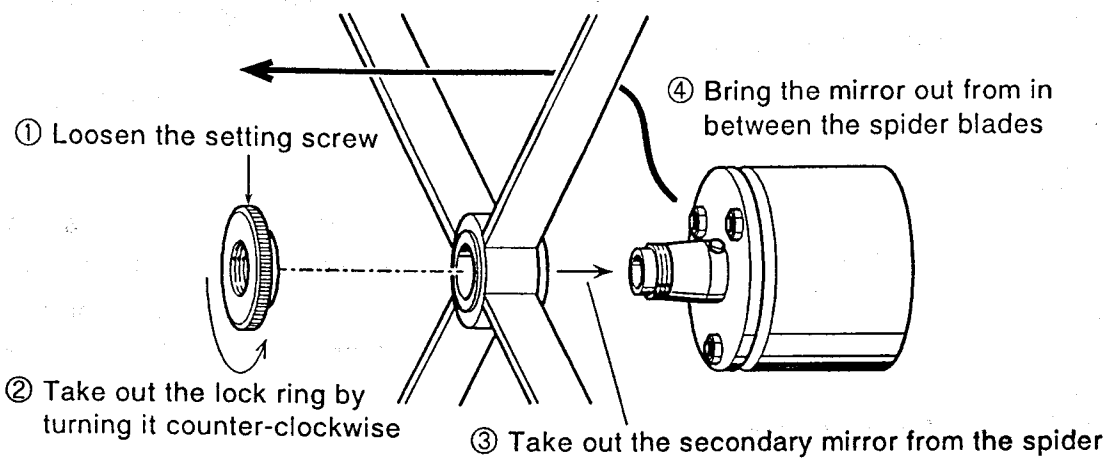


Fig.24

When you exchange the mirrors, set the tube horizontally. At first, take out the secondary mirror from the spider. Be careful not to drop and hit them, when exchanging.

Attach the diagonal mirror to the spider in the reverse procedure, fitting the key of the unit to the keyway of the spider. Tighten the lock ring firmly and lock it with a set screw. At the first setting, the optical axis must be adjusted in order. Refer to the explanation for the optical axis adjustment.

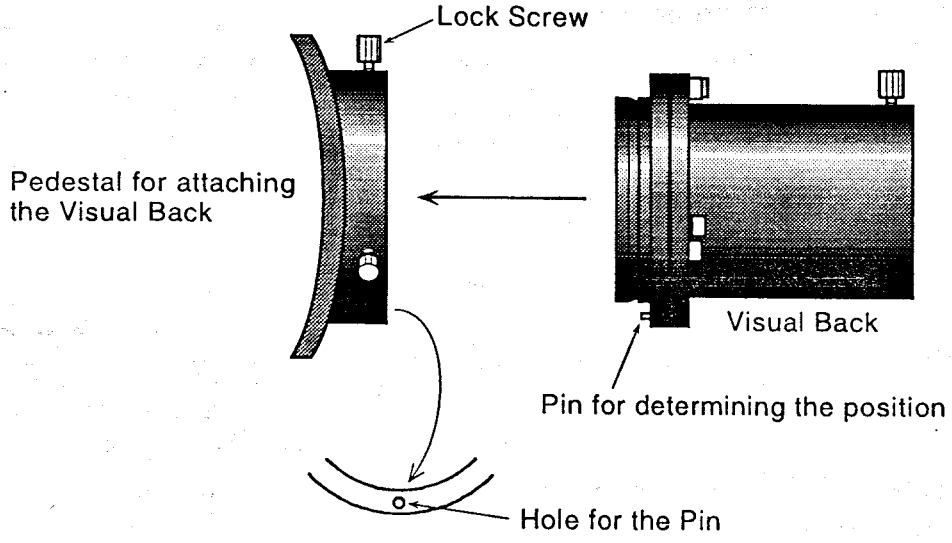
Below is an illustration how to exchange the mirrors.



* When exchanging the mirrors, be careful not to touch your fingers the aluminized mirror face.

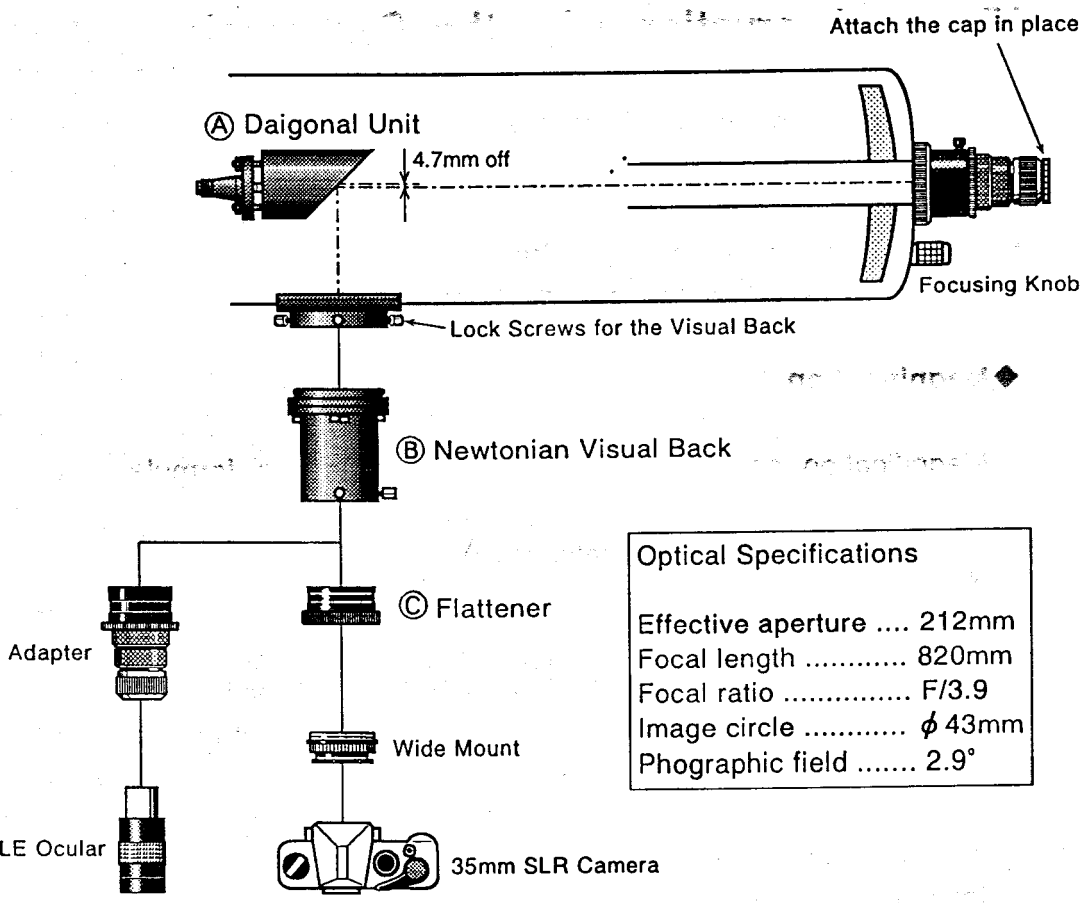
◆Attaching the Newtonian unit and photographing with it

1. Change the secondary mirror to the diagonal mirror.
2. On the base for attaching the visual back, a small hole is provided to determine the position of the visual back. Attach the visual back setting the pin into the hole and then lock the visual back firmly with screws provided on the base.
3. Adjust the optical axis. Refer to the optical axis adjustment in this manual.
4. Start for photo/visual observation.



Focusing for the Newtonian system can be adjusted with a focusing knob as same as in the Cassegrain. In photographing, attach the flattener to the visual back and set a camera with a help of a wide T-mount.

After focused by the focusing knob, you can check with an ocular the object to be photographed. Loosen the lock screws on the Newtonian visual back and take out the flattener with a camera. Remove the 50.8 sleeve and the ocular adapter from the visual back of the Cassegrain. Attach these parts to the Newtonian visual back. Then, set an ocular to the ocular adapter. Focus by sliding the ocular forwards and backwards. Focal point is set just outside of the ocular adapter. Refer to the illustration on next page.



Optical Specifications

Effective aperture	212mm
Focal length	820mm
Focal ratio	F/3.9
Image circle	ϕ 43mm
Phographic field	2.9°

* Attach the adapter for the Cassegrain and you can check visually with an LE ocular the object to be photographed.

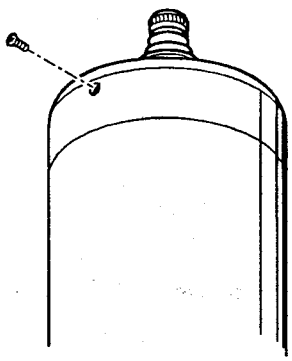
Care and Maintenance for your telescope

The primary mirror of your CN-212 is exposed directly to the open air. If the surface of the mirror is left covered with dusts and dew, it will become dim and make the contrast of images worse. With the following procedures, clean up dusts from the surface of the mirror with a blower at the regular interval. When you set the mirror back onto the tube, set the cell precisely in place with the tube. Then, lock them with screws and the optical axis will hardly become out of order. Refer to the fig.28.

Caution: The space between the outer edge of the primary mirror and the inner wall of the tube is so narrow that great care must be taken not to hit each other when you take out the primary mirror.

1. Stand the tube assembly on a level place, facing its opening to the ground.

2. Holding the visual back to stand the tube safely and take out the three screws locking the primary mirror cell.



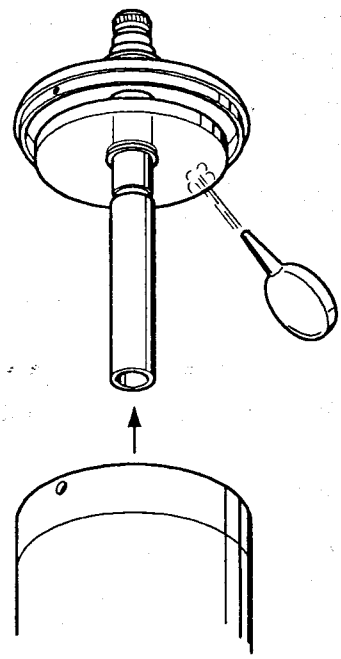


Fig.28

⚠ CAUTION

The space between the outer edge of the primary mirror and the inner face of the tube is so small that great care must be taken not to hit each other when you take out the primary mirror.

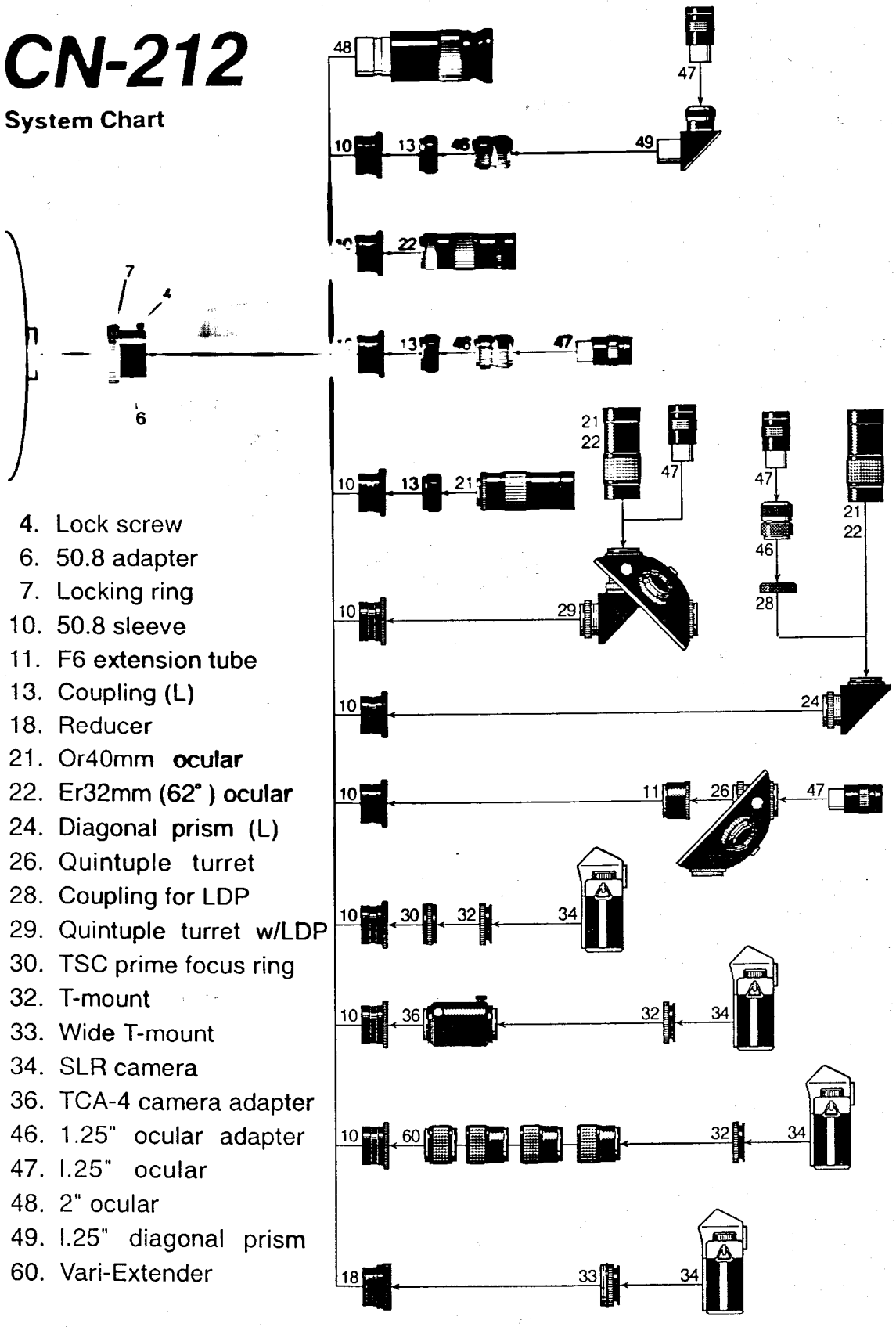
3. Pull up the primary mirror cell slowly with great care not to touch the mirror to the inside wall of the tube. Be certain that the end of the long baffle is completely out of the tube. If the primary mirror cell is set in the tube too tightly, pull it out very slowly until it comes totally out of the tube.

Note:

* After used, put the caps onto the opening of the tube and the ocular adapter to shut the dust out.
* When the tube well cooled in the outside is brought into the warm room, dew will sometimes form on the inside wall of the tube. Therefore, bring the tube into the room after it is closed up tightly with the caps.
* Dirt on the tube can be cleaned with car wax.
* When the mirrors become cloudy in white, they must be cleaned up or plated again. Is the dealers for repair.
* It is better for the secondary mirror to be cleaned by a blower in a regular interval.

CN-212

System Chart



4. Lock screw
6. 50.8 adapter
7. Locking ring
10. 50.8 sleeve
11. F6 extension tube
13. Coupling (L)
18. Reducer
21. Or40mm **ocular**
22. Er32mm (62°) **ocular**
24. Diagonal **prism** (L)
26. Quintuple turret
28. Coupling for LDP
29. Quintuple turret w/LDP
30. TSC prime focus ring
32. T-mount
33. Wide T-mount
34. SLR camera
36. TCA-4 camera adapter
46. 1.25" ocular adapter
47. I.25" ocular
48. 2" ocular
49. I.25" diagonal prism
60. Vari-Extender