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INSTRUCTION MANUAL FOR BYERS 812TR AND BYERS 812 GERMAN EQUATORIAL

****Please read entire manual carefully before assembling or operating mounting.

ASSEMBLY

The BYERS 812TR is the main component of the BYERS 812 System and is essentially a motorized polar assembly. This unit provides a right ascension, sidereal drive for popular fork-mounted telescopes, such as the Celestron 8. The 812TR may be converted to the 812 German Equatorial by attaching the integrated declination assembly, which is available separately.

NOTE: Always remember to carry the 812TR from its rectangular base. It is not advisable to carry the mounting by holding onto the polar cone.

A. For operating the 812TR with a fork-mounted telescope, first attach the circular aluminum adaptor plate to the base of the fork, using the pre-tapped holes and screws provided. The entire fork-mounted telescope may be attached to the upper end of the polar cone by first lining up the 6 holes in the adaptor plate (pre-tapped in a circular pattern) with the 6 small holes pre-tapped in the flange of the polar cone. If the 812TR is equipped with a R.A. setting circle, it will also be necessary to line up the 6 holes in the circle with the 6 holes in the flange. Secure the telescope to the mounting by inserting and tightening the 6 Allen screws from the underside of the polar cone flange. Do not let go of the telescope until the screws have been tightened.

B. In order to convert the 812TR mounting to the 812 German Equatorial, line up the 4 holes in the flange of the declination cone assembly with the 4 large holes pre-tapped in the polar cone flange of the 812TR, and then insert and tighten the 4 Allen screws provided for this purpose. The declination shaft extension may be attached by screwing it into the bottom end of the declination casting. Rotation of the counterweight will accurately adjust its location along the threaded length of the declination shaft extension.

The power cord receptacle is located next to the lower end of the polar cone. A 3-prong grounded power cord is provided for connecting the RA drive motor to a frequency controller (drive corrector) or directly to an electrical outlet.

OPERATION

**Refer to attached diagrams.

F --- R.A. CLUTCH KNOB. This knob is attached to the top of the sector gear assembly. Turning this knob will release the R.A. clutch and allow the polar cone to move freely in right ascension through the sector gear assembly. With the clutch released, always remember to balance the telescope about the polar axis <u>before</u> (1) turning the drive on or (2) resetting the drive. (HINT: Best performance is obtained by adjusting the counterweight along the declination shaft so that the telescope tends to move <u>very slightly</u> in right ascension, e.g., in the tracking direction, when the clutch is released.) While tracking, the R.A. clutch knob should be in its original position so that the clutch is re-engaged. The telescope may be slewed manually in right ascension, regardless of whether the clutch knob is engaged or released.

A --- BRAKE CONTROL KNOB. When tightened, this knob applies pressure to a nylon pin which contacts the bearing surface at the top of the polar cone. By <u>lightly</u> tightening it, a slight braking action will occur and the cone will encounter friction when turning. NOTE: This knob should always be loose when tracking. It should only be

tightened when, (1) it is desired to re-set the R,A. setting circle without turning the polar cone, or (2) it is desired to re-set the sector gear drive without turning the polar cone. (For larger telescopes or heavier payloads, there may be sufficient friction such that application of this brake is unnecessary.) The R.A. circle is a true slip-ring and may be set manually at the beginning of each tracking period by pointing the telescope at a star of known right ascension and turning the R.A. circle by hand until that right ascension co-ordinate is indicated on the circle.

B --- PHOTOGRAPHIC TIMER. To set the R.A. tracking motor to automatically turn off at a pre-determined time, for instance, after a one hour exposure, loosen knob "B" by turning counter-clockwise. Slide the pointer to the "1" position, and then tighten knob "B". At the end of the desired tracking period, e.g., one hour, a red light located inside the unit will light. Approximately three minutes later the motor will automatically shut off. The photographic exposure should be terminated as soon as the red light turns on, and before the motor stops, to avoid damage to the exposure.

C --- DRIVE RESET KNOB. The maximum period of uninterrupted tracking is two hours, after which the drive must be reset. When the drive reset knob is oriented with the "flat edge up" (as shown in the attached diagram), the knob cannot be depressed, and the precision worm is fully engaged and spring-loaded into the sector gear. To reset the sidereal drive, turn this knob 180 degrees to the "flat edge down" position and press the knob down. Keeping the knob depressed, first move the gold sector gear assembly back to the beginning of its travel, and then release the knob so that the worm completely engages the sector gear. Now rotate the knob 180 degrees back to the original "flat edge up" position. If the knob does not turn easily back to the "flat edge up" position, the worm has not been fully re-engaged with the sector gear. If this problem should occur, with the "flat edge down" depress the knob again, move the sector gear slightly away from its stop, and then release the knob. The drive is properly reset when the knob can be released and rotated 180 degrees to the original "flat edge up" position. CAUTION!! TO AVOID POSSIBLE DAMAGE TO THE DRIVE: When the drive reset knob is oriented "flat edge down" but has not yet been depressed, DO NOT ATTEMPT to move the telescope, turn the polar cone, or reset the sector gear. Always remember to fully depress the drive reset knob so that the worm is completely dis-engaged from the sector gear. The telescope may be moved when, (1) the drive reset knob is oriented "flat edge down" and is also pressed down, or (2) the drive reset knob is oriented "flat edge up". The sector gear assembly may be moved only when the drive reset knob is oriented "flat edge down" and is also pressed down.

D --- TRACKING MOTOR SWITCH. When this switch is "up", the R.A. motor is running. When this switch is "down", the motor is off.

E --- RED LIGHT SWITCH. When this switch is "up", the red light inside the unit is always on. When the switch is "down", the light turns on only at the end of the tracking period, e.g., at the end of the sector gear travel.

To reset the drive without disturbing the orientation of the telescope: (1) Engage the brake, if necessary, (2) Release the R.A. clutch by turning the R.A. clutch knob, (3) Reset the drive as already described, (4) Re-engage the clutch by turning the R.A. clutch knob back to its original position, (5) Release the brake, if it was applied.

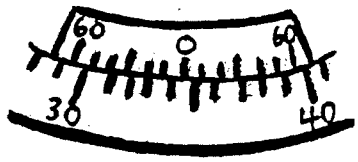
The R.A. setting circle is a true slip-ring and is designed to track with the polar cone. Before resetting the drive make note of the R.A. co-ordinate, as indicated on the circle. After resetting the drive, remember to reset the R.A. circle. During the tracking period, the right ascension of any celestial object centered in the field of view may be read directly from the setting circle.

Azimuth Adjustment. At each corner of the rectangular base of the polar assembly, there is a precision radial slot which allows the mounting to be adjusted up to 4 degrees in azimuth. Using these four radial slots, the mounting may be attached to an existing permanent pier, or to the portable three-legged base offered as an optional accessory.

Altitude Adjustment. A handwheel located beneath the lower end of the polar cone allows very fine and accurate adjustment of the inclination of the polar axis.

Latitude Vernier. An internal double pendulum operates as an extremely accurate inclinometer for the adjustment of the polar axis. Since the inclination of the polar axis must correspond with the geographic latitude of the observing site, it is possible to "dial in" the latitude, (e.g., polar axis inclination), by turning the handwheel and watching the pendulum vernier move across the latitude scale on the side of the mounting. The vernier pointer is pre-calibrated at the factory, and leveling of the equatorial head is not necessary. The normal range of latitude adjustment provided is 25 degrees to 50 degrees. DO NOT ATTEMPT TO GO BEYOND THESE LIMITS when adjusting the inclination of the polar axis. (For those observing sites in higher or lower geographic latitudes, the factory has made the necessary provisions during the assembly of the mounting.)

How to Read the Latitude Vernier



The latitude vernier reads directly to 10 minutes of arc, e.g. 1/6 of a degree. However, with practice the vernier may be read to 2-3 minutes of arc by interpolating visually. For each 10 divisions on the larger latitude scale, there are 12 divisions on the smaller vernier scale. The number of degrees latitude is indicated by reading the first division on the latitude scale which lies to the left of the "0" mark. The number of minutes is indicated by reading the division on the vernier scale to the right of "0" mark which lines up with (or comes closest to lining up with) a division on the latitude scale.

EXAMPLE: In the above diagram, the first degree division to the left of the "0" is "34", and the vernier division which lines up most accurately with a division on the latitude scale is the 4th division to the right of the "0", e.g., 40 minutes. Hence, the vernier reads "34 degrees, 40 minutes".

Polar Sighting Feature. Since Polaris is slightly offset from the true celestial pole, this star will circumscribe a circle just under 2 degrees in diameter about the north celestial pole as the earth rotates. A polar peep-sight which displays 2 degrees of sky is provided. On the 812 German Equatorial the peep-sight is utilized by removing the knurled screw on the declination cone assembly and pointing the telescope/tracking platform toward the north celestial pole. This will line up the two holes in the declination cone and internal declination shaft with the sighting hole in the bottom of the polar cone. (For the 812TR, a drop-in disc for the upper end of the polar cone will soon be provided in order to offer a similar sighting feature.)

Polar Alignment. The following simple technique will provide reasonably accurate polar alignment, sufficient for wide-angle, e.g., short focal length, astrophotography, and will also permit location of celestial objects, using setting circles:

(1) "Dial in" the geographic latitude of the observing site by turning the altitude adjustment handwheel and watching the latitude vernier move across the latitude scale.

(2) Shift the mounting in azimuth toward the "handle" of the Big Dipper, e.g., away from Cassiopeia, until Polaris reaches the edge of the field displayed in the polar peep-sight.

For extremely accurate polar alignment, sufficient for long-exposure, long focal length, deep-sky photography, the following technique, popular for many years and refined by astrophotographers Robert Provin and Brad Wallis, is recommended:

(1) First use the simple polar alignment procedure described above.

(2) With an illuminated reticle eyepiece, point the telescope at a bright star near the intersection of the meridian and the celestial equator and determine the direction of the declination drift. (Ignore any drift in right ascension.)

(a) If the star drifts to the south, the polar axis points east of the pole.

(b) If the star drifts to the north, the polar axis points west of the pole.

Adjust the mounting as necessary until no drift to the north or south can be detected.

(3) Repoint the telescope at a bright star near the eastern horizon and near the celestial equator.

(a) If the star drifts to the south, the polar axis points below the pole.

(b) If the star drifts to the north, the polar axis points above the pole.

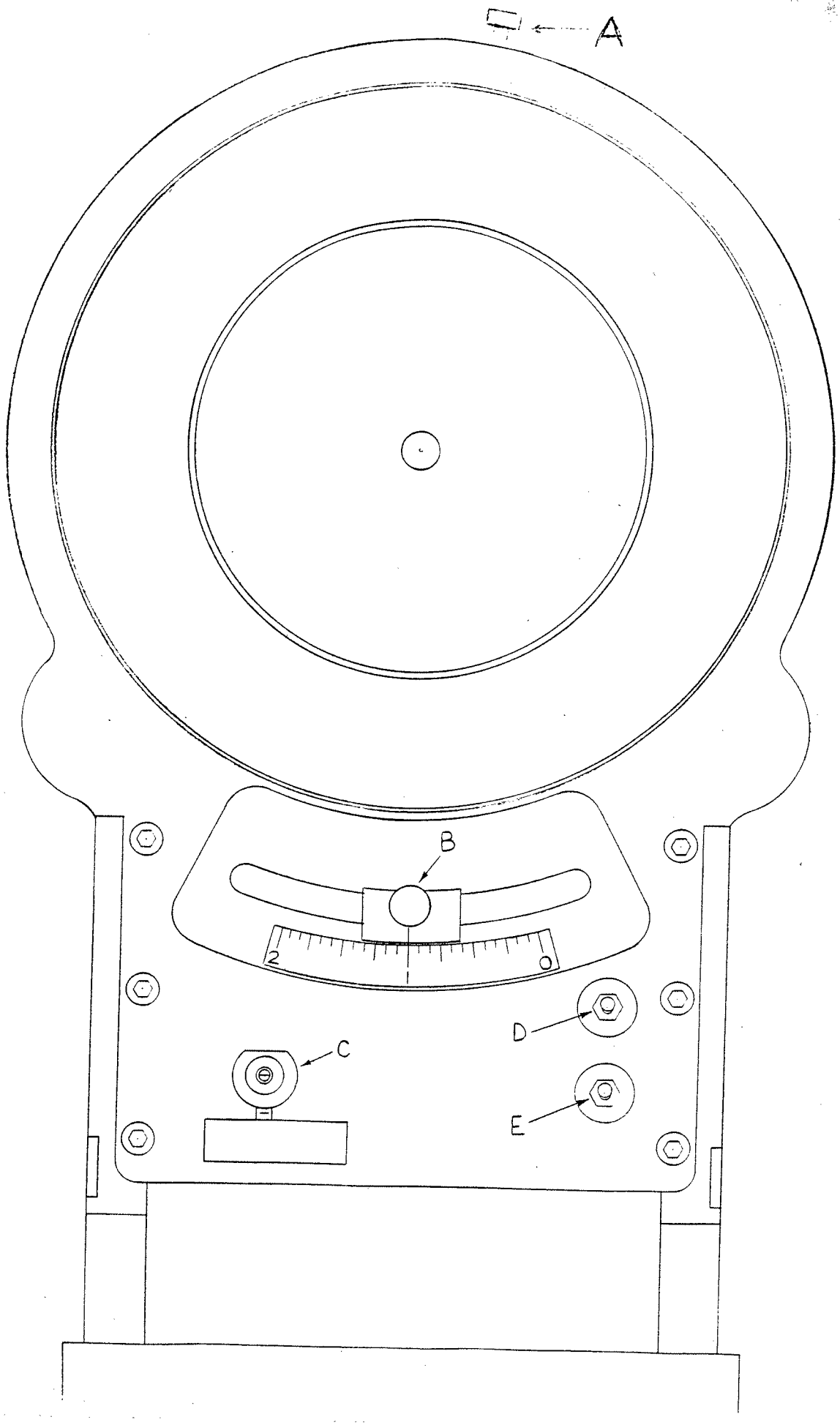
Again adjust the mounting as necessary to eliminate the declination drift. When the drift is no longer noticeable after an extended period of time, precise polar alignment has been attained. (NOTE: For observing sites in the Southern Hemisphere, this technique can also be used, but the direction of declination drift will be reversed.)

Calibrating the Declination Circle (on 812 German Equatorial). Once this calibration has been done accurately, adjustment of the declination circle is permanent and need not be made again. Employing the technique just described, obtain precise polar alignment. Then point the telescope at a star of known declination near the celestial equator. With a high power eyepiece, center the star in the field of view. Using a small Allen wrench, loosen the set screw on the underside of the declination circle, and reset the circle so that the declination indicated corresponds to the declination co-ordinate of the star centered in the field of view. Now tighten the set screw with the Allen wrench, being careful not to move the telescope or setting circle.

Declination Motor (on 812 German Equatorial). This special AC motor utilizes dynamic braking to eliminate coasting or overshoot, and should be used with a dual-axis frequency controller designed for operation with an AC declination motor.

Declination Tangent Arm Control Knob (on 812 German Equatorial). This knob is located at the underside of the tracking platform and may be rotated by hand in order to make fine manual adjustments in declination. If the mounting is equipped with the optional declination motor, the tangent arm control knob may also be used as a manual override, if desired.

Adjustments of R.A. and Declination Clutches. The R.A. and declination clutches utilize split-ring designs with tension-adjustment screws, which have been pre-set at the factory. The R.A. clutch adjustment screw is located adjacent to the R.A. clutch knob at the top of the sector gear assembly. The declination clutch adjustment screw is located on the split-ring at the top of the declination cone assembly. These screws should be set just tight enough to keep the telescope pointed at a star. CAUTION!! DO NOT OVER-TIGHTEN the clutch adjustment screws.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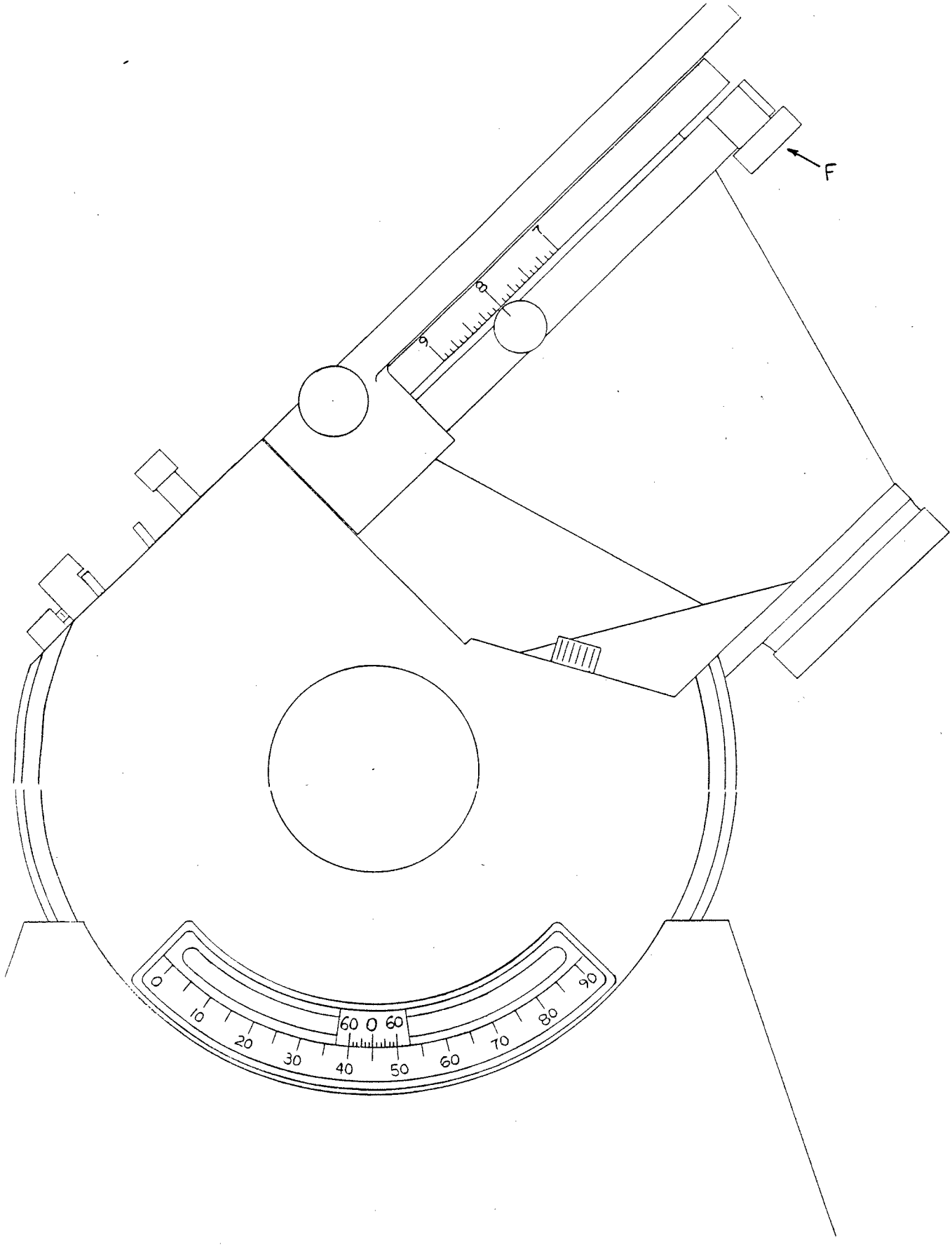
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A screw has been installed in the pendulum arm to prevent the inclinometer from swinging during shipment. Remove this screw after the mounting has been set-up and is ready for use. It is recommended that the screw be re-installed in the pendulum and taped to mounting when this instrument is to be moved.

This allen-head screw has a nylon button under it which contacts the outer edge of the polar cone. If necessary to prevent the cone from turning when re-setting the R.A. circle, "LIGHTLY TIGHTEN" the screw (only finger tight). This will provide sufficient "braking action" to permit the circle to be set without moving the cone. Many times it is not necessary to use this brake.

CAUTION: SCREW SHOULD ALWAYS BE LOOSE WHEN TELESCOPE IS TRACKING.

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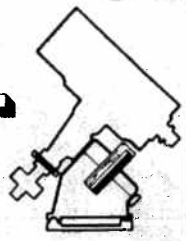
Specialists in Astronomical Instruments



INVOICE

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YOUR P. O. NUMBER	
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Robert W. Wessale
PO Box 201
Cave Creek, AZ

(602) 488-3352

QTY.	UNIT	DESCRIPTION	UNIT PRICE	AMOUNT
		2TR Polar Assembly		
		SHIPPED UPS 12/14/81 without base adaptor. Adaptor will be shipped separately after we receive an accurate tracing of hole pattern in base of your telescope.		
			SUB TOTAL	
			TAX	
			TOTAL	