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Journal of San Angelo Amateur Astronomy Association
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NEXT MEETING: Wed, 7:30 PM, Apr 7, '71 - at the Statio, Howard and S. Parkway (rear).

By Steve Arvedson :::

Dr Moon recently purchased an 8 in Schmidt-Cassegrain telescope for the club. At the same time he gave the 12½ in Cave scope to the club. In the last year SAAAA has grown quite well. In this writer's opinion, the club is at an all-time high for potential. Members, Mike Cox and Kelly Knowlton are building scopes. Kelly has completed an excellent spectrograph. His work at present is limited, due to schoolwork, to minor mechanical adjustments on it.

More and more members are becoming interested in photography. With the Celestron 8, photography is almost automatic. One night I decided to get a picture of the moon at prime focus with the new scope. I climbed to the observation platform with the scope on tabletop stand. The observer soon finds out that he must be in a reclined position to focus on an object near the zenith. Now, on my side, with a cold north wind blowing, my shot was spoiled because I was shivering enough to cause the whole platform to shake. This, however, is the fun (and dogma) of amateur astronomy. I hope the club can work on spectrography. Land near Mathis Field may soon be available to the club. Away from city lights, the Celestron will surely astound us.

In addition to the great gift of Dr Moon, Mr Windell's kindness should be noted. He gave us bolts, including spares, to mount the scope on its pier. He gave us a level to use with the telescope. This is typical of support the club has been given.

I've just received Scientific American in the mail. An intriguing account of Mars is included. Since Jupiter will be our next topic of discussion, on Apr 7, a final note on Mars is here made. The 201 pictures of Mars sent back by Mariners 6 and 7 in July and Aug of 1969, have been exhaustively studied. Computers give the photo experts over 3,500 different versions of the terrain photographed. Evidence of atmospheric clouds and haze, the character of the South Polar Cap, and the three types of land structure seem to be the primary concern of the professionals. The maximum resolution of 0.3 kilometers on many of the photos helps the men involved to plan the 2 photo-missions for later this year. The pictures show that Mars lacks dense clouds, but thin haze-layers above the limb of the planet seem to be present. "Afternoon brightening" is observed and it is not known whether this is a surface phenomenon or an atmospheric one.

The Mariner pictures show excellent views of the South Polar Cap. The investigating team reports that the Cap is frozen carbon dioxide with a maximum thickness of "tens of meters." The polar region exhibits cratering and marked variation in brightness. This variation is attributed to "differences in related frost textures and to the local history of evaporation and sublimation."

The terrain described as chaotic or featureless continues to mystify the Mariner investigators. The chaotic terrain covers more than a million square miles and has no exact counterpart on the earth or the moon. The featureless part is represented by Hellas. Hellas is devoid of any topographic feature larger than 500 meters. One hypothesis states that Hellas' surface is kept in fluidized motion by the venting of volcanic gases. Despite the outcome, Mars will be a fascinating object for the geophysicists!

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Some notes from your Secretary

It appears that we shall be losing Steve, and his many contributions to SAAAA activities before the year is out. He will be hieing off to University. We are glad to have his notes in S&H Journal, above.

If the Mentor of SAAAA can buy the club such a fine instrument as Celestron 8, in addition to all his other continuing assists to a better and virile association of astronomers, it seems that every one of us should do no less than learn, learn, learn to use and care for every one of the items at the club's disposal. This special issue of S&H risks the wrath of Celestron Co by reproducing the set of instructions they furnished, so that every member can have his own copy for study. So study!

## Your First Look

You will no doubt be eager for your first look through your new Celestron 8. We, therefore, urge you to read first the first section of this operating manual so that you will acquaint yourself with some of the things you can do and can't do with this instrument. We want your first view through the Celestron 8 to be pleasing and create a lasting good impression If your first look is in the evening when a moon is available in 1st quarter to 3rd quarter phase, it will present a fine and lasting first view through the Celestron 8. The instrument was focused and tested at infinity with the 25 millimeter ocular and the star diagonal in place. It should, therefore, be near the correct focus for you to look at the moon or objects at infinity. Again, however, we urge you to review the check list of items included in the shipment and read the section on focusing and collimation to make sure that the instrument is performing satisfactorily.

## Focusing

Focusing of the Celestron 8 is accomplished by moving the primary mirror in respect to the secondary. This allows a very large range of focus from within 35 feet through beyond infinity. Focusing is accomplished by turning the knurled knob located at the right of the eyepiece drawtube. The full focal travel is 32 complete turns of this knob, and infinite focus is at about 20 turns counterclockwise from the end of this travel.

Since a very large amount of focal travel is available it is not too difficult to get lost on the focal travel. If you are trying to focus on a very faint object and you are far out of focus, you will be lost and will not know which way to turn the focus knob. If you find yourself in this situation it is best to point the telescope at some bright or high contrast object, remove the eyepiece and find the focal position by moving your eye toward the eyepiece drawtube.

If the focal position is inside the drawtube the object will tend to grow larger as you move your eye toward the eyepiece drawtube. If the focal plane is behind the eyepiece drawtube it will pass through a blurred position as you move your eye toward the eyepiece drawtube.

If the focal position is inside the drawtube, turn the focal knob counterclockwise to push the focal place out to its correct position which is about coincident with the end of the eyepiece drawtube. If the focal position is far out beyond the eyepiece drawtube, turn the focus knob clockwise to pull the focal plane into the correct position. Of course, when the diagonal is in place the end of the eyepiece drawtube means the output drawtube of the diagonal.

## Collimation

At least 50% of all telescopes give poor performance due to the fact that the collimation adjustments are misaligned and that the telescope user is not acquainted with the techniques of recollimation. Collimation means that the optical elements of the telescope are all positioned so that their optical centers coincide with a given line and that they are tilted so that their individual optical axes also coincide with a line through the optical axis of the over all instrument. The Celestron Telescope has 3 main optical elements; the corrector lens, the primary mirror, and the secondary mirror.

optical axis of each of the three elements must coincide and be parallel to a line drawn from the center of the eyepiece drawtube through the center of the secondary toward the object being viewed. Two of these adjustments are factory prealigned and permanently fixed in the Celestron 8. The primary mirror is carefully adjusted on installation so that its optical axis is squared on with the baffle tube on which it is mounted. The corrector lens has been carefully edged so that its mechanical center and optical center coincide. The secondary mirror is fixed over the optical center of the corrector lens. This means that the only adjustment is the tilt adjustment of the secondary mirror.

## Celestron 8 Collimation Procedure

The Celestron 8 is a ruggedly built telescope and should retain collimation unless dropped or severely handled in transportation. A misadjustment in the collimation can seriously affect the resolving power of the instrument.

## How To Check Collimation

Using as high a power eyepiece as the seeing conditions will allow point the instrument at a star near the zenith. Now defocus the telescope so that the out-of-focus blur circle occupies about 1/3 of the field of view. If the shadow of the central obstruction is not perfectly centered, then the instrument is out of collimation.

Fig. 1
Collimation is out of adjustment if the out-of-focus blur circle of a star image shows the shadow of the obstruction off center.

Fig 2
To recollimate, first move the image to the edge of the field of view in the direction that the shadow is off center by repointing the telescope with the slow motion controls.

Fig. 3
Bring the image back to the center of the eyepiece field using the tilt adjustments on the secondary mirror. Correct collimation is indicated by the out-of-focus blur circle of a star appearing concentric.

a. If the instrument is out of collimation as indicated by the out-of-focus blur circle not being concentric as in Fig. 1, first shift the image to the edge of the eyepiece field in the direction that the shadow is off center by re-pointing the telescope - Fig. 2.

b. Using the small Allan screws which are the secondary tilt adjustments located on the outside front end of the tube assembly near the center of the corrector lens, bring the image back to the center of the eyepiece field. In this case set screw "b" is tightened slightly, and set screws "A" and "C" are loosened slightly.

c. Repeat steps a and b until the out-of-focus blur circle appears perfectly concentric.

d. If you have a higher power eyepiece available (6MM is adequate) shift to the higher power and repeat. At high power if the seeing conditions are good, final collimation is best accomplished with the instrument in focus. Adjust the col-

limation as in a and b above, but this time observe the Airy disc (the brighter central maxima of a 3rd magnitude star), and make it appear concentric with the faint ring which will appear around it.

Caution: The tilt adjustments on the secondary are very sensitive - a tenth of a turn will generally completely change the collimation. Also, keep the three screws under tension at all times so that the secondary mirror cannot rotate on its mounting. Do not adjust the center screw.

Magnification

After you have used a large precision telescope such as the Celestron 8 you will soon be discussing optimum magnification for a given celestial object, rather than "How much power can I use?" The actual magnification of a given instrument is determined by dividing the focal length of the objective lens system by the focal length of the eyepiece used. At the eyepiece position the effective focal length of the Celestron 8 is close to 2,250 millimeters. The following tabulation gives the magnification for the various eyepieces included with the Celestron 8 or available as accessories.

| OCULAR | MAGNIFICATION |
|---|---|
| 40mm | 56 power |
| 25 | 90 |
| 18 | 125 |
| 12.5 | 180 |
| 9 | 250 |
| 6 | 375 |

Faint stars even through large telescopes subtend an angle much smaller than the theoretical instrument resolution. The diffraction limit of a telescope, therefore, determines the highest power which you can use under perfect seeing conditions. In an 8-inch telescope at 160 power you can just detect a small round ball for a faint star. This small round ball is the Airy-disc. Using the Celestron 8 at 375 power this small round ball is clearly visible and dominates.

The optimum magnification for a given object will vary from 50 to 400 power with the Celestron 8 depending on the nature of the object and the seeing conditions. If you are viewing a galactic cluster the optimum magnification is the lowest power available. If you are viewing a planet the optimum magnification is the highest power that the seeing conditions will allow. A good working magnification for the Celestron 8 is in the range of 90 to 180 power.

The Stellar Coordinate System

Consider as the ancients did that all the stars are on the inside surface of a huge ball and that we are located in the center of this ball. The earth rotates on its axis inside of this celestial ball. The axis of rotation of the earth points at the celestial pole. The pole star, Polaris, is quite close to the celestial pole (approximately 0.8 degrees off). The celestial equator is simply the projection of several star catalogues and atlas's which catalog the position of all of the stars visible to the unaided eye and many of the fainter celestial objects.

The coordinate system gives these positions in hour angle and declination angle. The hour angle is the rotation of the celestial sphere of a given object from an arbitrary fixed reference. The declination of a given celestial object is the angle measured from the celestial equator toward the north pole as plus and toward the south pole as minus. As an illustration the bright star Vega has coordinates 18 hours 35.2 minutes in right ascension and plus 38 degrees 44 minutes in declination.

## Polar Axis Alignment

The Celestron 8 is equipped with an accurate clock drive in its base which compensates for the rotation of the earth under the celestial sphere. The coordinate system of the Celestron 8 is also calibrated to match the coordinate system of the celestial sphere when the base of the telescope is properly set. To accomplish the setting of the base of the telescope set it on its equatorial wedge and point the instrument so that the tube parallels the fork tines. Next orient the telescope until the polar axis points in the general direction of Polaris. Rotate the telescope about its polar axis so that the declination axis is at right angles to an imaginary line passing from the pole star to the 3rd star in the handle of the Big Dipper. Now swing the front end of the telescope away from the Big Dipper slightly so that the declination setting circle reads 0.8 degrees. Next looking through the finder telescope adjust the equatorial wedge so that Polaris is on the cross hairs of the finder scope.

## Setting Circles

The declination setting circles are fixed relative to the optical axis of the instrument. When the optical axis is parallel with the polar axis of the instrument the reading on the declination setting circle should be 90 degrees. This can be checked by pointing the instrument at a bright star near the celestial equator. First note the reading on the declination setting circle then tumble the telescope 180 degrees in both declination and right ascension.

Repoint the telescope to the same bright star near the celestial equator. The declination setting circle reading should be the same as in the previous sighting. If not, note the difference in reading and reset the declination setting circle to half way between the two settings. (The declination setting circle is fixed to the declination axis by the small Allen head screw at the center of the declination setting circle plate. Loosen the screw before attempting to rotate the declination setting circle. After the declination setting circle has been reset, tighten the screw so that the circle cannot rotate).

The right ascension setting circle is driven by the master drive of the Celestron 8. It will accurately indicate sidereal time once set and so long as the telescope drive is operating. To set the right ascension setting circle point the telescope at a bright star near the celestial equator of known right ascension. Rotate the setting circle until the pointer indicates the right ascension of the object to which the telescope is pointed.

## Finding Objects With The Setting Circle

After you have properly set the equatorial wedge of the Celestron 8 and have set the right ascension setting circle you can point the instrument at many of the faint celestial objects by translating the coordinates of these objects to the setting circles of the Celestron 8 Keep in mind that the field of view using the 40 millimeter ocular is only 0.5 degrees. You must, therefore, set the circles accurately and make sure that the polar axis is pointed accurately at the celestial pole. Further be prepared to sweep a degree or two in both directions in finding a given object to compensate for any error in pointing.

## Slow Motion Controls And Clamps

Manual slow motion controls and clamps are provided on both axes of the Celestron 8. The declination clamp is the small knob at the top of the left fork tine. The declination slow motion control is the small knob at the base of the left fork tine. One turn of the declination slow motion control knob moves the telescope approximately one hour in time. The declination clamp is a 3-inch band which is adjusted by the declination clamp. This should never wear out and is adjusted simply by tightening or loosening the declination clamp knob.

The right ascension clamp is a small nylon ball which presses against the side of the right ascension main drive gear. The nylon ball is a wear point and is adjusted by removing the set screw from the center of rotation of the right ascension clamp. After removing the top set screw you will find underneath the set screw another similar set screw. Rotate the lower set screw clockwise to accomplish the desired drag when the clamp is rotated fully clockwise. After this has been accomplished replace the set screw which holds this position. It is best not to overclamp either declination or right ascension particularly if you have other people at an observing session. Novices have a tendency to try to horse the telescope around overriding the clamps.

## Terrestrial Viewing

The Celestron 8 may be used as a terrestrial telescope. The fork mount serves as an altitude azimuth mounting when the base is set up-right on a table top or other support. Erect images are provided by looking down into the diagonal or by using the straight-through image erecting system provided as an optional accessory. Keep in mind that no telescope can cut through fog, haze, or mist, nor can it quiet turbulent air waves. To avoid disappointment your first terrestrial views should be of nearby objects. A bird, tree or flower or perhaps a street sign about 100 feet away and not across hot pavement. After a little experience you will appreciate the best type objects to view with a telescope. You will generally find that the 40 millimeter ocular is adequate for terrestrial viewing.

## Lens Care And Cleaning

1. An eyepiece or cap should be kept in the eyepiece at all times to prevent dust and vapors from entering the tube thereby contaminating the first surface mirrors. If this is done regularly the telescope should never require cleaning internally or the mirrors realuminized.

2. When not in use the telescope should be completely covered with the plastic cover in which it was shipped, or it should be placed in its carrying case.

3. The corrector lens should be cleaned only when absolutely necessary. Use a camel's hair brush to remove loose dust and dirt. A glass cleaner such as Windex or regular lens solution may be used along with Kleenex. Soap is not recommended as it leaves a film. When cleaning the corrector lens front surface do not use vigorous circular motions. A single grain of sand if present could severely sleek the front surface of the corrector using this approach. Use a number of soft facial tissues, take a single swipe from the denter out with each tissue. The same care should be used in cleaning the corrector lens as you would use on your fine reading glasses.

## Exterior Finish-Cleaning

The velvetone finish of the Celestron 8 may appear delicate - this is not the case. The finish colors are accomplished by mixing tiny colored glass beads in a clear resin material. The resin material which holds these beads is almost impervious to most cleaning solutions. There are several approaches which you could use with good success in cleaning finger marks or grease spots from the exterior finish of the Celestron 8. A small bristle brush such as used for scrubbing dishes or cleaning fingernails in conjunction with soap and water is a good approach. A felt tipped dry cleaning solution bottle such as used for spotting clothes will work nicely. Acetone with Kleenex tissues if used sparingly will remove grease spots quickly.

## The Solar Telescope

Caution: Read this section before pointing the Celestron 8 at the sun. Permanent eye damage can result almost instantaneously by looking at the sun with any optical instrument which increases the light grasp. Do not place your eye at the eyepiece of the Celestron 8 or its finder scope until you have - - -

- - - until you have thoroughly reviewed this section.

Solar Observing By Eyepiece Projection

By far the simplest and rewarding technique of observing the solar disc is by Eyepiece Projection. It is accomplished as follows: Place the 40mm ocular in the eyepiece drawtube (no diagonal). Focus the telescope visually at a distant land object. Hold a large white card about 12 inches behind the ocular and point the Celestron 8 at the sun. You will note that the solar image is projected on the card through the finder telescope and through the main telescope when it is properly pointed. After the sun is centered in the field cap the finder telescope so that the cross hairs will not be burned by excessive heat from the solar image.

The apparent magnification of the instrument with the eyepiece projection technique can be varied by changing the distance from the card to the ocular. A good working distance is about 20 inches. Holding the card at this distance focus the telescope to give a maximum sharpness of the solar disc and sun spots. Do not observe the sun with this technique for a period exceeding 60 seconds. Heat will build up on the secondary of the telescope and in the eyepiece, thereby causing permanent damage to the instrument if left pointed at the sun for a longer period of time.

Full Aperture Solar Filter

A full aperture solar filter is available to Celestron 8 owners as an optional accessory. This filter reduces all of the components of the solar radiation down to 1/100th of 1%. Using this filter and additional neutral density color filters which further reduce light by a factor of 10, you can comfortably view the solar disc. Again we caution you to make sure that the solar filter is firmly placed at the front end of the telescope. If it should be knocked off while some one is viewing the solar image through the eyepiece, eye damage can be sustained.

Photography

(These pages are being mimeographed from the original set of instructions that came with the Celestron 8. The pages do not conform in number. Page 8 of the original is being Zeroxed, and will be inserted as the page following this page. Meanwhile, we continue the instructions that follow on page 9 of the original in the next paragraph).

Best results for terrestrial photography are obtained using a single lens reflex camera having a behind-the-lens metering system. If you do not have a camera having a built-in meter, the next best bet is to use an incident light meter. In taking pictures of distant objects that are sunlight illuminated, assume that the lighting is the same where you are. So simply take the incident light meter reading of the unprotected sun rays. Set the light meter computer to f/10 and then the shutter speed of the camera to that called for by the light meter.

The focal length of the Celestron 10 lens system can be increased to any desired value using the tele-extender system. The tele-extender tube is used in conjunction with one of the eyepieces to accomplish positive transfer magnification. As an illustration insert the 25mm ocular in the drawtube of the Celestron 8. Now screw the tele-extender tube onto the eyepiece drawtube. Next using the camera T-ring, connect the camera body to the tele-extender tube. This increases the effective focal length of the system to about 6,000 millimeters.

Keep in mind when using the Celestron 8 Telephoto lens that the photographs will be sharp only when you have very carefully focused on the ground glass of the camera and held the lens system very steady during exposure. No telephoto lens will cut through smog, haze, or heat waves.

Celestial photography with the Celestron 8 will be a most rewarding experience. With little experience you can take excellent color slides of the moon and planets. At the Cassegrain focus of the Celestron 8 and using high speed Ectachrome film the exposure time should be about 1/200 second. You may use the tele-extender tube and photograph individual areas of the moon. The shutter speed will be in the neighborhood of 1/10th second when using the 25mm ocular as the transfer lens.

In photographing the planets such as Jupiter and Saturn it is usually desirable to increase the image scale from the size that would be obtained using the straight cassegrain focus. Nice results can be obtained using the 12.5mm ocular with the tele-extender tube. Exposure times are in the neighborhood of 1/2 to 5 seconds. Keep in mind that even the professional photographers and astronomers take many photographs of celestial objects and show only the best. Therefore, be prepared to experiment with exposure times to achieve maximum contrast when photographing the planets.

If you wish to photograph galactic clusters and some nebulous objects you must acquaint yourself with guiding techniques and obtained specialized frequency controllers as well as the optional guiding eyepiece assembly offered. When you have graduated to this point you should contact your Celestron representative for further information.

Dewing

It is advisable not to use any large telescope during atmospheric conditions of heavy dewing. If water is collecting on the body of the telescope, heavy dewing conditions exist and the instrument should be covered. On the other hand, if only moderate dewing circumstances exist the front surface of the corrector lens only will be collecting dew. When this occurs the optical performance will be seriously degraded. The situation can be temporarily corrected by wiping away the dew with soft tissue paper (this should be done only if the front surface of the corrector is completely free of dust or dirt). A more sure remedy to light dewing of the corrector lens is to make available a portable electric hair dryer. Just a few seconds blast of warm air from the electric hair dryer will elevate the temperature of the correcting lens slightly and it will remain free of further dewing for up to a half hour.

Recommended Books and Publications

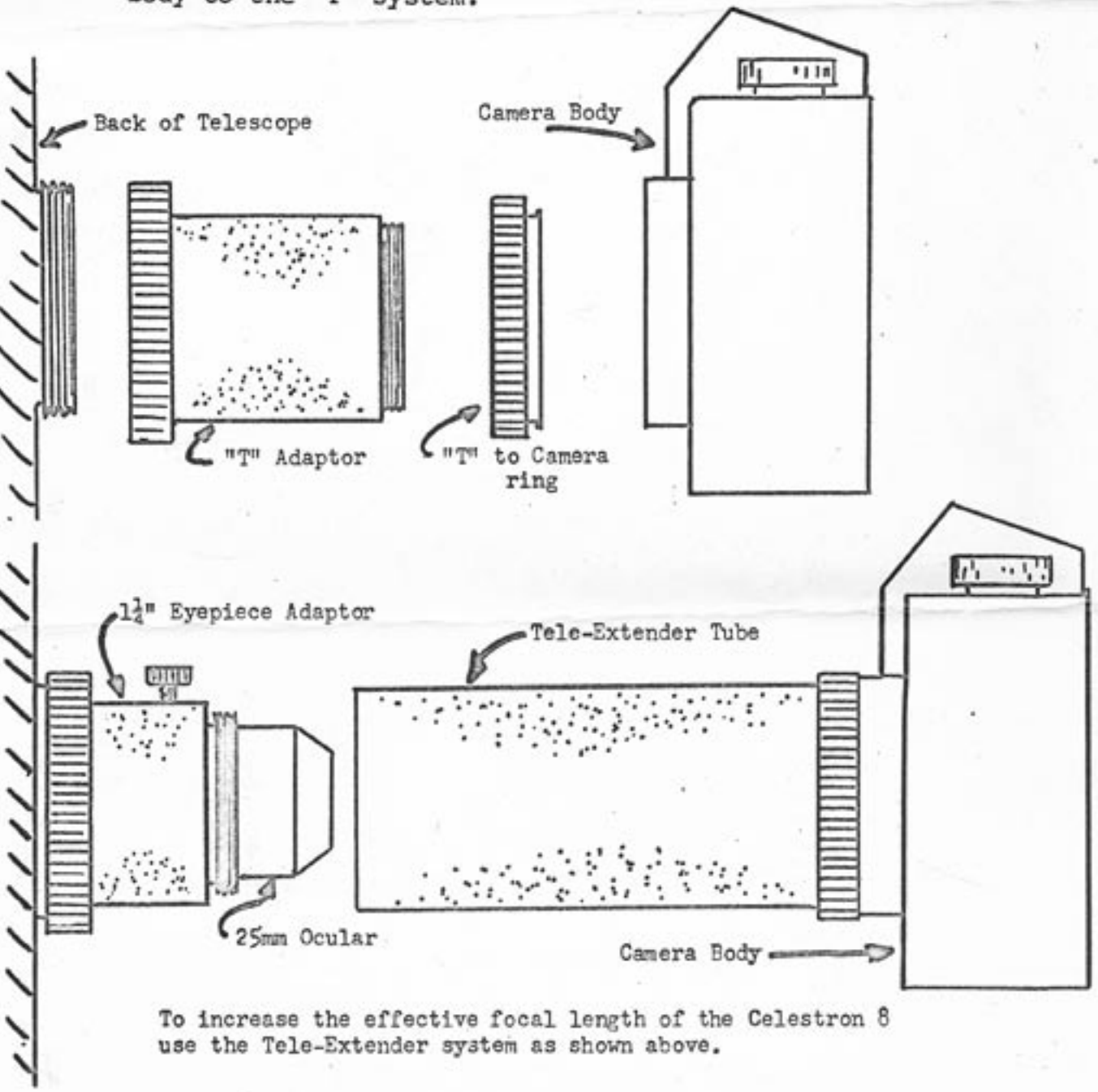
In order to obtain greatest utility from your Celestron 8 you should obtain a good star atlas and star catalog. You should browse through some of the elemental optical theory, and familiarize yourself with some of the other optical systems. The following are recommendations for your library:

1. "Sky and Telescope" magazine. Published monthly by Sky Publishing Corporation, 49-51 Bay State Road, Cambridge, Mass. 02138. Price $7 yearly.
2. "A New Popular Star Atlas." Sky Publishing Corporation. Price $2.50.
3. "Norton's Star Atlas and Reference Book" - Sky Publishing Corporation. $6.50.
4. "All About Telescopes." Edmund Scientific Company, 150 Edscorp Bldg., Barrington, New Jersey 08007. Catalog number 9094. Price $3.00.
5. "How To Use Your Telescope." Edmund Scientific Company, Cat no 90055. $6.60.

or color filters which further reduce the light by a factor of 10 you can comfortably view the solar disc. Again we caution you to make sure that the solar filter is firmly placed at the front end of the telescope. If it should be knocked off while someone is viewing the solar image through the eyepiece, eye damage can be sustained.

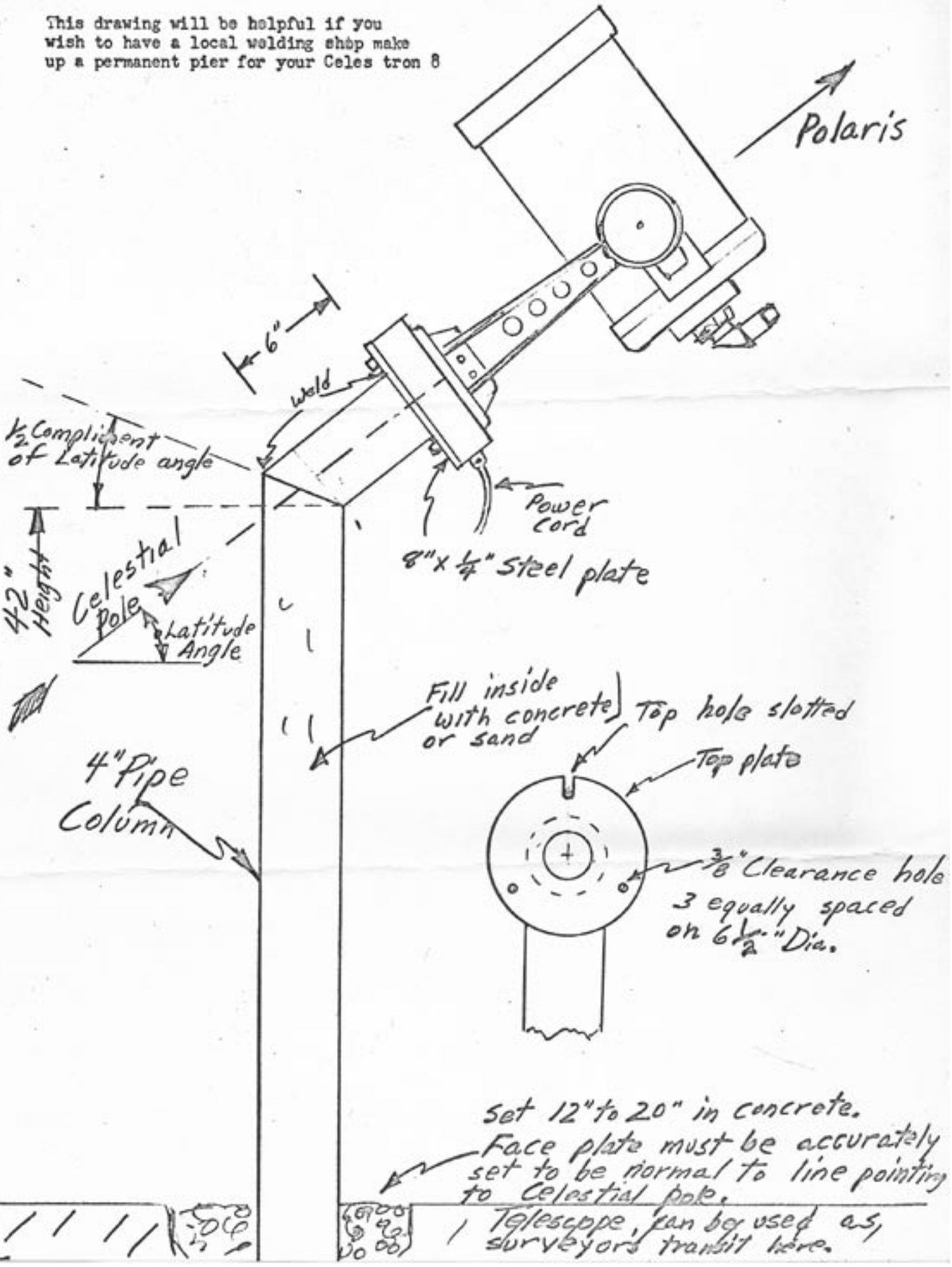
## Photography With The Celestron 8

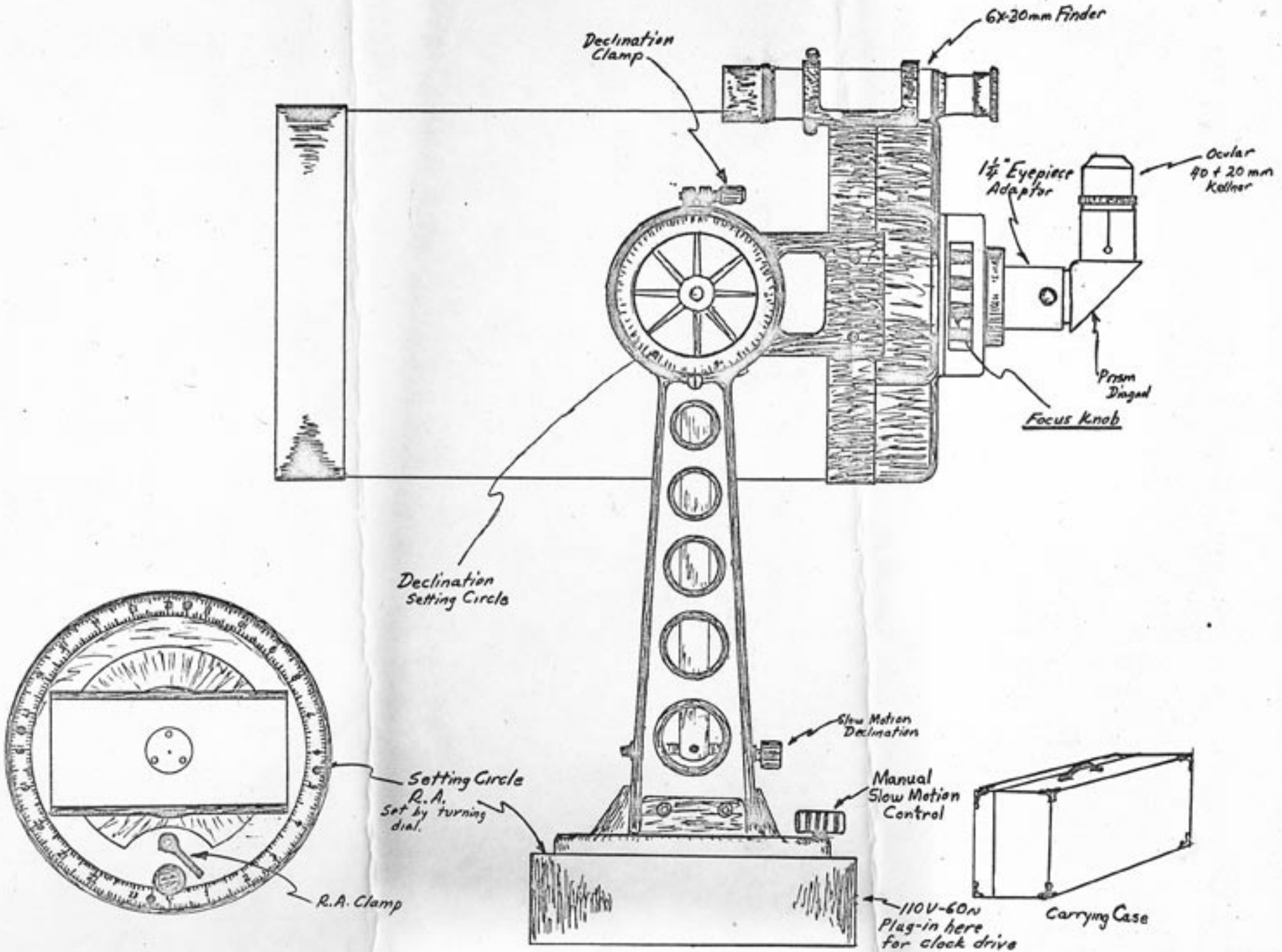
The Celestron 8 Telescope serves as an excellent extreme telephoto lens for both terrestrial and for astronomical photography. Most any 35 millimeter single lens reflex camera having fully removable lens and focal plane shutter can be adapted to the Celestron 8. Refer to the drawing below. The optional "T" mount adaptor converts the Celestron 8 to the standard "T" mount system. You can obtain a T-ring from your local camera store to convert your camera body to the "T" system.




To increase the effective focal length of the Celestron 8 use the Tele-Extender system as shown above.

This drawing will be helpful if you wish to have a local welding shop make up a permanent pier for your Celes tron 8




6x-30mm Finder
Declination Clamp
1¼" Eyepiece Adaptor
Ocular 40 + 20 mm Kellner
Prism Diagonal
Focus Knob
Declination Setting Circle
Slow Motion Declination
Manual Slow Motion Control
Setting Circle R.A. Set by turning dial.
R.A. Clamp
110V-60N Plug-in here for clock drive
Carrying Case