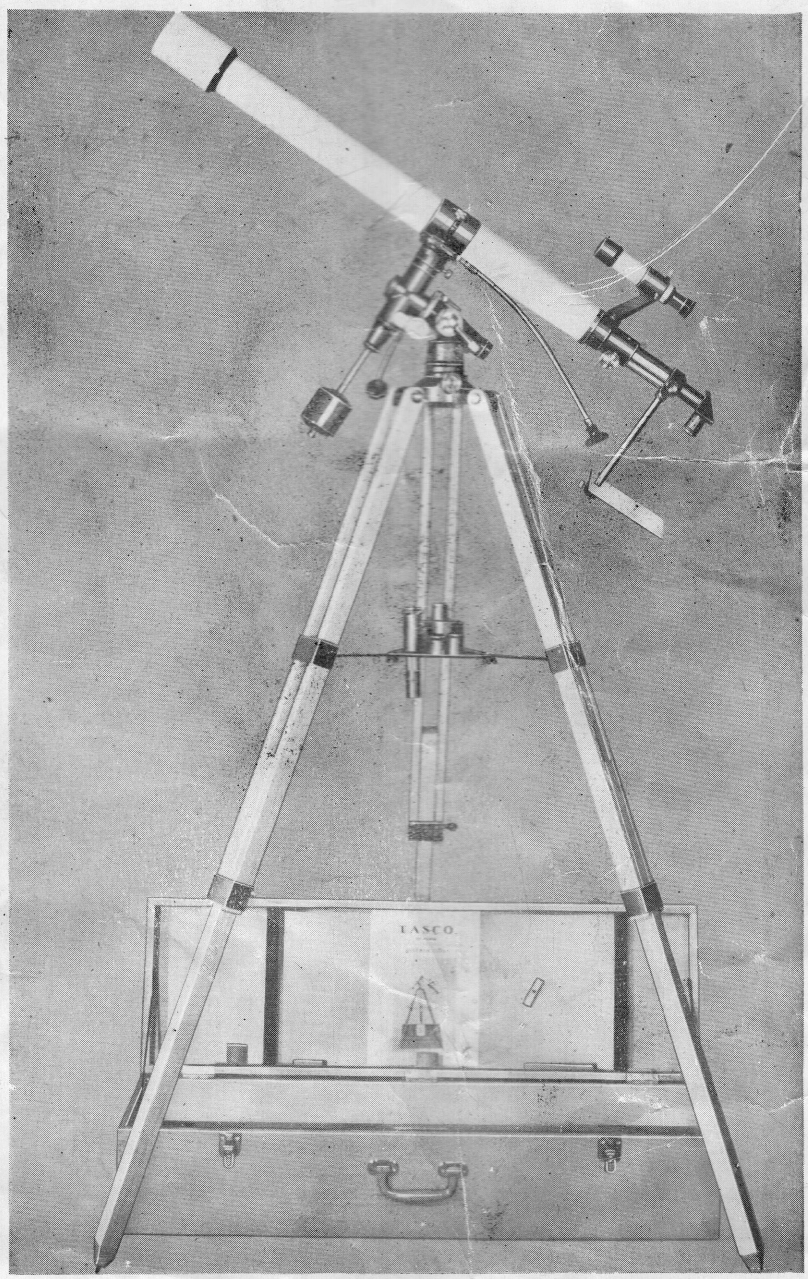
Tasco

304 POWER

ASTRONOMICAL AND TERRESTRIAL TELESCOPE

INSTRUCTIONS



NAME OF THE TELESCOPE PARTS

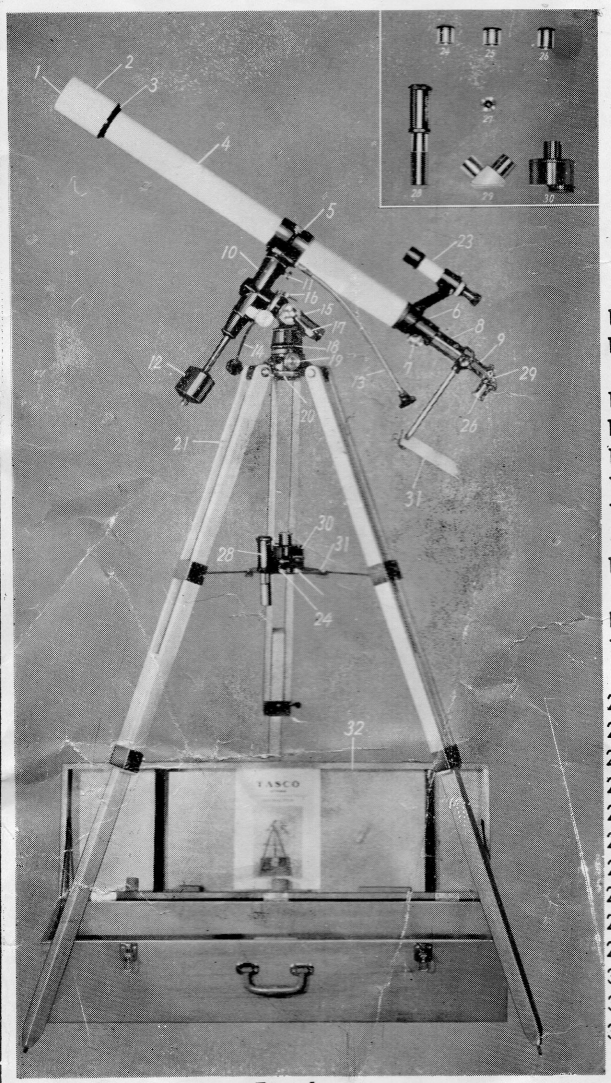


Fig. 1

1. Dust Cap
2. Dew Cap
3. Objective mount with "Squaring On Adjustment"
4. Telescope Tube
5. Hinged sleeve type telescope tube holder (trunnion) fitted with thumb screw
6. Eye-End
7. Micro focusing knob with pinion
8. Focusing draw-tube with rack
9. Eyepiece sliding sleeve
10. Declination axis
11. Clamp for attaching telescope to the Declination axis
12. Adjusting counter-poise (balance-weight)
13. Slow motion in Declination
14. Slow motion in Right Ascension
15. Polar axis
16. Clamp lever for attaching the telescope to the Polar axis
17. Clamp for attaching the Inclination of the Polar axis
18. Tripod Head
19. Clamp screw for azimuth adjustment of the tripod head
20. Base of the tripod head
21. Adjustable wooden tripod
22. Accessories tray and tripod stretcher
23. Finder telescope
24. Eyepiece HM 6mm
25. Eyepiece HM 12.5mm
26. Eyepiece H 20mm
27. Sun-glass
28. Barlow Lens
29. Star Diagonal Prism
30. Erecting Prism
31. Sun projection screen
32. Wooden carrying case.

OPTICAL EFFECT

Objective (Fraunhofer type, achromat, hard coated)					Magnifications		
					For Astro.		For Terr.
Clear aperture	Focal length	Light gathering power for naked eye	Resolving power with respect to double stars	Faintest discernible stars	Original	with Barlow lens	
mm	mm	×	″	m			
60	910	74	1.9	10.7	152×, 73×, 45×	304×, 146×, 90×	Same as Astro.

ADVANCED FEATURES

1. Superior Optical Effect

A. Quality

Each part of this telescope is of the finest quality that can be produced, designed and manufactured to meet the exacting requirements of critical astronomical observation. Fully corrected for spherical and chromatic aberration and coma. All lenses are fully coated for maximum light transmission. The resolving power exceeds the "Dawes" limit empirical criterion which is the most vital factor in star observation.

B. Magnification

The magnification would ordinarily be 152X, 73X and 45X, but when the Barlow lens is attached to the telescope eyepiece sliding sleeve, it increases the magnifying power to 304X, 146X and 90X, and thus enables the operator to make three eyepieces do the work of six.

2. Objective Mount Provided With "Squaring On Adjustment"

The objective mount is equipped with a special adjustment device which permits the object to be exactly "Squared On" and centered, thus ensuring the concentration of the star rings.

3. Advance Mounting

The unique alt-azimuth and equatorial combination contribute to the versatility and ease of operation. The telescope may be used as both an equatorial telescope for astronomical observation and as an alt-azimuth telescope for terrestrial observation. The tripod head may be revolved on the base of the tripod as an aid to the azimuth fine adjustment. Both Right Ascension and Declination slow motions may be effected via angular drive by means of a flexible shaft in any observing position.

4. Sturdy Field Tripod

The tripod has a steel stretcher and accessory tray which fixes the exact distance apart of the tripod legs and has suitable recesses to hold the eyepieces.

5. Additional Features

a. The special design of the telescope permits its quick and easy assembly and disassembly because it may be separated into three parts – the telescope – mounting – tripod.

b. Newly designed eyepieces are superior and precise, permitting comfortable observation.

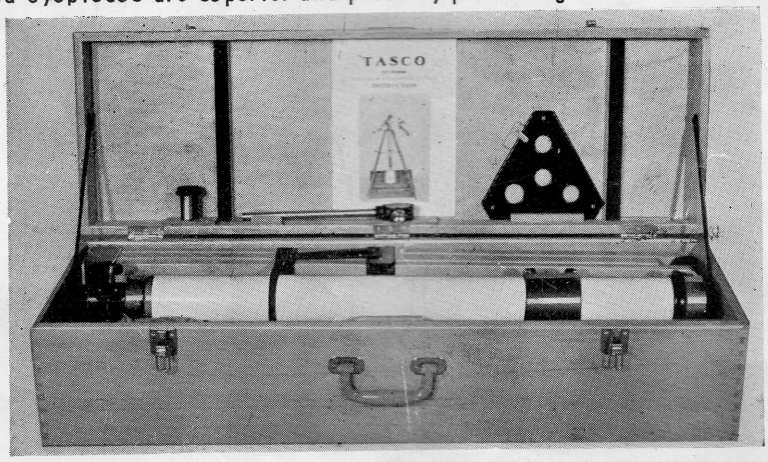


Fig. 2

ASSEMBLING THE TELESCOPE

1. The tube and tripod legs are tied together with a tape when packed as shown in Fig. 2. When removing the telescope from the case, raise and pull out the eye-end section first.
2. Let the tripod legs down after you untie the tape, (Fig. 3). Lift up the main tube by the mount section and the legs of the tripod will fall naturally into position.
3. The main tube slides freely. To balance the main tube, slide it a little toward the eye-end. Tighten the wing nuts on the tripod tightly. Spread apart the legs of the tripod, attach the steel plate stretcher and accessories tray to the legs with the wing nuts and bolts.
4. Screw the balance weight in as shown in Fig. 5.
5. Attach sighter scope at end of telescope tube as shown in Fig. 6.
6. Attach the flexible shafts to the slow motion worm for R.A. and Decl. as shown in Fig. 4.

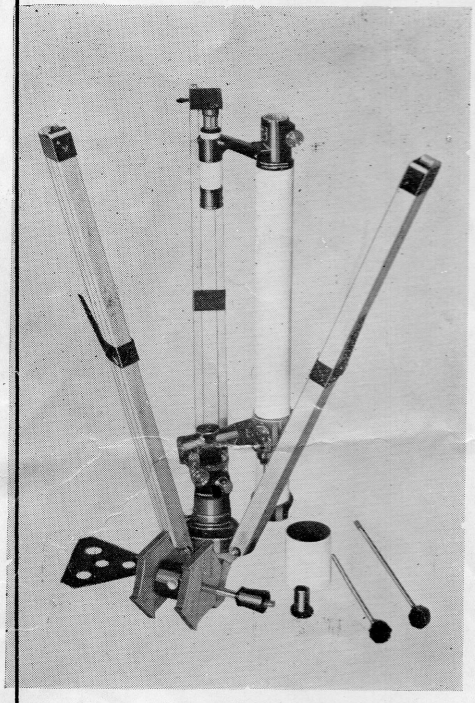


Fig. 3

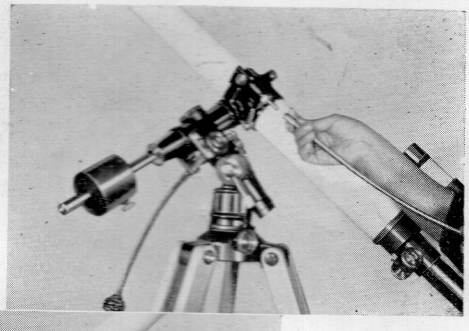


Fig. 4

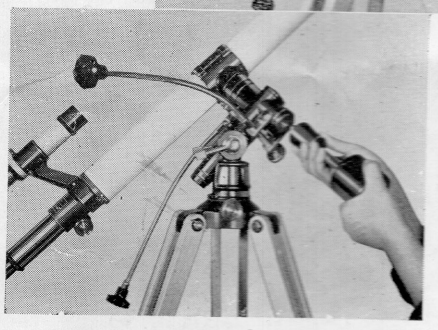


Fig. 5

DISASSEMBLING THE TELESCOPE

1. Disassembling procedure is the exact reverse of setting up. All accessories are first removed. Then the balance weight is unscrewed and removed.
2. The main tube, pointing straight up is pulled up until the eye-end is level with the tripod head and rotated to a position right by the pillar crevice, then the tripod legs are folded up one by one as shown in Fig. 3.
3. When tying the legs of the tripod to the main tube, the balance weight holder is placed at the point of the middle bands of the folded legs. Then tie the telescope and tripod together with the tape.
4. To remove or turn the mounting from the tripod head, unscrew or loosen the clamp lever which is placed behind the tripod head.

HOW TO USE TELESCOPE IN AN EQUATORIAL POSITION

1. Balance The Weight Of The Telescope

Both the telescope tube itself and the counterpoise (balance weight) must be carefully balanced in each observation. (Fig. 6)

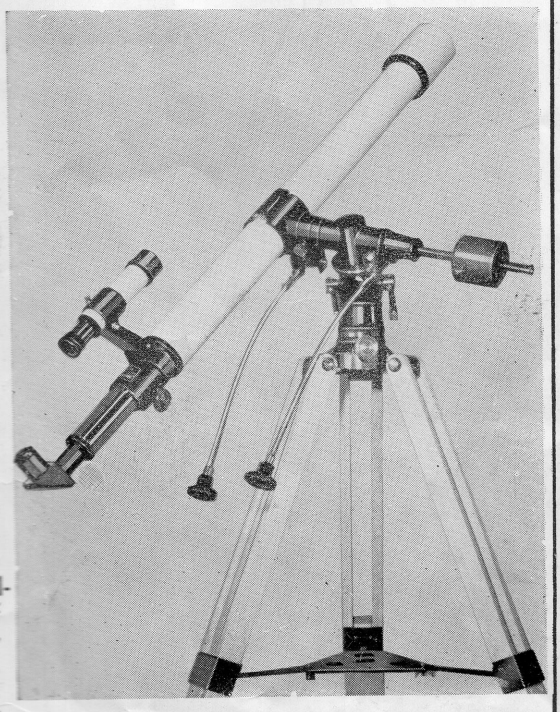


Fig. 6

2. Equatorial Adjustments

a. The completed stand should be set up so that the top of the stand is perfectly level atop the legs of the tripod. (Fig. 6)

b. The telescope tube is next set as nearly parallel to the polar axis as possible. Now turn the polar axis until Polaris (the pole star) is seen in the field of view of the finder telescope.

c. The true North pole, towards which the polar axis should be directed as nearly as possible, lies about 1° (two full moon breadths) distant from Polaris, and very nearly on the straight line joining Polaris and Ursae Majoris – the last star in the tail of the 'Great Bear'. If possible choose the time for observing when Polaris transits above or below the pole (see Fig. 7). Direct the telescope toward Polaris so that it appears in the center of the field of view. Raising or lowering the axis, not over 1°, by means of the adjustment of the polar axis inclination and azimuth will make the adjustment sufficiently accurate for finding an object in the field of the finders view as shown in Fig. 8.

3. Notes On Using The Tripod

With a movable tripod it is a good idea to provide some means of being able to place it in exact position once a good adjustment has been made. This will save much valuable time that would be lost in making the adjustment each time. For convenience, we suggest three stone slabs or concrete blocks with gunmetal or brass plugs be placed in a triangle to accommodate each tripod leg. Metal spikes are provided on the ends of the tripod legs for easy insertion into the metal plugs. This assures correct placement of telescope each time.

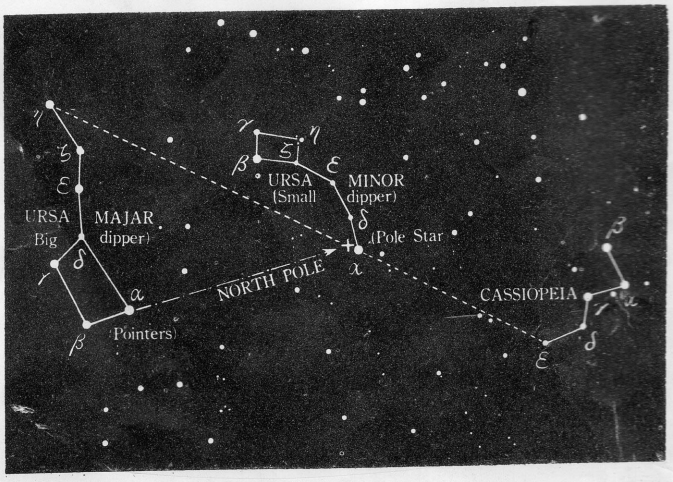


Fig. 7

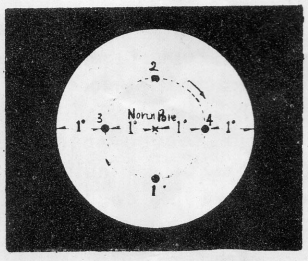


Fig. 8

The North Pole and Polaris can be found in the field of the finder when the polar axis of the equatorial is set accurately.

1. Transit of Polaris above the pole.
2. Transit of Polaris below the pole.
3. Eastern greatest elongation.
4. Western greatest elongation.

HOW TO USE THE TELESCOPE IN A TERRESTRIAL POSITION

1. To observe terrestrial objects, the telescope should be placed in a position as shown in Fig. 9.
2. Use the erecting prism and low power eyepiece.

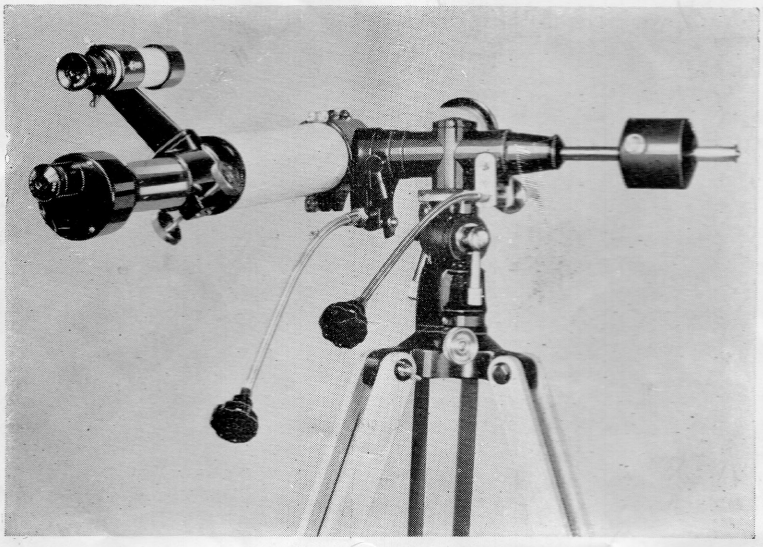


Fig. 9

"SQUARING ON" OF THE TELESCOPE

The objective lens, to perform perfectly, must be set accurately at right angles to the axis of the telescope tube. This operation is usually expressed by saying it must be "Squared On". The actual performance of the telescope on any celestial object is the only satisfactory test. Seen through the telescope using the high power 152x or more eyepiece, a fixed star of the second magnitude- (the atmosphere being steady and free from cross-currents)- should appear as a minute, well-defined, circular disc of light, almost a point, and surrounded by one or two thin concentric bright rings as shown in Fig. 10-A.

If not properly "squared on", the light from the star enters obliquely so that the image is distorted and does not show as the concentric "disc-and-ring" that it should. It will appear rather as an irregular image with a "tail" (which is called a "coma"), to one side as shown in Fig. 10 B or C. This is more evident when the image is just out of focus. To correct this distortion, adjustment can be made with screws on the objective mount which permit it to be slightly tilted in any direction. When the disc is not circular and triangular or oval shaped rings are seen, this condition is known as flexor or "Astigmatism" of the objective glass.

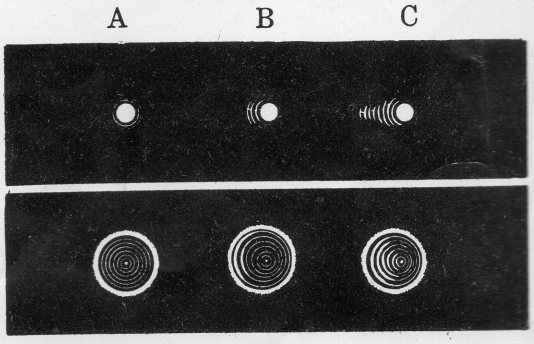


Fig. 10

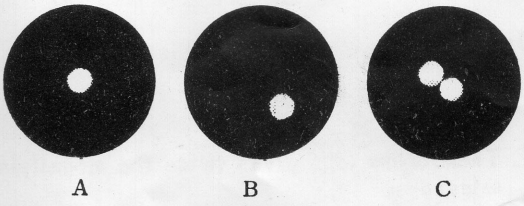


Fig. 11

If it is necessary to "square on" in the daytime, the following method is easiest.

1. Remove the eyepiece from the sliding sleeve.
2. Cover the objective lens with a cap or black cloth.
3. Peep into the eyepiece from the sliding sleeve.
4. You will see "Ghosts" of reflection light from every surface of the lenses.
   a. If these ghosts are seen as a concentric circle as shown in Fig. 11-A, the telescope is "squared on".
   b. If these ghosts are seen as diffused circles as shown in Fig. 11-B or C, the alignment is faulty.

CARE AND USE OF THE ACCESSORIES

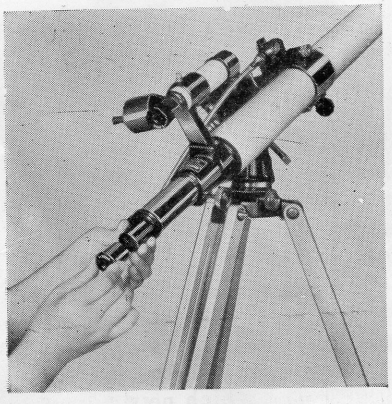


Fig. 12

1. As shown in Fig. 12, the eyepiece is inserted into the eyepiece sliding sleeve simply by being pushed in. To focus, turn the slow motion knobs.
2. The engraved 'H' on the eyepiece cap or 'HM' stands for Huygenian or Huygenian Mittenzay which denotes the type of lens combination, and the engraved number shows the focal length of the eyepiece in millimeter.
3. The magnifying power of the telescope can be obtained by dividing the focal length (Fo) of the objective lens by that of the eyepiece (Fe), the formula being Fo/Fe; thus, with the focal length of the objective at 910 and that of the eyepiece at 125mm, the magnifying power is termed 73x.
4. Observers who wear other than astigmatic glasses should, if possible, remove them in observation.

Barlow Lens

1. The Barlow lens gives twice the magnifying power of the telescope.
2. Slide the lens into the eyepiece sliding sleeve, up to the center, then slide the eyepiece into the Barlow lens tube as shown in Fig. 13.

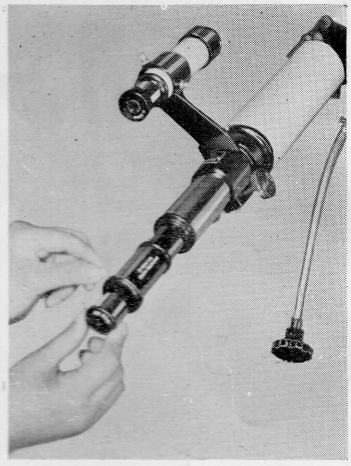


Fig. 13

Star Diagonal Prism

1. This is an L-shaped tube that contains a right angle totally reflecting prism, which passes all the light and thus makes it possible to enjoy a much more comfortable position while observing stars at a high altitude.
2. It may be used as shown in Fig. 14 in place of the eyepiece, the eyepiece being slipped into the prism sleeve.
3. In case the prism is used, the draw-tube must be pushed into a depth of about 60mm to allow a light path for the prism.
4. The prism gives an erect image, but right and left are reversed.

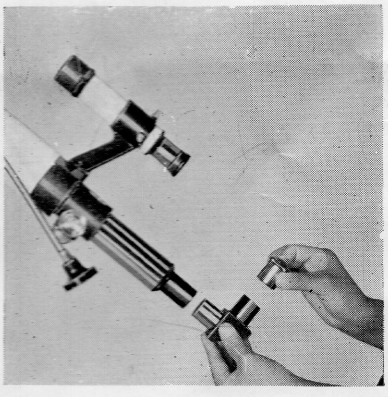
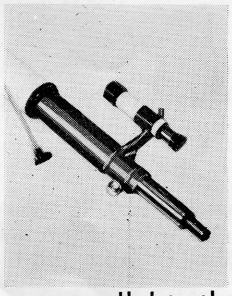


Fig. 14

Sun – Glass

1. The sun-glass which intercepts the heat and glare of the sun's rays, permits safe solar observation.
2. It is screwed into the end of the eyepiece.

Finder Telescope



1. The finder is a small telescope mounted on the large telescope parallel to the main tube fixed by supports, and having 6x magnifying power with cross-wires in the field of view.

2. The objective lens of the finder is 30mm in clear aperture and both the objective lens and eyepiece are capable of being separately focused. The eyepiece should first be focused on the cross-wires which mark the center of the field of view, and a star should then be brought into focus by adjusting the objective glass.

3. It is extremely difficult to find an object when high powers are used. The subject to be examined is therefore "sought and found" immediately with the finder which is so adjusted that when the subject is in the center of the cross-wires, it will also be in the center of the field of the large telescope and observations can be made immediately.

4. The finder may be roughly adjusted by day on a distant vane rod or some other definite object. To improve the adjustment, bring a bright star into the center of the field of a low power eyepiece on the large telescope, then alter the direction of the finder by means of the adjusting screws, until the star image is in the center of the field of the telescope, and is also bisected by the cross-wires of the finder at the same time. Now replace the low-power eyepiece with one of high power, and perfect the adjustments in the same way.

Erecting Prism

As any astronomical telescope shows an inverted image, an erecting prism is needed for terrestrial purposes. The erect image is obtained by means of two right angle prisms. An ordinary astronomical eyepiece is attached. Considerably less light is lost than with the erecting eyepieces, and a wide field of view is obtainable. If the prism is used, the draw tube must be shortened by about 100 mm.

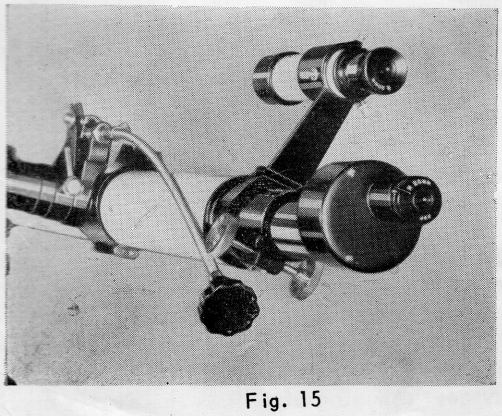


Fig. 15

CARE AND USE OF THE TELESCOPE

Sun Projection Screen

1. The sun projection screen, as its name indicates, is used for the projection of the image of the sun, as observed through the telescope, on the screen in observation.
2. The assembling of the sun screen is done as shown in in Fig. 17. When attaching the ring of the rod holding the screen to the draw tube, be sure that the grooved side of the ring is directed toward the draw tube.
3. The H20mm eyepiece is used for projection of the image occupying 10cm in diameter of the screen. Use of the diagonal prism will project an upright image on the screen.
4. For best results it is advisable to fasten a sheet of pure white paper on the reflecting side of the screen with a paper clip.
5. To get a magnified image of the sun-spots use a high power eyepiece.

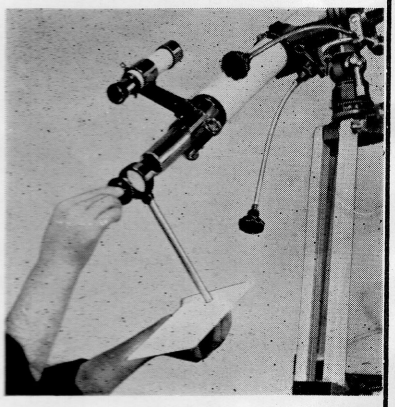


Fig. 16

1. Care Of The Objective Lens

A good objective lens is so delicately finished that it should be cleaned as rarely and carefully as possible for fear of affecting its accuracy and performance. The lenses should never be taken out of their mount by an inexperienced person. The lenses should be held in their mount with just sufficient "play" for a slight rattle to be heard when gently shaken. If the operator turns up the squaring on adjustment screws or the mount collar too tightly, strains in the glass which mar the perfect definition will result.

2. Hints On Cleaning The Lenses

When it becomes necessary to clean the lenses, dust should first be removed with a camel-hair brush or with a syringe. Then the lenses should be wiped very gently with a piece of very fine clean wash-leather or worn out cotton cloth with a few drops of ether or alcohol.

3. Special Hints On Use Of The Telescope

At least half an hour before the observation, remove the telescope to the cold outdoors from the warm room so as to get a good image. Never take the instrument from the cold air into a warm room or the objective lens will become misted. If this should happen, the objective lens must not be left in that state. It should be placed in a warm room at a safe distance from a room heater or fire until the moisture vanishes. Any stains left on the glass must be removed by gentle wiping after it is thoroughly dry.

NOTES ON OBSERVATION

1. Observation Of The Sun

It is extremely dangerous to observe the sun unless proper precautions are taken. "BLINDNESS" may be the penalty of rashness or ignorance. A perfectly safe method is to use the sun projection screen. If the sun is viewed directly through the telescope, you must use the sun-glass on the eyepiece.

2. Observation Of The Moon

Our satellite Moon has been a favorite target of observers ever since Galileo turned his first telescope to her. To see the lunar landscape under best conditions telescopically, when they lie near the "Terminator"- (the dividing line between sunlit and dark portions of the moon caused by the long shadows cast by the mountains and the craters) the best time is between the New moon and a day or two before it is Full and a similar interval after the Full and the next New Moon.

The bright mysterious streaks radiating from prominent craters "Tycho" – "Copernicus" – "Kepler" and several others are very conspicuous under a high light at or near the time of the Full moon.

3. Observation Of The Planets

VENUS: Venus is best viewed in the twilight or just before the dawn, when the faint light of day serves to deprive the radiant orb of a portion of its brilliancy. But if Venus is very near the horizion, it is a telescopic disappointment causing distortion of the image owing to the unsteadiness of the Earth's atmosphere. When near inferior conjunction, Venus is often bright enough to be seen with the naked eye in broad daylight and its phase is a thin crescent.

MARS: Near the "Opposition" when her distance is nearest, Mars may be seen with her white polar caps and a little detail of the surface. Magnification of this planet's observation needs 152X or more.

JUPITER: A fine object, "paralled belt" markings, the "Great red spot" and Galilean four satellities can be seen very clearly.

SATURN: The beautiful and mysterious ring and faint parallel-belt markings may be discerned easily.

MERCURY – URANUS – NEPTUNE: Seen easily, but you will need a star atlas, nautical almanac or astronomical ephemeris.