ASTRONOMICAL TELESCOPE

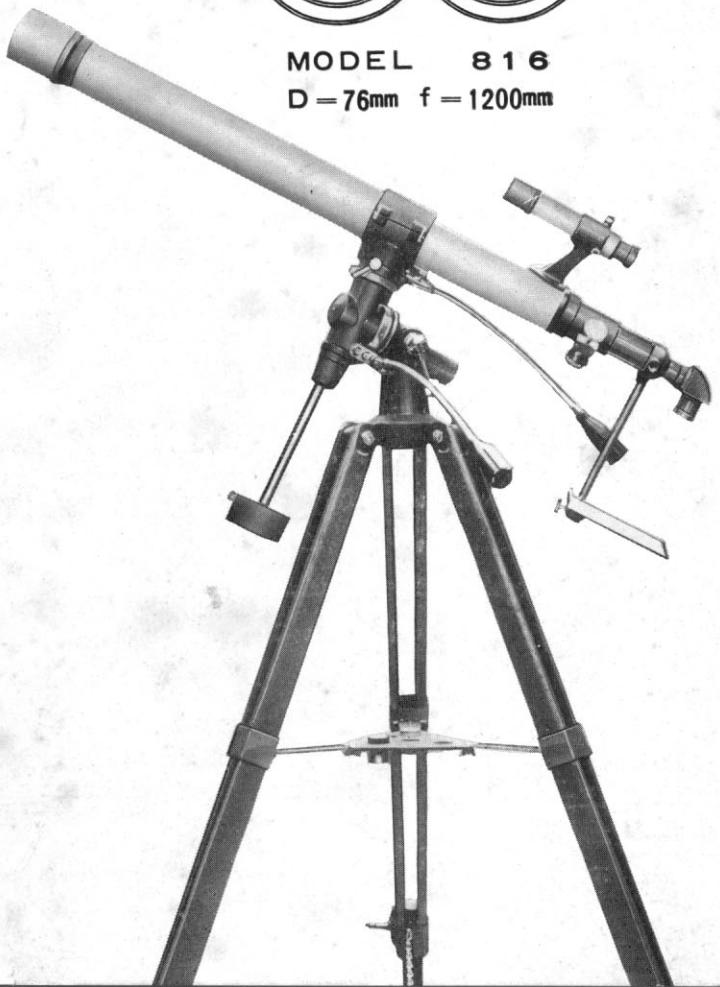
INSTRUCTION—HOW TO USE

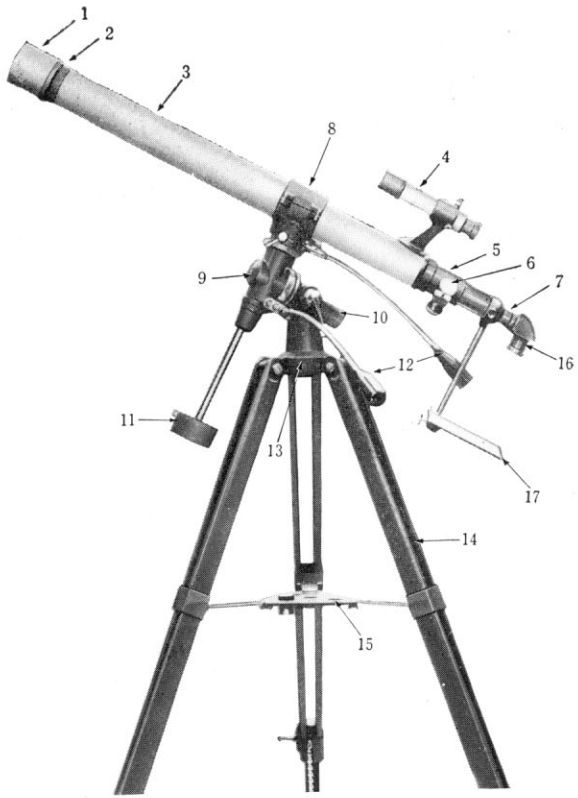
REFRACTOR

MAYFLOWER

MODEL 816

D = 76mm f = 1200mm





Parts List

1. Lens Hood
2. Objective Cell
3. Main Tube
4. Finder
5. Eye End
6. Focusing Knob
7. Eyepiece Adapter
8. Tube Holder
9. Declination Axis
10. Polar Axis
11. Balance Weight
12. Flexible Handle
13. Tripod Head
14. Tripod
15. Accessory Tray
16. Diagonal Prism
17. Sun Projection Screen

INSTRUCTIONS

Assembling of Telescope

Open the carrying case and note the arrangement of the telescope components. On replacing the telescope in its case, the various parts should always be returned to their proper places. The case is especially designed to enable the observer to transport the instrument without damage to the telescope or its accessories.

The telescope can be assembled without difficulty by following the step-by-step procedure:

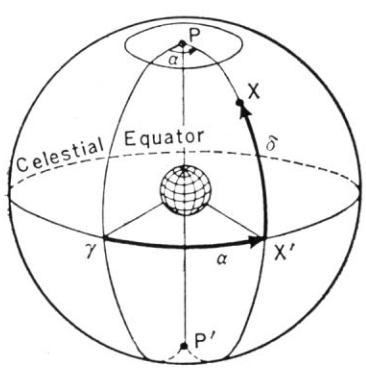
1. Take the tripod legs (#14) from the case and adjust all of them to the same length. Lock the movable member of the tripod leg by tightening the thumb-screw which compresses the metal clamps.
2. Attach the legs of the tripod to the telescope mount base (#13) with the special long bolts provided. The bolts pass through the openings in the tripod legs and through the 3 holes in the telescope mount base.
3. Open the tripod legs and set up the instrument. Take the triangular accessory tray (#15) and attach it with the bolts provided.
4. In using the equatorial mounting, the balance weight (#11) or counterpoise is screwed on to the threaded shaft of the holder as seen in the illustration.

   Its position on the shaft should be adjusted until the telescope moves smoothly and easily through its several motions.

5. Open the main telescope tube clamp (#8) and install the telescope tube (#3), so that the weight is evenly distributed on each side of the tube clamp.
6. Place the various telescope accessories (eyepieces, star diagonal prism, etc.) in the accessory tray (#15), using the openings provided.
7. Disassembling procedure is the exact reverse of assembling.

Equatorial Mount

This mount is more complicated than an altazimuth mount, and is used for following a specific star in its diurnal motion. This mount can be used as an altazimuth mount by setting the polar axis in a straight up and down direction. The declination axis then provides the azimuth movement, and altitude (elevation) is provided by the right ascension (hour angle) axis. The imaginary far greater globe enclosing the globe of the Earth is called the Celestial Sphere. The relation of some points on the Celestial Sphere and the Earth is shown below.



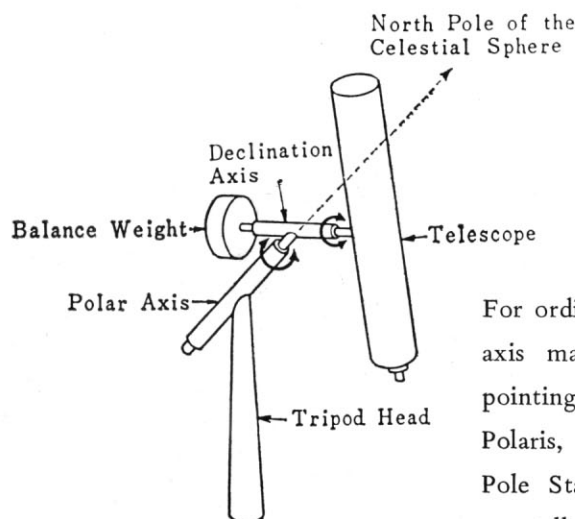
The points P, P' are the North Pole and South Pole of the Celestial Sphere. PXX'P' is an hour circle passing the star X. PrP' is a meridian passing the Vernal Equinox, and is the prime (0) hour circle. The angles formed by rX' and X'X in the center of the Sphere are respectively the hour angle and declination of the star X.

Declination circles are parallel to the Celestial Equator and range from 0° to 90° both northward and southward.

The Celestial Sphere appears to rotate around the Earth in 24 sidereal hours, so the Sphere is divided by 24 hour circles. If we express an hour angle by degrees, we may express an hour by 15°, and 1 minute by 15'. The hour angle of a star is called the star's Right Ascension.

The equatorial mount consists of two axes (polar axis and declination axis) at right angles to each other.

The telescope, in its cradle, is free to move about either of the tow axes. The main task in setting up the Equatorial mount is to line up the polar axis with the axis to the Celestial Sphere.



For ordinary work, the polar axis may be lined up by pointing the telescope at Polaris, the Pole Star. The Pole Star is a star of the constellation Ursa Minor, and is about 1 degree away from the true Pole.

For an observer in any given latitude, the altitude of the Pole is equal to the latitude.

Assuming that the altitude of the polar axis is approximately correct, here is a simple rule to refine the setting. Center a star in the field of view of a low powered eyepiece. If the polar axis is correctly pointed to the Pole of the Celestial Sphere, you may follow and keep the star in the center of the field of view only by rotating the telescope around the polar axis. If the polar axis is not in the meridian, it will be necessary to move the declination and hour angle settings to keep the star centered. If the correction in declination was toward the North in the northern hemisphere or toward the South in the southern hemisphere, the upper end of the polar axis is pointing too far westward. If the correction is in an opposite direction to that described, the polar axis is pointing too far eastward. Shift the polar axis in azimuth in the direction indicated and make a fresh trial. One or two such traials should put the polar axis in sufficiently close adjustment for the most practical purposes. Use two or three stars in widely separeted parts of the sky for each trial.

Observation

It is not always true that the higher magnification gives you the most satisfactory observation. You should remember that the highest effective magnification of telescope is limited by the diameter of its objective lens, and generally a telescope having a larger objective lens

has a higher effective magnification limit.

You may use your telescope roughly in three different power ranges, low, medium and high powers. Low power should be used for observing star clusters, nebulae, variable star, comets, etc., which occupy a wide area of the field of view. High power should be used for observing planets, double stars, etc., for which observation you need the highest effective magnification. However, high power may not produce the expected good result if the atmospheric condition is not good, in which case you should use medium power. Low power produces a brighter, clearer image and wider field of view, while high power enables you to see the minute details of an object, and medium power should be chosen when low or high power is found to be not suitable.

You will make the most effective use of your telescope if you select the most suitable power for the type of observation and the atmospheric conditions as described above.

Resolving Power

The most important part of the telescope will be the objective lens which mainly decides the efficiency of the telescope. You may look at double stars in order to measure the efficiency of the telescope, and your proficiency in handling the telescope. The efficiency of the telescope is measured by the degrees or fractions of degrees between two stars for which the telescope will distinguish one from the other. This efficiency is called Resolving Power.

Finder:

The finder (#4) is a guide telescope for picking up an object easily before using the main telescope. There is a cross-hair in the eyepiece of the finder, and when the object is seen at the center of this cross-hair, the object will be seen at the center of the main telescope. In order to adjust the position of the finder properly to the main telescope, you must look at a chimney or other object at least 500 yards distant and place it in the center of the main telescope. Then adjust the finder by turning its set screws until the object is located at the center of the finder cross-hair.

The Sun Glass may be attached to the end of the finder ocular so that the sun may be observed safely through Finder. The same size Sun Glass may be used either for the eyepiece of the main Telescope or for the ocular of the Finder.

ACCESSORIES:

Eyepiece:

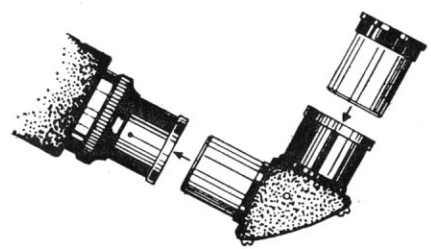
The eyepiece magnifies the image produced by the objective lens. The magnification of the telescope is obtained by dividing the focal length of the objective (910mm) by that of the eyepiece. The eyepiece is inserted into the eyepiece adapter which may be moved by turning the fine focusing knob. The letters on the eyepiece designate the type of eyepiece. H for Huygenian, HM for Huygen Mittenzwey, OR for Orthoscopic, SR for Special Ramsden, AH for Achromatic Huygen, K for Kellner. The number beside the letter denotes the focal length of the eyepiece in millimeters.

If you place the eye too close to the eyepice, it may be made dirty by the eyelashes or eyelid, or obscured by your breath. In such case you should wipe the eyepiece carefully with a soft cloth.

The user of spectacles usually should take them off before looking into the telescope. However, if his spectacles correct for astigmatism they should be kept on.

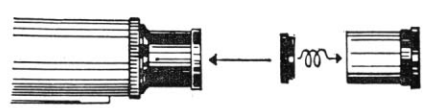
Diagonal Prism:

This prism is also called Zenith Prism and is used to change the direction of light 90° so that you may observe the stars around the Zenith from a comfortable position. The Diagonal Prism is inserted between eyepiece adapter and eyepiece as shown by the figure. In this case you must move the draw tube of eyepiece adapter inward about 60 mm.



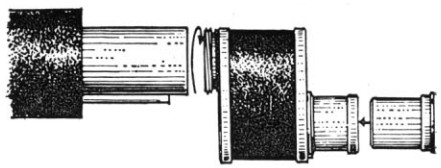
Sun Glass (Moon Glass)

The Sun Glass absorbs some of the heat and light of the sun so that with proper care you may observe the sun safely. The Sun Glass may be cracked because of the heat of the sun unless you turn the telescope off the sun after observing the sun for 10 minutes or so. If this care is neglected, the Sun Glass might be cracked and the eye might be hurt. Never observe the sun without the Sun Glass! ! .



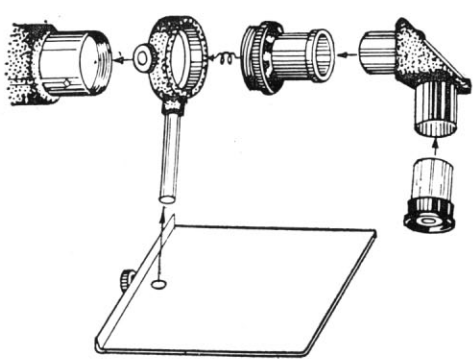
(The Moon Glass is used for observing the moon just like the Sun Glass for the sun.)

Erecting Prism:



The image of an astronomical telescope is upside-down, so you must use Erecting Prism in order to erect the image for terrestrial observation.

For installing the Erecting Prism, unscrew and remove Eyepiece Adapter from Draw Tube, then screw Erecting Prism into the end of Draw Tube. Then the desired Eyepiece may be attached to the end of Erecting Prism. Draw Tube must be moved inward about 60 mm for correct focus.



Sun Projection Screen

The sun projection screen (#17), as its name indicates, is used for the projection of the image of the sun through the telescope onto the screen.

The assembling of the sun screen is done as illustrated. When attaching the ring of the rod holding the screen to the drawtube, be sure that the grooved side of the ring is directed toward the drawtube. The use of the diagonal prism will project an upright image on the screen.

Maintenance

It happens frequently that the life span of the optical instrument or lens is made unreasonably short because of neglect or improper care. You must know the proper care so that you may maintain your telescope at its best condition for the longest possible life span. Don't shake the telescope, nor allow it to incur shock. Keep it from dust, moisture and sudden change of temperature.

After use, the mechanical parts should be wiped clean with a dry cloth and the surface of lens also should be cleaned. For cleaning the lens, you may blow the dust off its surface with blower (or spurt) or brush off with dry feather or a brush. In wiping off such dirt as cannot be blown nor brushed off, you should use clean and dry cotton cloth, gauze or lens tissue with a small amount of alcohol.

You should keep unnecessary disassembly of your telescope to an absolute minimum, because it is difficult for an amateur to reassemble the instrument exactly to the original state. If disassembly is absolutely necessary, mark each part so that you may know which parts connect with each other when you reassemble the instrument.

Above all, moisture is not good for the lens, so you should store your Telescope in a shaded place with good air circulation.



PRINTED IN JAPAN