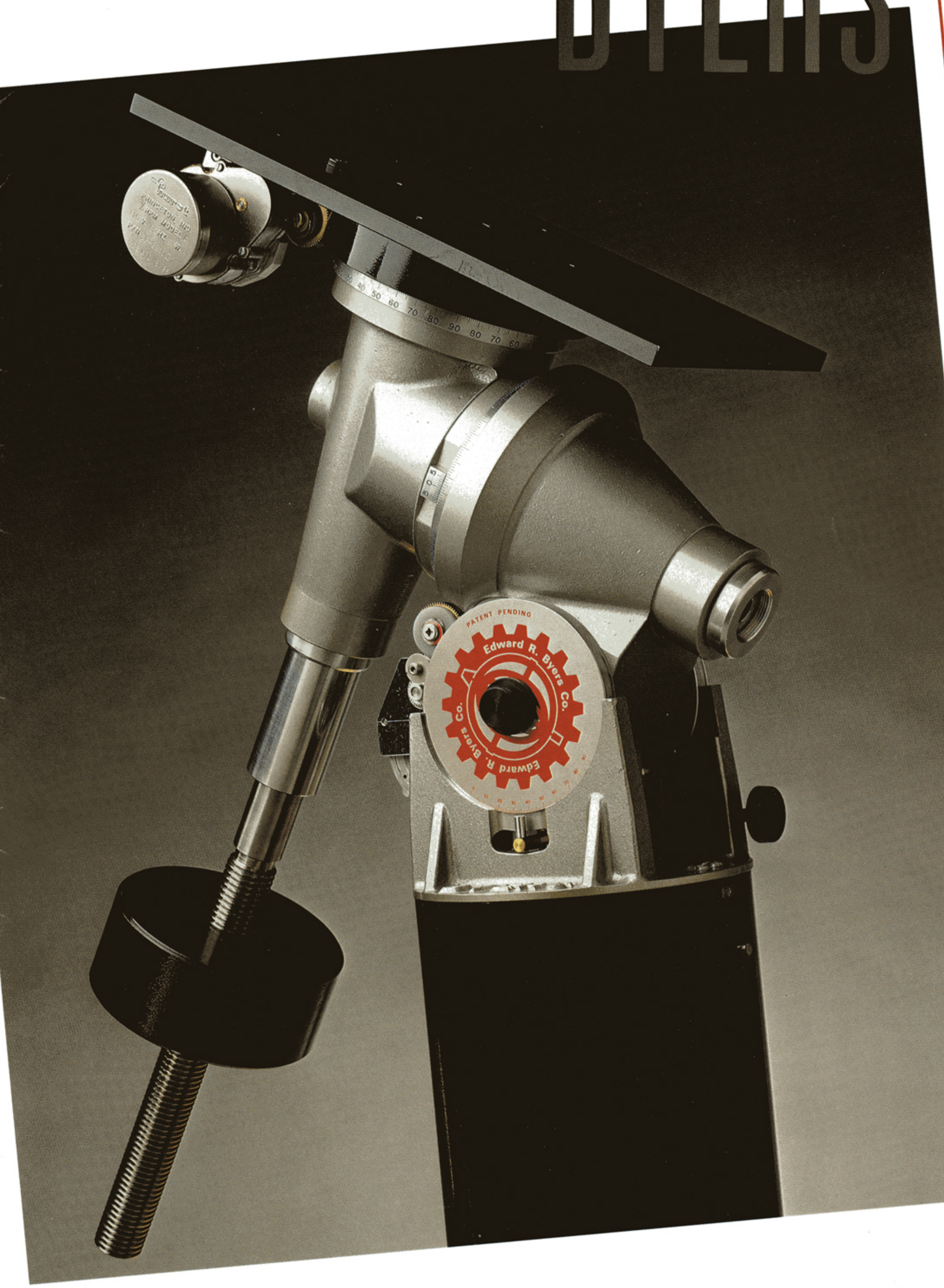
EDWARD R. BYERS CO.

BYERS

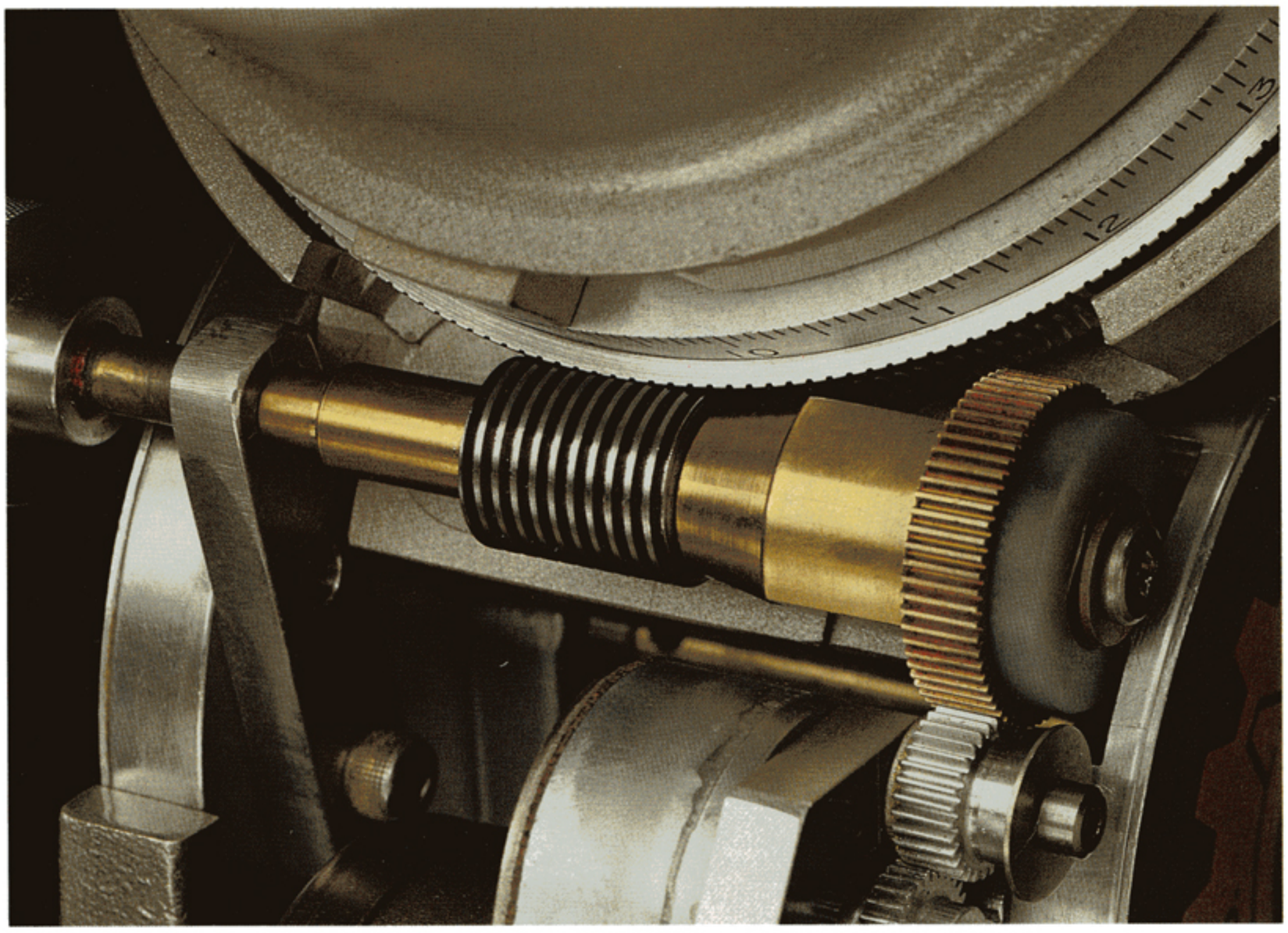


THE
BYERS
58
GERMAN
EQUATORIAL
MOUNTING

BYERS 58 SIDEREAL RATE WORM GEAR DRIVE SYSTEM (Patent Pending):
A research quality BYERS driving system has been specifically developed for the BYERS 58. Proprietary techniques and a revolutionary design breakthrough make the BYERS 58 worm gear drive the most accurate tracking system for its size ever offered by the Edward R. Byers Co. The unique configuration of the new sidereal drive delivers tracking accuracy equivalent to that of a standard BYERS 9.3 inch drive. The BYERS drive eliminates most guiding, and makes astrophotography an effortless pleasure.

PRECISION AZIMUTH ADJUSTMENT:
The portable pier base incorporates an azimuth fine control to facilitate polar alignment of the equatorial head.

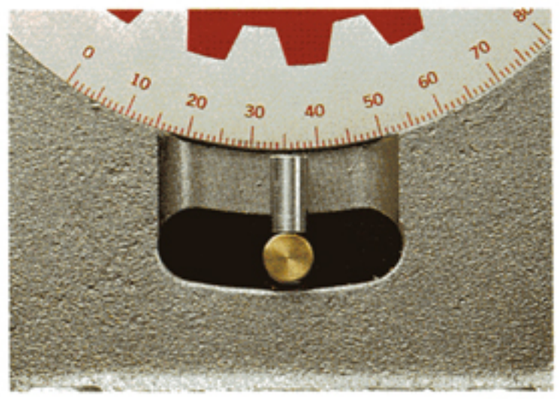
PRECISION ALTITUDE SETTING:
Twin control knobs allow exact adjustment of the inclination of the polar axis.



WORM GEAR DRIVE SYSTEM

POLAR AXIS INCLINOMETER:
A pendulum operates as an inclinometer for adjustment of the polar axis. Since the inclination of the polar axis must correspond to the geographic latitude of the observing site, it is possible to 'dial in' the latitude (e.g. polar axis inclination) by turning the control knob and watching the motion of the latitude scale on the side of the mounting. The pendulum pointer is quickly calibrated and no leveling of the equatorial head is necessary. In preparation for long-exposure, deep sky photography, this feature substantially reduces the time required for polar alignment.

ENGRAVED ALUMINUM SETTING CIRCLES WITH VERNIER POINTERS:
These setting circles are the finest and most accurate available. Declination and right ascension circles are indexed and engraved on the BYERS master dividing engine. Unlike setting circles provided on other German equatorial mountings, the R.A. circle on the BYERS 58 is driven in tandem with the pointer and is a true Porter slip-ring, always displaying the R.A. coordinate of any object centered in the field of view. It is unnecessary to reset the circle or pointer when moving from one celestial object to the next. Typical German equatorial mountings lack this important feature.



POLAR AXIS INCLINOMETER

STAINLESS STEEL DECLINATION COUNTERWEIGHT SHAFT:
The stainless steel counterweight shaft is threaded along its length to permit correct balancing of payloads during tracking. To ensure portability, it is removable from the declination housing.

INSTRUMENT CLASS, 3 INCH DIAMETER BALL BEARINGS:
The BYERS 58 design provides massive 3 inch diameter ball bearings on both axes.

MANUAL SLOW MOTION RIGHT ASCENSION AND DECLINATION CONTROLS:
Manual slow motion R.A. and declination controls operate independently to override the tracking motor and optional declination motor.

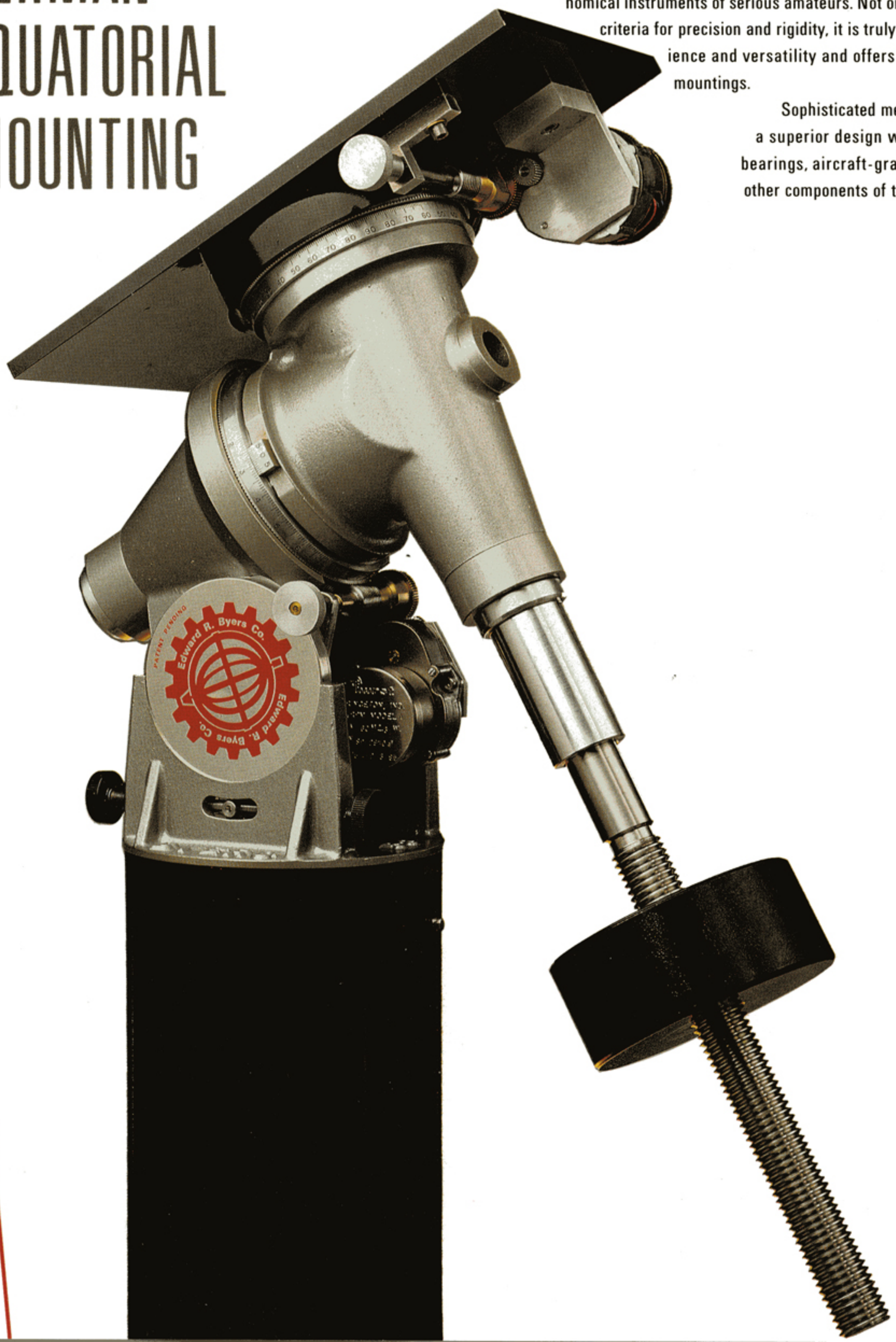
POLAR ALIGNMENT TELESCOPE (optional):
A polar alignment telescope with offset illuminated reticle fits inside the polar axis.

PORTABLE PIER BASE (optional):
An extremely rigid and well designed portable pier base, which attaches to the azimuth plate of the equatorial head, is available in varying heights to accommodate Newtonians, Cassegrains, astrographs, and refractors. Each pier leg wraps around the vertical post and extends upward to maximize stability.

MOTORIZED DECLINATION DRIVE (optional):
The standard manual worm gear declination drive may also be motorized. This option includes a heavy duty motor with precision clock reduction gears for driving the declination worm. This motor utilizes dynamic braking and will not coast or overshoot.

BYERS ELECTRONIC TRACKING CONTROL (optional):
A dual-axis ultra-stable electronic frequency control with integrated DC power supply is available for critical photographic applications and battery operation at remote observing sites. A highly sensitive calibrated adjustment enables effective compensation for atmospheric refraction. A pushbutton hand paddle is provided with the unit.

THE BYERS 58 GERMAN EQUATORIAL MOUNTING



Edward R. Byers, a master craftsman with an international reputation, combines a specialized background in mechanical engineering, machine design, and metallurgy with over thirty years experience in the design and manufacture of precision astronomical driving systems.

For the scientific community, the Edward R. Byers Co. has continued to provide research level components to such institutions as NASA, Kitt Peak, Jet Propulsion Laboratory, M.I.T. Lincoln Laboratories, and the U.S. National Bureau of Standards. Among professionals and amateurs alike, BYERS drives have achieved legendary status for their phenomenal tracking accuracy.

The BYERS 58 has been developed in response to the demand for a compact, portable equatorial mounting which is both professional in quality and compatible with the astronomical instruments of serious amateurs. Not only does the BYERS 58 meet all necessary criteria for precision and rigidity, it is truly human-engineered for maximum convenience and versatility and offers features unavailable on other telescope mountings.

Sophisticated mechanical stress analyses have resulted in a superior design which incorporates instrument class ball bearings, aircraft-grade heat-treated aluminum castings, and other components of the highest standard.

Selection of a telescope mounting deserves careful consideration. Maximum enjoyment of fine optics can be realized with the unprecedented BYERS 58. A superbly engineered German equatorial mounting, the BYERS 58 is easily portable, and delivers the stability and tracking accuracy required for serious observing and successful astrophotography.

EDWARD R. BYERS CO.

EDWARD R. BYERS CO.
29001 W. Hwy. 58
BARSTOW, CA 92311

[redacted] CALIF 902[redacted]

[redacted]

ART DIRECTION + DESIGN: JEFF LANCASTER FOR L-SHAPE, LTD.
PHOTOGRAPHY: WYNN MILLER

"The BYERS 58 is a terrific precision mounting and should be very popular with the serious-minded astrophotographer. The differences in workmanship between the BYERS 58 and other mountings are quite obvious."

Robert E. Cox
noted columnist, Sky & Telescope
editor, Telescope Making

BYERS 58 Technical Data

Approximate weights of components:

Equatorial head without counterweight shaft: 25 lbs.
Counterweight shaft: 5 lbs.
Portable pier post: 18 lbs. (for 2' height).
Pier legs: 2.3 lbs. each.
Counterweights: 9.5 lb. provided standard.
16 lb. optional.
Total weight of BYERS 58 with portable pier: 55 lbs. (not including counterweights).

Dimensions:

Distance from pier cap to intersection of polar and declination axes: approximately 9" (will vary with geographical latitude).
Diameter of steel pier and base of equatorial head: 6".
Pier height: 2' (recommended for 8"-10" Newtonians).
Optional pier heights: 2½', 3', 3½', and 4'
(3' recommended for Celestron 8 and Celestron 11).
Pier leg: 15" length, 11" height.
Tracking platform: 11.85" length, 5.85" width.
Diameter of polar axis through north bearing: 3".
Diameter of declination axis through upper bearing: 3.25".

R.A. and declination drive motors: Heavy-duty, AC synchronous, 3 watts, 150 in.oz. torque.

Maximum recommended payload for tracking platform: 50 lbs. (Newtonians up to 10" aperture and Cassegrains up to 11").

Approximate shipping weight: 75-95 lbs. depending on counterweights provided.

Guideline for selecting counterweights: Payload may be balanced about polar axis with counterweights equal to 70% to 100% of payload, depending upon location of weights on the counterweight shaft.

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WHAT YOU SHOULD KNOW ABOUT TRACKING ACCURACY

It is common for manufacturers to make spurious or misleading claims when quoting tracking accuracy. 'Custom' driving systems 'accurate to less than 10 seconds' per day typically are plagued with periodic errors of 50-150 arc seconds per worm revolution. These periodic errors are caused by worm inaccuracies and will be repeated many times over a single long-exposure photograph.

Erratic errors are even more troublesome to astrophotographers since they can occur at any moment and ruin a long exposure. Such erratic errors are caused by gear tooth irregularities or 'indexing errors.'

Electronic frequency controllers or drive correctors merely ensure an overall average sidereal rate of tracking by maintaining a motor speed which compensates for the incorrect solar rate gearing of mass-produced telescope drives. If this sounds confusing, consider that a worm-gear drive system consists of two components: a worm-gear set and a tracking motor. Sophisticated electronic frequency controllers operate to stabilize only the speed of the tracking motor. Once the motor speed has been accurately stabilized, periodic errors caused by an inaccurate worm and gear set are still free to occur.

It is seldom pointed out to amateurs that electronics 'accurate to ±.005% of the sidereal rate' do nothing whatsoever to reduce periodic and erratic errors which sabotage astronomical photographs. Furthermore, it is extremely difficult, if not impossible, to make electronic guiding corrections for the excessive periodic and erratic errors which afflict commercially manufactured worm-gear drives. A micro-processor controlled tracking motor does not ensure tracking accuracy.

The tracking accuracy of any worm-gear drive is a function of several factors:

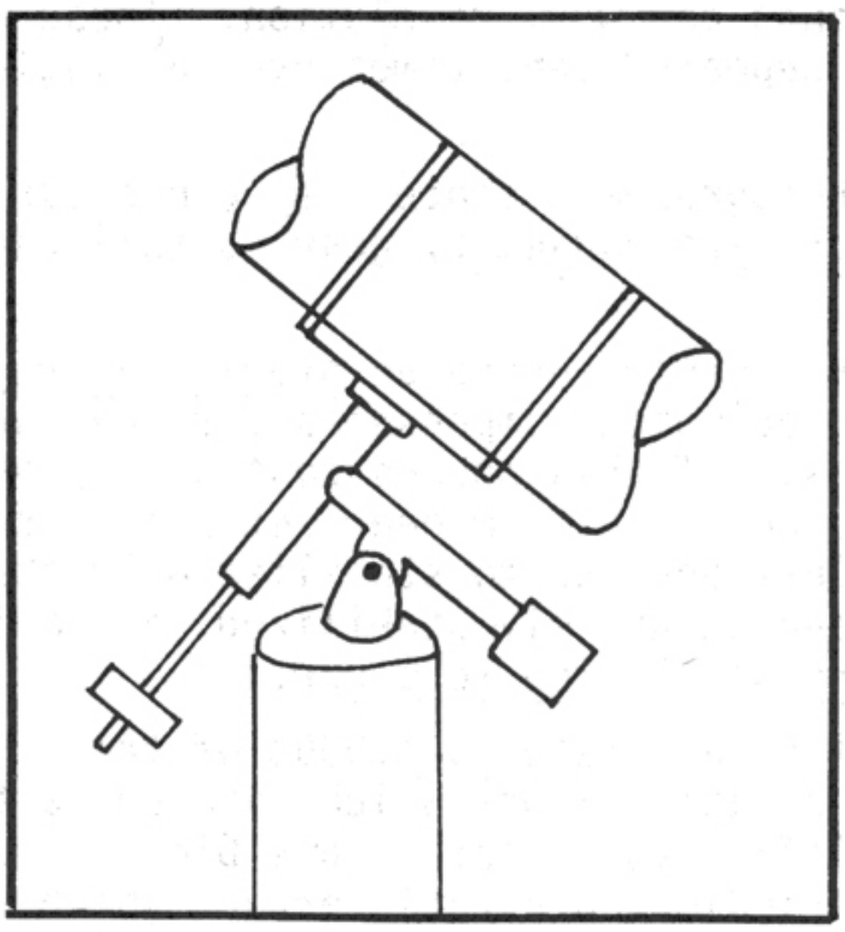
1. Tooth to tooth indexing in the driving polar gear: Indexing errors produce erratic and unpredictable variations in the tracking rate of a telescope. These errors are caused by departures of the gear teeth from their theoretical locations on a perfect gear. Indexing accuracy is directly related to both the accuracy of the gear hob, or cutting tool, and the accuracy of the gear machine which drives the hob. The BYERS gear machine, designed and built by Edward R. Byers, is the most accurate machine of its kind in existence. This machine is fitted with custom Class AA gear hobs manufactured to our own specifications, and produces gears with virtually zero indexing errors.
2. True helical path in the worm threads: Deviations of the worm threads from a true helical path are the major sources of periodic error. Worms for the BYERS 58 are precision ground and tested on the BYERS Helical Path Analyzer, the only instrument of its type in the world. This instrument is capable of detecting helical path deviations as small as 10 millionths of an inch, and enables us to guarantee the very highest standard of worm accuracy. The helical path accuracy of BYERS drives is 8-10 times greater than that of mass-produced drives.
3. Diameter of the polar gear: Helical path deviations can be compensated by increasing gear size, since tracking accuracy is a linear function of gear diameter. In general, mass-produced drives require gears literally 8-10 times the diameter of a BYERS gear in order to deliver an equivalent level of tracking accuracy. It is for this reason that we advise amateurs to maintain a healthy degree of skepticism when assessing tracking accuracy advertising claims.

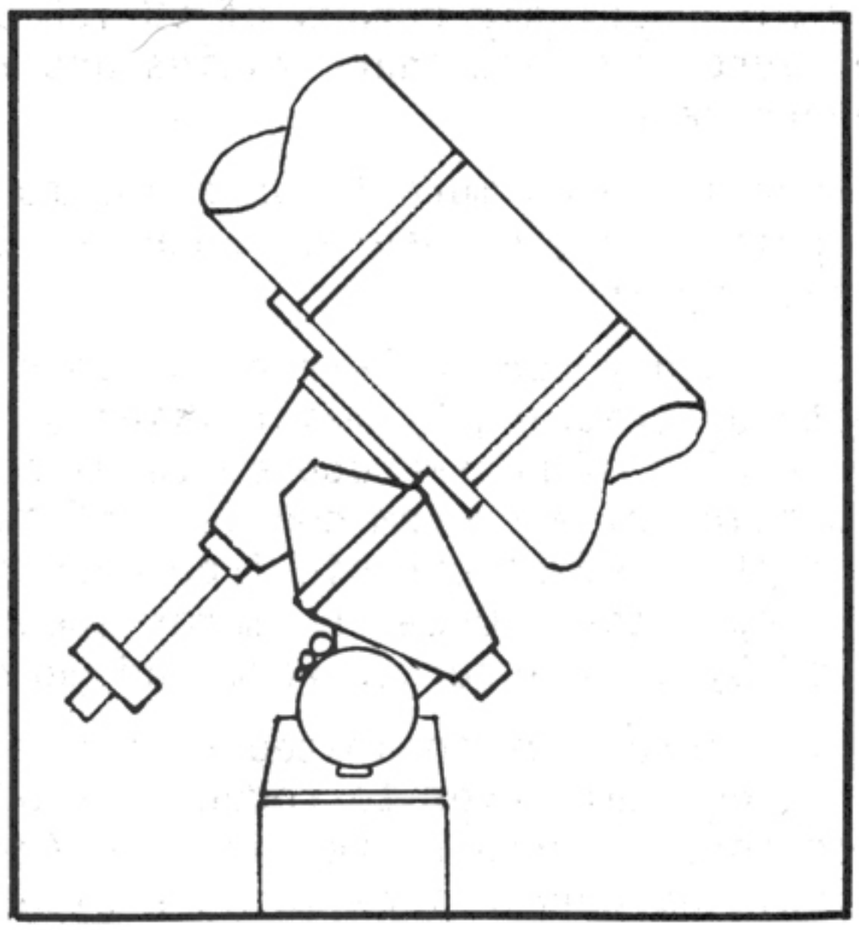
Independent of the driving system, tracking accuracy is affected by mechanical flaws in the equatorial mounting:

1. Departures from concentricity at the polar shaft-bearing interfaces: Inaccuracies in machining may prevent a true geometric rotation of the polar axis.
2. Mechanical flexure in the equatorial mounting: A mounting with poorly designed castings or undersized polar and declination shafts and bearings cannot rigidly support a telescope.

The magnifying power of a telescope will make the smallest driving errors and mounting defects glaringly apparent. For serious work in astronomy, the chain of accuracy cannot afford any weak links. A mounting equipped with a perfect worm-gear-drive system would not track accurately if it were affected by even one of these mechanical flaws.

THE ADVANTAGES OF A BYERS MOUNTING





MECHANICAL DESIGN

BYERS mountings are superbly engineered and efficiently designed to maximize stability and rigidity.

The drawing on the left illustrates the common German equatorial mounting available to amateurs. Although the design is simple and inexpensive to manufacture, it represents a flagrant violation of sound principles of mechanical engineering, ignoring virtually all of Russell Porter's recommendations for mounting construction.**

The intersection of the declination axis with the optical tube is the 'Achilles Heel' of most German equatorial mountings. Note the small cross-sectional area at this point in contrast to that of the BYERS mounting on the right. Compare the small shafts and bearings with the oversize shafts, bearings, and huge thrust bearing surfaces of the BYERS design.

TRACKING ACCURACY

BYERS drives have achieved legendary status for phenomenal tracking accuracy. Worm-gear components such as those supplied to the telescope industry by commercial gear manufacturers, while adequate for power transfer applications, are rarely satisfactory for serious research and long-exposure astrophotography.

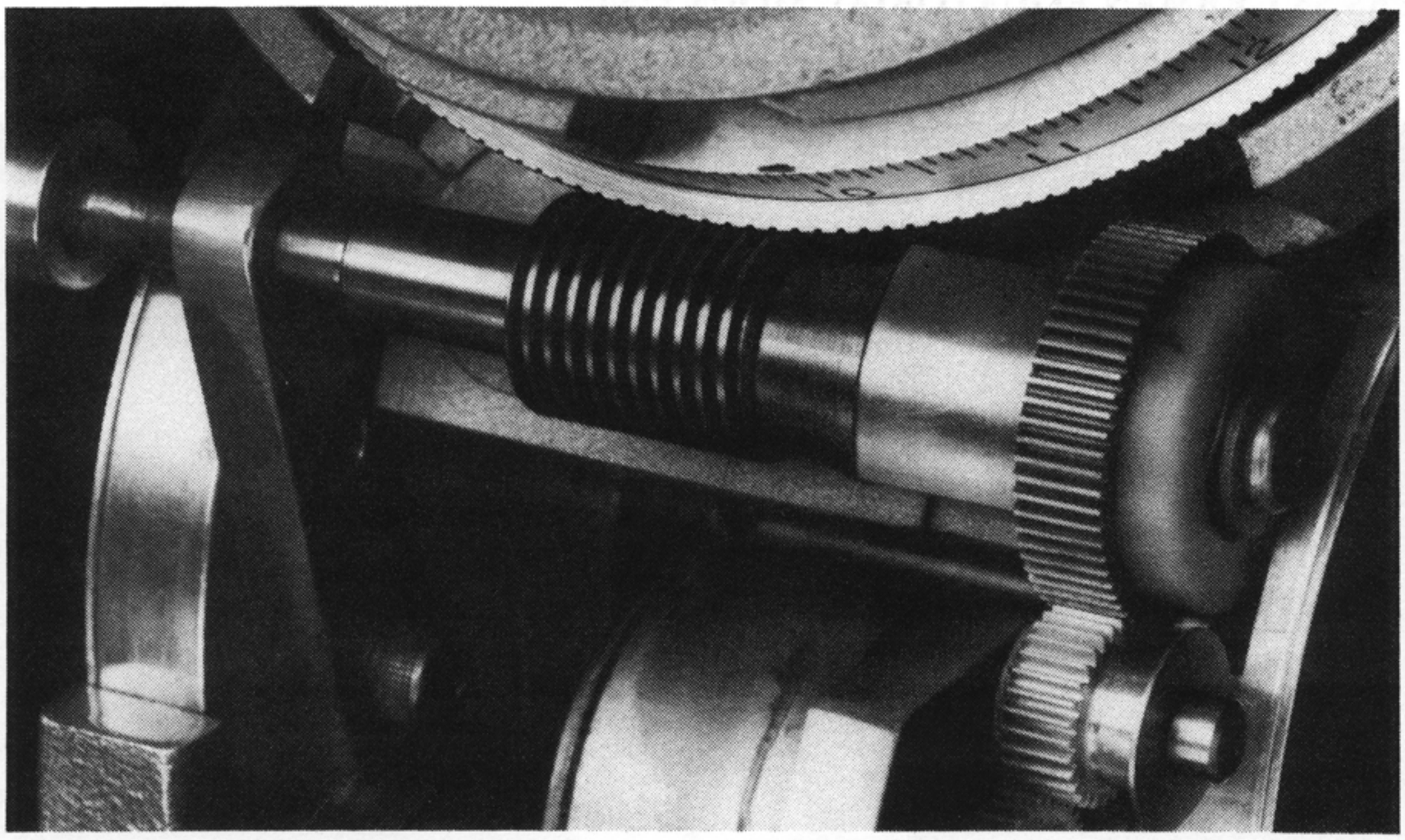
Highly accurate worm-gear drives for astronomical use cannot be mass produced in the ordinary sense. To meet the demanding requirements of astronomy professionals, all BYERS drives are manufactured to the very highest standards at our own facility, utilizing proprietary techniques and specialized machinery developed by Edward R. Byers.

**Porter, Russell W., "Fundamentals in the Design of Telescope Mountings," in Amateur Telescope Making. Albert G. Ingalls, ed. (NY: Scientific American Press, 1974.) Book 1, page 131. (Originally published 1935.)

THE BYERS 58 GERMAN EQUATORIAL MOUNTING



EDWARD R. BYERS CO.
29001 W. Hwy. 58
BARSTOW, CA 92311



EDWARD R. BYERS CO.

Renowned for Research-Quality Instruments of Unparalleled Tracking Accuracy

INTRODUCES

A State of the Art Industry Standard

THE BYERS 58 GERMAN EQUATORIAL MOUNTING

Features:

*Superb design and engineering for mechanical excellence.

*Dual-axis, full-diameter worm-gear BYERS drives with precision-ground stainless-steel worms.

*Engraved setting circles with vernier pointers.

*True Porter R.A. slip ring does not have to be reset when moving from one celestial object to the next (unlike setting circles provided on other German Equatorial mountings).

*Huge 3-inch-diameter ball bearings on both axes — massive and rigid yet lightweight and portable.

*Slow-motion R.A. and Declination controls.

*Micrometer altitude and azimuth adjustments with quick polar alignment features for astrophotography.

*Ultra-stable portable pier for Newtonians, Cassegrains, astrographs, and refractors.

*True sidereal-rate tracking, even *without* a drive corrector. ("Custom" driving systems assembled from commercial grade worm-gear components require drive correctors to compensate for incorrect solar-rate tracking and excessive periodic error.)

*Unguided photography with photovisual astro-cameras and telescopes.

*Popularly priced.

A BYERS MOUNTING IS THE FINEST AND MOST ACCURATE MOUNTING YOU CAN BUY.

Byers drives are unconditionally guaranteed to surpass the tracking accuracy of all other driving systems offered by manufacturers of popular telescopes.

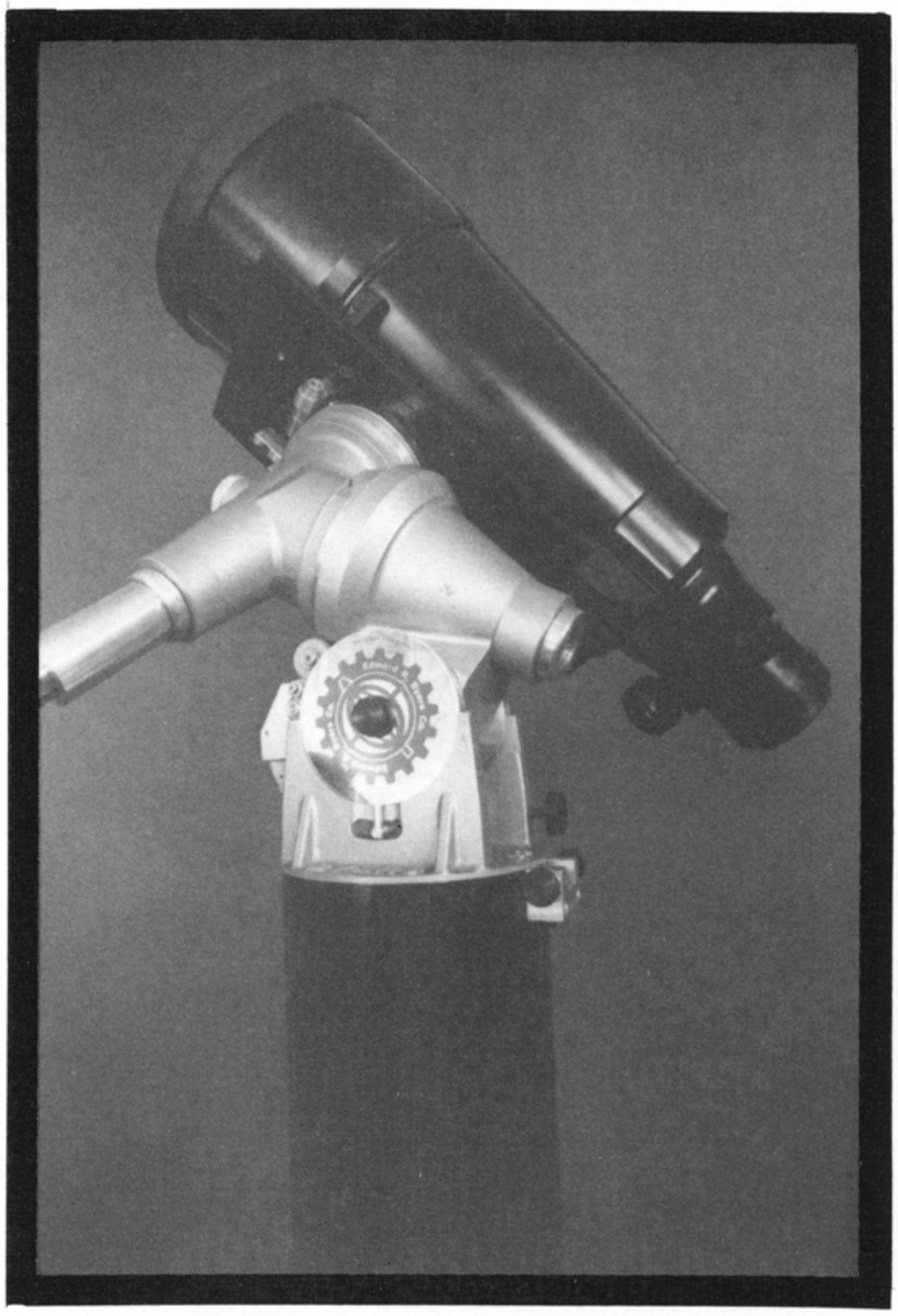
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The more you know about astronomy, the more you will appreciate a BYERS mounting.

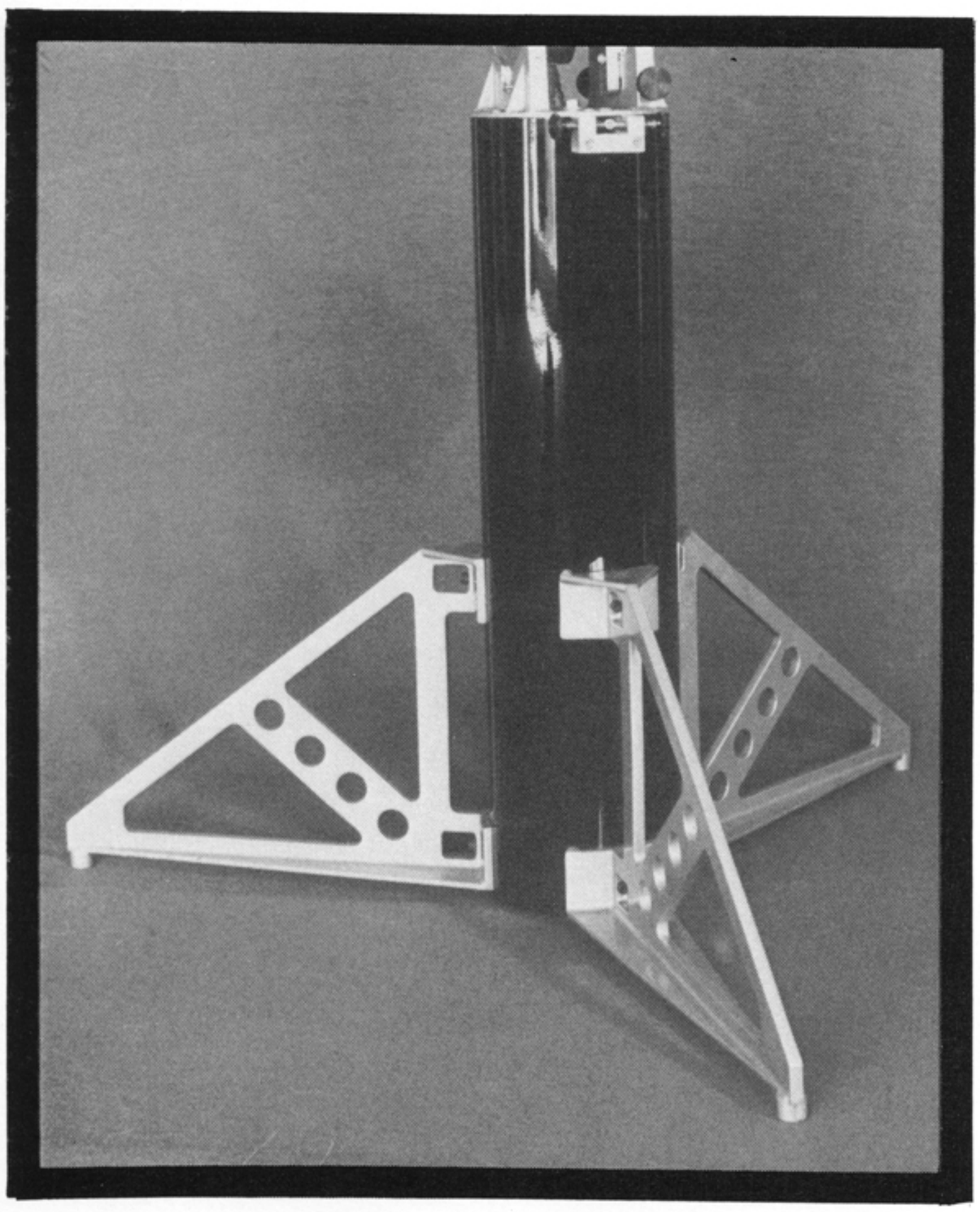
BYERS 58

German Equatorial Mounting



BYERS 58
Portable Pier Base
with
Azimuth Fine Control

Pier: 6" Diameter Steel Tube
Legs: 356 T6 Aluminum



BYERS 58
demonstrated with
8" aperture
astrographic testing instrument

Optical Tube Assembly
Length: 32"
Weight: 41 lbs.

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