

Nikon

ASTRONOMICAL INSTRUMENTS



Nippon Kogaku K.K. was established in Tokyo in 1917 as a comprehensive manufacturer of a full line of optical machinery. The superior technical know-how which has been nurtured and accumulated by the company during the nearly 50 years since then is crystallized today in the "Nikon" brand of products.

It is extremely gratifying to us that such a large segment of the world public is familiar with the "Nikon" brand name in connection with the company's regular line of cameras, binoculars, microscopes, measuring instruments, surveying instruments, etc. However, it may be less well known overseas that, ever since the foundation of our company, we have also been consistently exerting massive efforts in the production of instruments for astronomical observation, and that we have already accumulated quite an extensive record in the production of many types of such instruments. Since these products are always intended for specialized uses, they have been designed and produced under contracts on a case-by-case basis with special clients such as astronomical observatories, weather bureaus, schools, research laboratories, etc.

In this brochure you will find a representative selection of the instruments for astronomical observation which our company has produced in the past. We shall be deeply pleased if the efforts which we have made in the past and which we shall continue to make in the future may contribute in a small way to furthering man's knowledge about the universe in which he lives, and we promise to redouble our efforts to this end in the future.

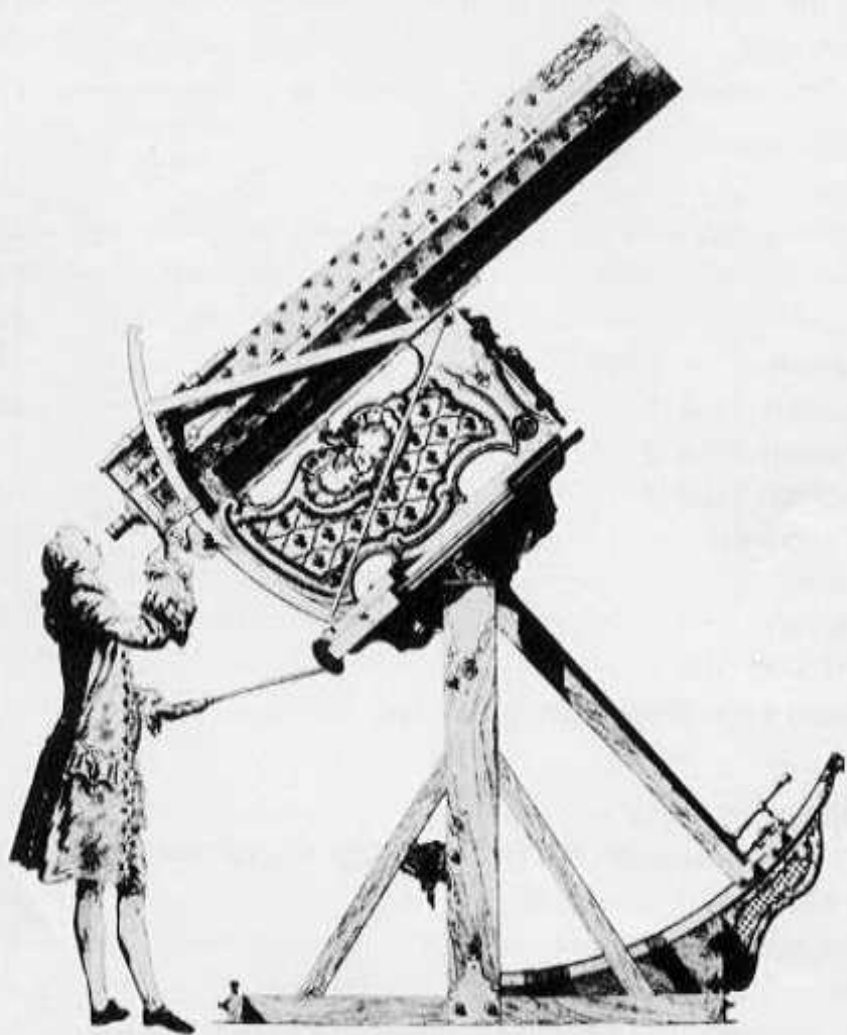
As can be readily imagined, theoretical research of a very high order, as well as a high degree of precision, are required in the production of these machines. There are, in addition, various types of observations, to each of which different considerations apply. It is essential, therefore, to design and produce machines fully matching the individual requirements in each case.

If you should happen to require machines of these types, we shall be glad to send you detailed information on the products of interest to you. It is our desire to co-operate fully in fulfilling your specialized requirements. Please do not hesitate to send us your inquiries. Our experts would like very much to co-operate with you in your research ventures.



INDEX

1. TELESCOPES	
91cm (36 inch) Reflector for Photoelectric Photometry	4
91cm (36 inch) Reflector	6
30cm (12 inch) Reflector	10
20cm (8 inch) Refractor	12
15cm (6 inch) Refractor	14
Solar Tower Telescope	16
Floating Zenith Telescope	17
2. SPECTROGRAPHS AND OTHERS	
Spectroheliograph	20
Monochromatic Heliograph	22
Coronagraph	24
K-Coronameter	26
Auroral Spectrograph	28
Airglow Spectrograph Type 1	30
Airglow Spectrograph Type 2	31
Airglow Spectrograph Type 3	32
Photoelectric Photometer	33
Grating Spectrograph	34
Nebular Spectrograph	36
30cm (12 inch) Coelostat	38
Fisheye Lens Camera for Photographing the Sun	39
3. MEASURING APPARATUS	
Self-Recording Microphotometer	42
Plate Standardizing Spectrograph for Self-Recording Microphotometer	44
Spectro Comparator	45
Densitometer for Astrographic Plate	46
Blink Comparator	48
Electronic Isophotometer	50
Shadowgraphs	51



1. TELESCOPES

91cm (36 inch) Reflector for Photoelectric Photometry

Used with the photoelectric photometer.

Fork type mounting.

The main telescope can be set to the right ascension and declination angle from the control desk equipped with a preset system.

For greater accuracy, it can be aimed at a star by means of slow and fine adjustments on the hand-set-box while sighting through the guiding telescopes.

Sidereal drive is operated by means of a synchronous motor.

A crystal oscillator controls motor speed, which is variable for trailing in spectrographic work or in compensating for atmospheric refraction.

1. Main telescope

Main mirror: Parabolic mirror of low-expansion glass
($\alpha = 300 \times 10^{-6}$)

Secondary mirror: Hyperbolic mirror of low-expansion glass ($\alpha = 300 \times 10^{-6}$)

Aperture of main mirror: 914mm

Focal length of main mirror: 3.2m

Focal ratio of main mirror: F/3.5

Cassegrain focal length: 12.0m

Cassegrain focal ratio: F/13

2. Guiding telescope (Refractor)

Aperture of objective (Achromat): 200mm

Focal length of objective: 2.4m

Magnification: 185 and 40x

Field of view: 13' and 1°07'

3. Equatorial mounting: Fork type

4. Driving device

a) Sidereal drive

The precision worm gear on the end of the polar axis is driven by means of a synchronous motor controlled by a constant-frequency crystal oscillator in the control desk. For trailing in spectrographic work or in compensating for atmospheric refraction, the

frequency is continuously variable between +0.05 and -0.15% of sidereal rate. Also, it is provided with crystal oscillators whose frequencies are available in -0.2, -0.25, -0.35, -0.45, -0.6, -0.8, and -1% of sidereal rate.

b) Speed of quick drive: 45°/min. for both polar and declination axis.

c) Speed of slow drive: 1'/sec for both polar and declination axis.

d) Speed of fine drive: 1.5"/sec for polar axis.
2"/sec for declination axis.

5. Control desk

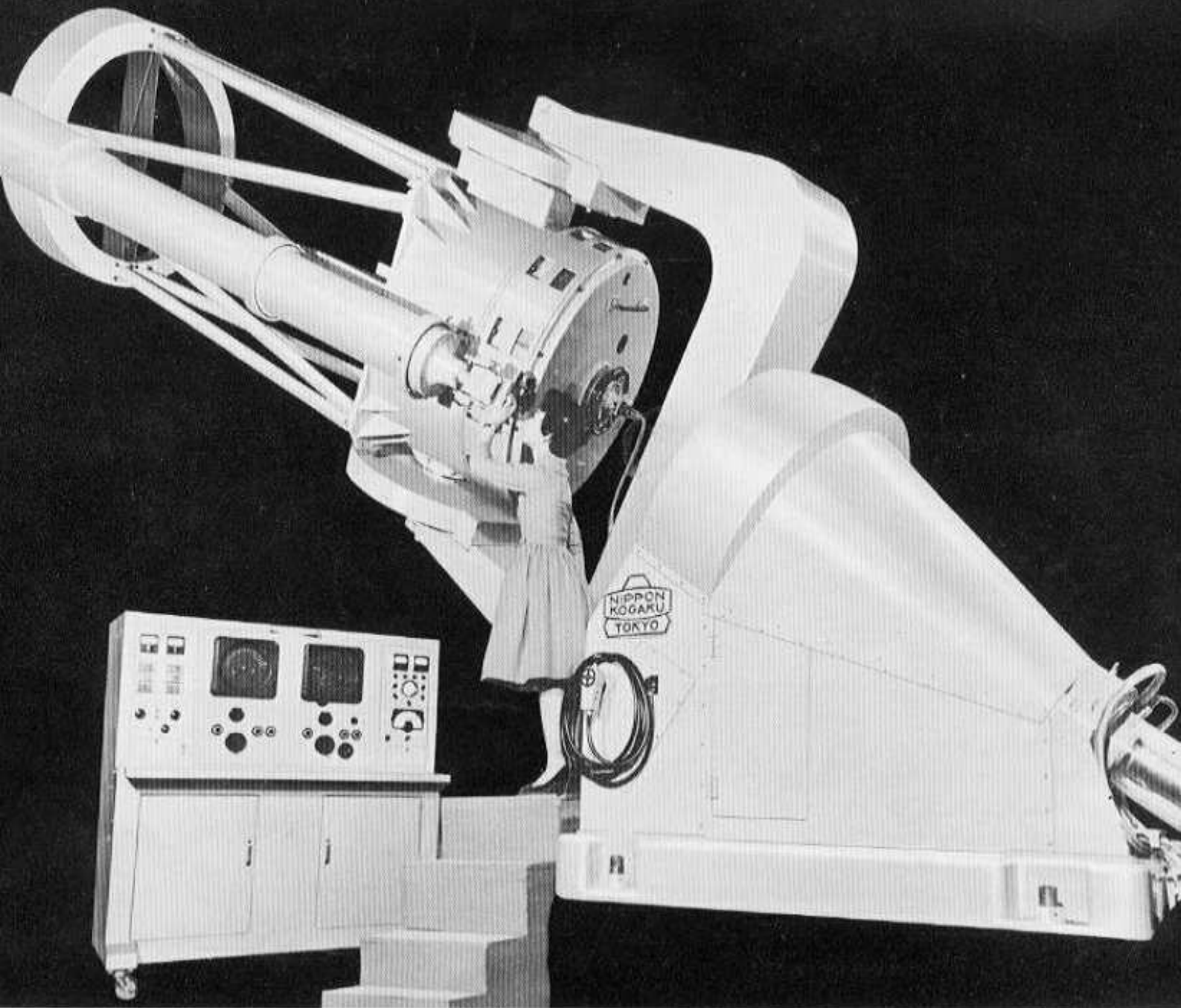
It contains automatic setting device (with quick drive) and manual adjustment device (with slow and fine drive) for declination and right ascension, crystal oscillators for sidereal drive, several power supplies and relays. Safety device prevents dangerous positioning.

6. Size and weight

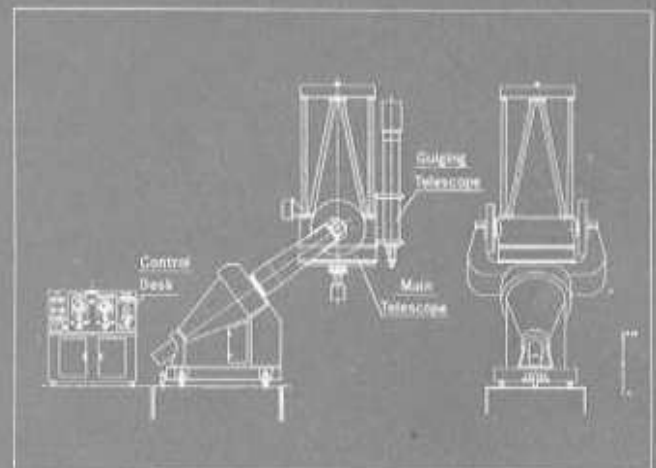
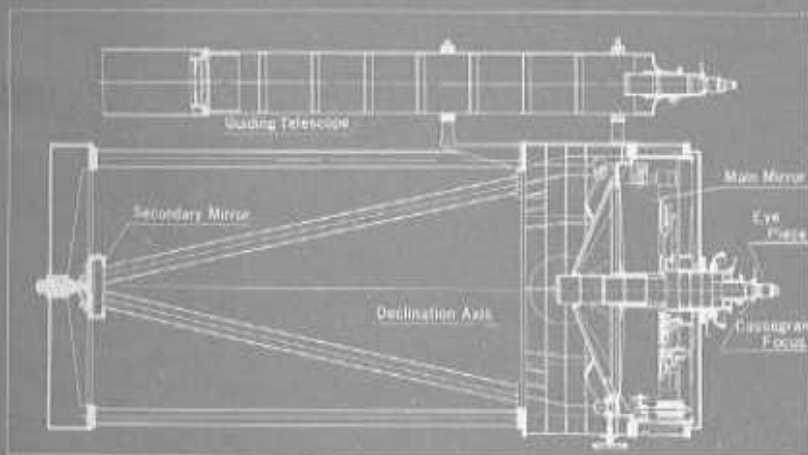
Length of main telescope: 3.2m

Maximum height: 5.2m

Approximate weight: 6.0 ton



91cm (36 inch) Reflector for Photoelectric Photometry



91cm (36 inch) Reflector

For photographic astrometry, spectroscopic and photoelectric observation.

Used with photo equipment, spectrograph, photoelectric photometer.

English type mounting.

The main telescope can be operated at both the prime focus and the Cassegrain focus. For use at the prime focus, a Ross correcting lens and a photo equipment with a remote control device from the hand-set-box are provided. The main telescope can be set to the right ascension and declination angle from the control desk equipped with a preset system. For greater accuracy, it can be aimed at a star by means of slow and fine adjustments on the hand-set-box while sighting through the guiding telescopes. Sidereal drive is operated by means of a synchronous motor. A crystal oscillator controls motor speed, which is variable for trailing in spectrographic work or in compensating for atmospheric refraction.

1. Main telescope

Main mirror: Parabolic mirror of low-expansion glass
($\alpha = 300 \times 10^{-8}$)

Secondary mirror: Hyperbolic mirror of low-expansion glass
($\alpha = 300 \times 10^{-8}$)

Aperture of main mirror: 914mm

Focal length of main mirror: 4.6m

Focal ratio of main mirror: F/5

Cassegrain focal length: 16.5m

Cassegrain focal ratio: F/18

Minimum diameter of iris diaphragm opening: 700mm

2. Photo equipment

a) Prime focus photo equipment

Plate size: 82×107 mm ($1.0^\circ \times 1.3^\circ$)

Travel range of double slide carrier: 20mm

Remote control shutter: Bulb and Time

Ross lens diameter (detachable): 170mm

Guiding telescope at the prime focus side

Magnification: 10x

This telescope is also used for focusing

Magnification: 13.3x

Field of view: 15mm

Guiding telescope at the primary mirror side

Magnification: 20x and 10x

b) Cassegrain focus photo equipment

Plate size: 82×107 mm ($0.3^\circ \times 0.4^\circ$)

Travel range of double slide carrier and shutter are same as those of the prime focus photo equipment.

Rotating sector: Used to decrease excessive brightness of an adjacent star.

Guiding eyepieces

Magnification: 10x and 20x

3. Two guiding telescopes (Refractors)

Aperture of objective (Achromat): 150mm

Focal length of objective: 2.25m

Magnification: 90 and 28x

Field of view: $30'$ and $1^\circ 35'$

4. Equatorial mounting: English type

5. Driving device

a) Sidereal drive

The precision wormgear on the end of the polar axis is driven by means of a synchronous motor, controlled by a constant-frequency crystal oscillator in the control desk. For trailing in spectrographic work or in compensating for atmospheric refraction the frequency is continuously variable between $+0.05$ and -1% of sidereal rate. Also, it is provided with crystal oscillators whose frequencies are available in -1.5% , -2.5% , -3.5% , and -6% of sidereal rate.

b) Speed of quick drive: $90^\circ/\text{min}$ for both polar and declination axis.

c) Speed of slow drive: $1'/\text{sec}$ for both polar and declination axis.

d) Speed of fine drive: $1.5''/\text{sec}$ for polar axis.
 $2''/\text{sec}$ for declination axis.

6. Control desk

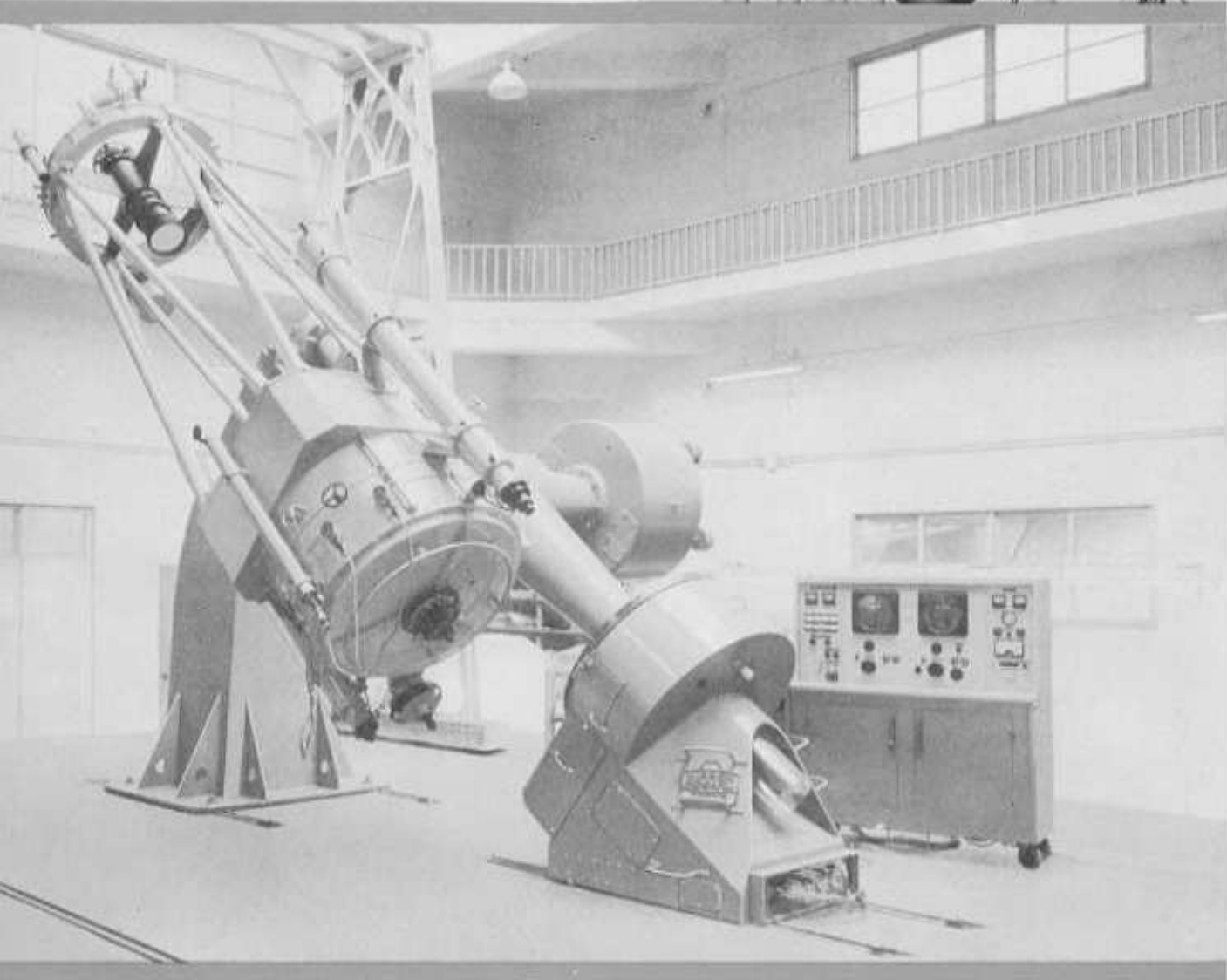
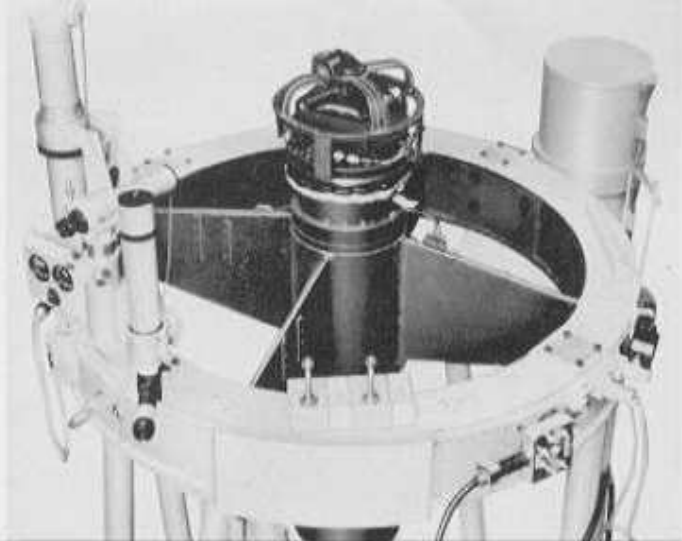
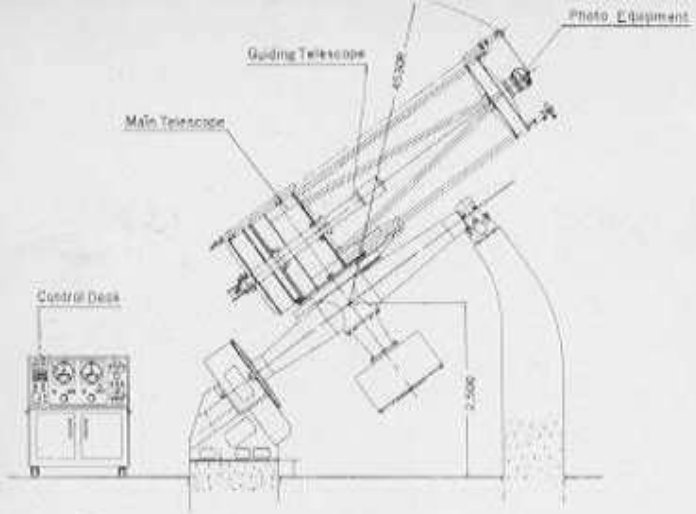
It contains automatic setting device (with quick drive) and manual adjustment device (with slow and fine drive) for declination and right ascension, crystal oscillators for sidereal drive, several power supplies and relays. Safety device prevents dangerous positioning.

7. Size and weight

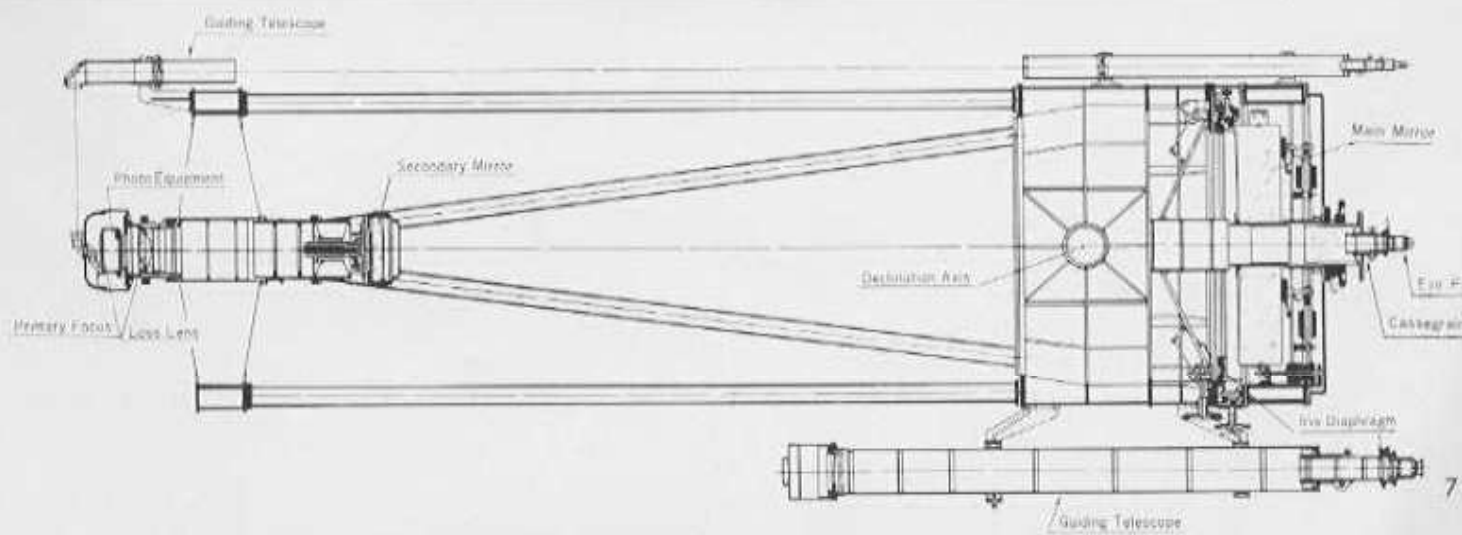
Length of main telescope: 5.6m

Maximum height: 7.0m

Approximate weight: 10 ton



91cm
(36 inch)
Reflector





Dodaira Station of the Tokyo Astronomical Observatory

Globular Cluster in Canes Venatici, M-1



Spiral Nebulae in Ursa Major, M-81





The Great Orion M-42

30cm (12 inch) Reflector

This Cassegrain type reflector consists of a main telescope, German type equatorial mounting, clock device driven by a synchronous motor, finder telescope, photo equipment and other accessories. It is used for visual and photographic observation of celestial bodies.

Also, it may be used for spectroscopic or photo-electric observation by attaching accessories.

1. Cassegrain type reflector

Focal length: 5m

Focal ratio: F/17

a) Main mirror: parabolic mirror

Aperture: 300mm

Focal length: 1.5m

b) Secondary mirror

Aperture: 80mm

2. Finder telescope

a) Objective

Aperture: 50mm

Focal length: 750mm

b) Eyepiece with reticle

Focal length: 28mm

Magnification: 27x

c) Field of view: 1°50'

3. Viewfinder

Objective aperture: 18mm

Magnification: 6x

Field of view: 5°

4. Equatorial mounting: German type

5. Clockwork is driven by synchronous motor

6. Photo equipments

a) Plate size: 82 x 107mm

b) Shutter: 1 to 1/125 second, Time and Bulb.

c) Filter: Green, yellow and red filters.

7. Accessories

a) Eyepiece

Huygenian: 60mm, 25mm and 18mm

Orthoscopic: 9mm

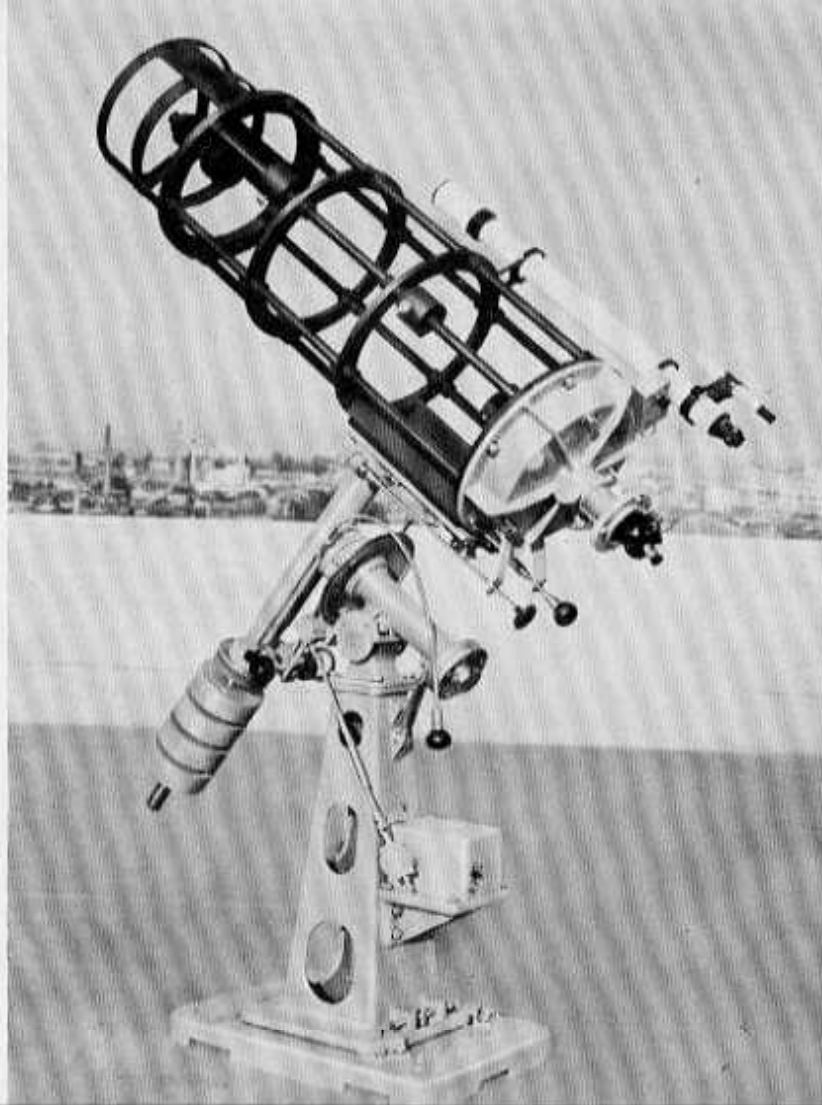
b) 3 sun glasses, a diagonal prism and a triple revolving nose-piece.

8. Size and weight

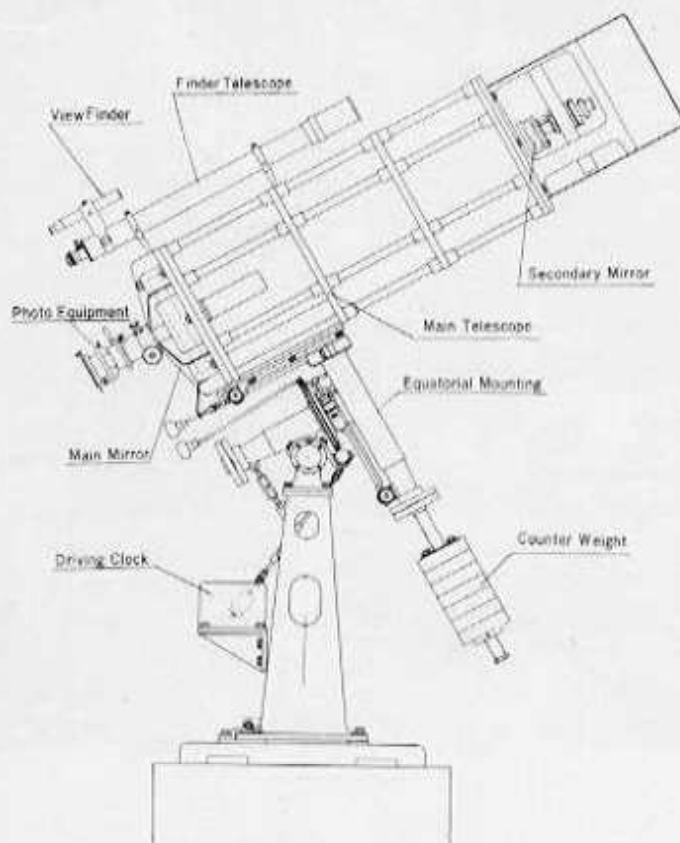
Length of main telescope: 2.1m

Maximum height: 2.5m

Approximate weight: 260kg



30cm (12 inch) Reflector



20cm (8 inch) Refractor

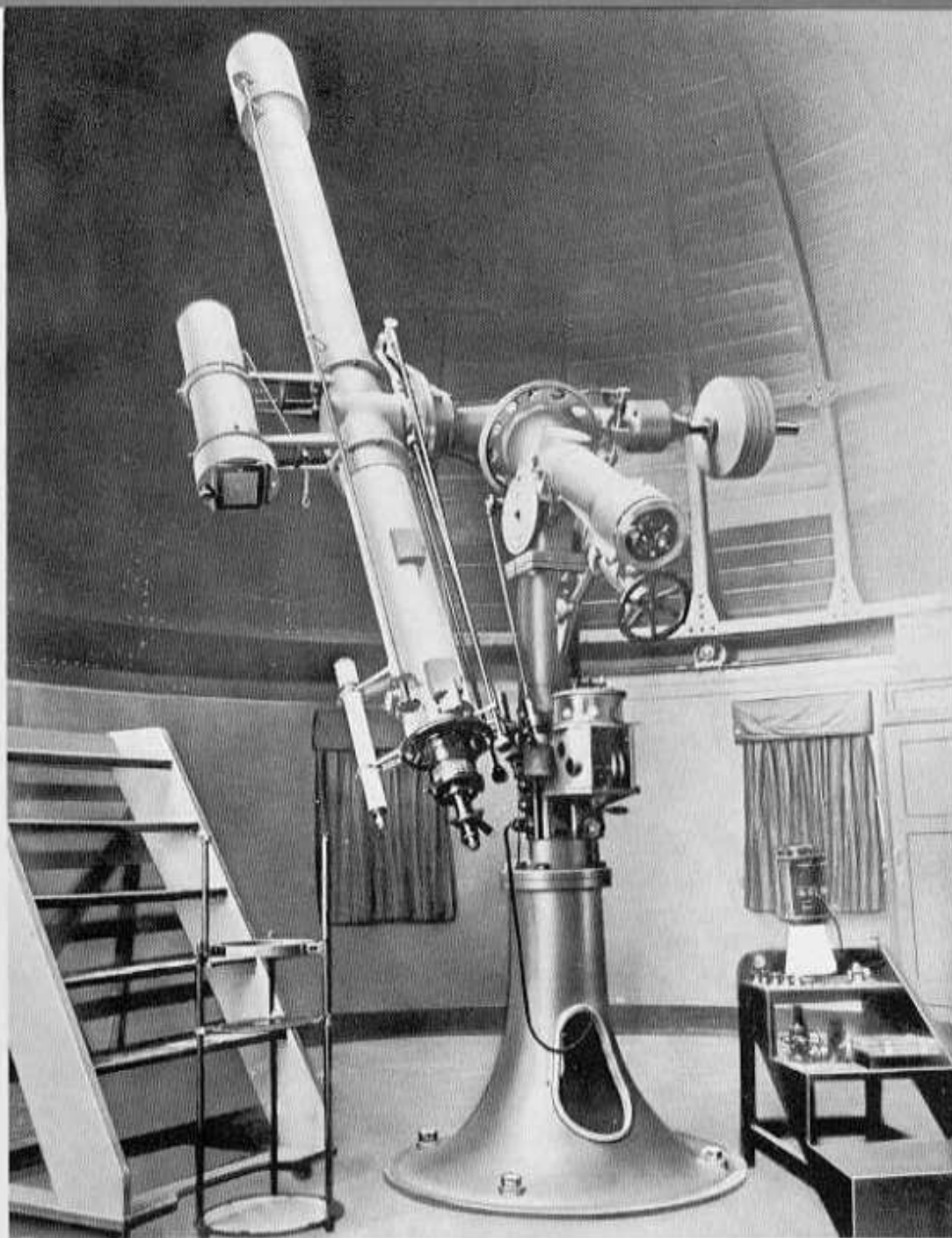
This refractor consists of a main telescope, German type equatorial mounting, clock device, finder telescope and other accessories.

For visual and photographic observation of celestial bodies.

1. Main telescope
 - a) Objective (Achromat)
Aperture : 200mm
Focal length : 3.6m
Resolving power : 0.57 second
 - b) Eyepieces
Huygenian : 60, 40, 25 and 18mm
Orthoscopic : 12.5 and 9mm
Kellner : 25mm
 - c) Magnification : 60-400x
2. Finder telescope
Objective aperture : 50mm
Focal length : 500mm
Magnification : 20x
Field of view : 2.5°
3. Equatorial mounting : German type
4. Clockwork is driven by weight.
5. Accessories included
Sun glass, moon glass, star diagonal prism, sun prism, triple revolving nose-piece with bayonet mount.
6. Optional accessories supplied on order.
 - a) Astro camera (Triplet)
Aperture : 125mm
Focal length : 600mm
Focal ratio : F/4.8
Plate size : 119 x 163mm
 - b) Sun and moon camera
plate size : 119 x 163mm
Shutter : 1 to 1/125 sec. , Time and Bulb.
Blue, red, yellow and neutral filters.
 - c) Sun projection screen
Effective area : diameter 300mm
 - d) Reading telemicroscope for declination angle
Aperture : 300mm
Magnification : 4x
 - e) Centering telescope
Aperture : 150mm
Focal length : 15mm
7. Size
Length of telescope : 4m
Maximum height : 5m



Photo taken at National Science Museum



20cm (8 inch) Refract

15cm (6 inch) Refractor

This refractor consists of a main telescope, German type equatorial mounting, clock device, finder telescope and other accessories.

For visual and photographic observation of celestial bodies.

1. Main telescope

a) Objective (Achromat)

Aperture: 150mm

Focal length: 2.25 m

Resolving power: 0.76 second

b) Eyepieces

Huygenian: 40, 25 and 18mm

Orthoscopic: 9 and 7mm

c) Magnification: 56 – 320x

2. Finder telescope

Aperture: 50mm

Focal length: 750mm

Magnification: 27x

Field of view: 1°50'

3. Equatorial mounting: German type

4. Clockwork is driven by weight

5. Accessories:

Sun glasses, moon glasses, star diagonal prism, sun prism, sun projection screen and triple revolving nose-piece with bayonet mount.

6. Optional accessories supplied on order.

a) Astro-camera (Triplet)

Aperture: 125mm

Focal length: 600mm

Focal ratio: F/4.8

Plate size: 119×163mm

b) Sun and moon camera

Plate size: 88×133mm

Blue, red, yellow and neutral filters are provided

c) 6x finder

Aperture: 30mm

Field of view: 6°20'

d) Position micrometer

12.5mm orthoscopic eyepiece and illuminating device for bright and dark field are provided.

Measuring range: ± 3mm

Minimum reading: 0.01mm

Circular graduation: 1 div. 1°

e) Eyepieces

Huygenian: 12.5 and 60mm

Orthoscopic: 5mm

7. Size

Length of telescope: 2.7m

Maximum height: 3.8m



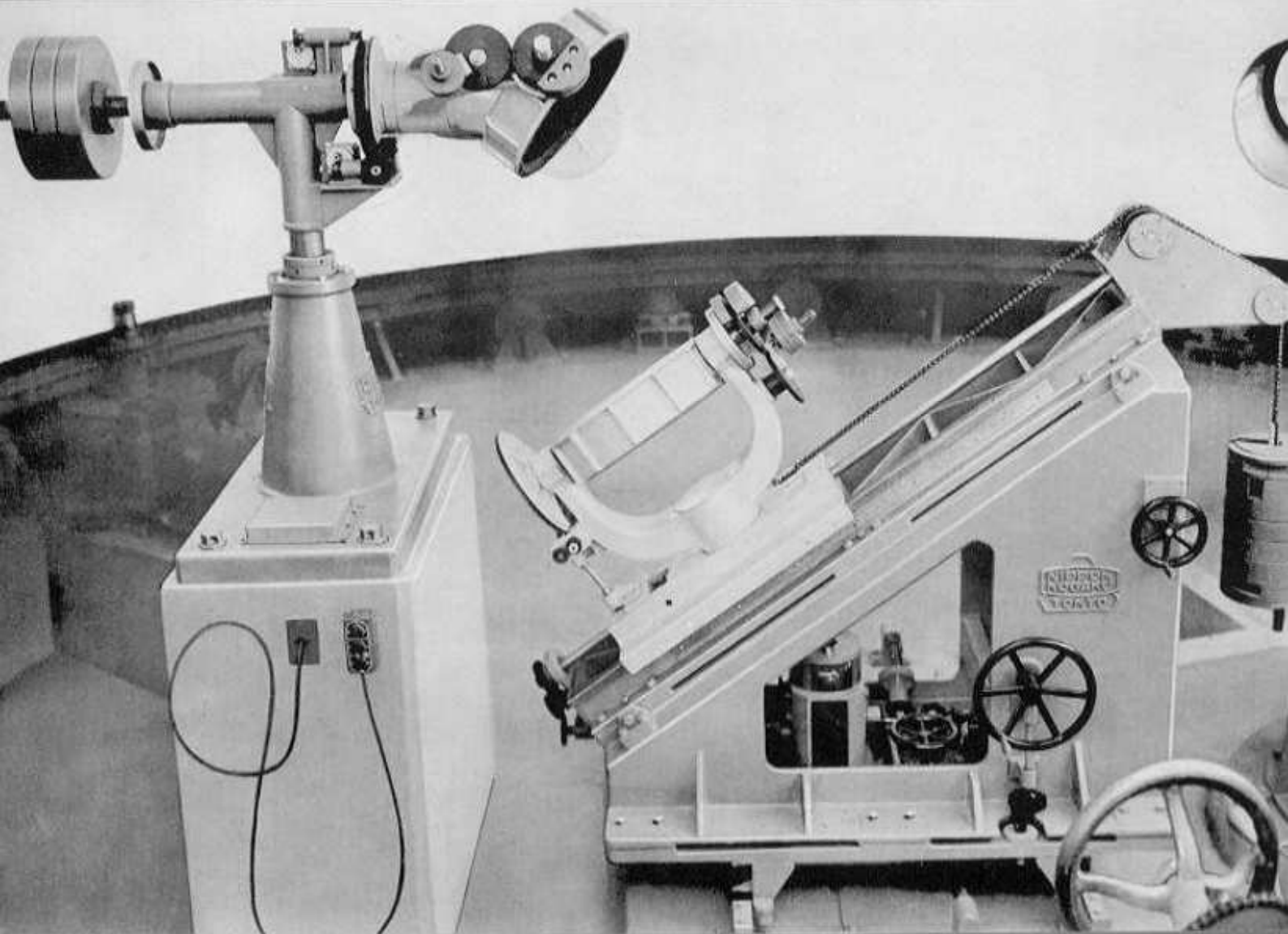
15cm (6 inch) Refractor

Solar Tower Telescope

For observation by the general public.

Solar light is fed to the vertical telescope by the coelostat and projected on an $800 \times 800\text{mm}$ screen to form a solar image.

This image is kept automatically on the screen by a photoelectric tracking device.



Solar Tower Telescope

1. Coelostat of fused quartz: (1st and 2nd mirrors)
Aperture: 300mm
2. Auxiliary mirror of fused quartz.
Aperture: 300mm
3. Telescope
 - a) Objective (Achromat)
Aperture: 150mm
Focal length: 2.7m

- b) Projection screen size: $800 \times 800\text{mm}$
4. Long distance projector
Distance: 6m
Screen size: $1.1 \times 1.1\text{m}$
Solar image size: diameter 800mm
5. Finder
Magnification: 10x
Field of view: 5°

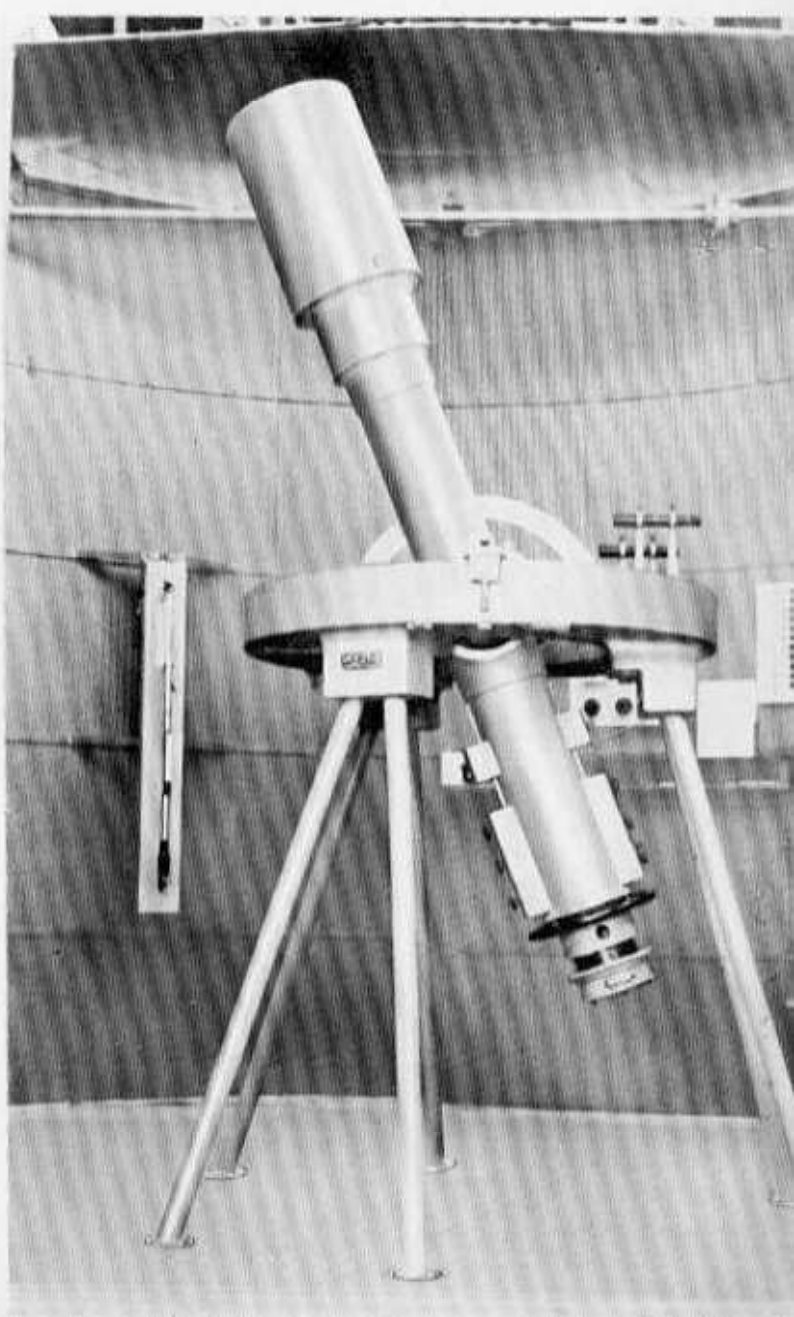
Floating Zenith Telescope

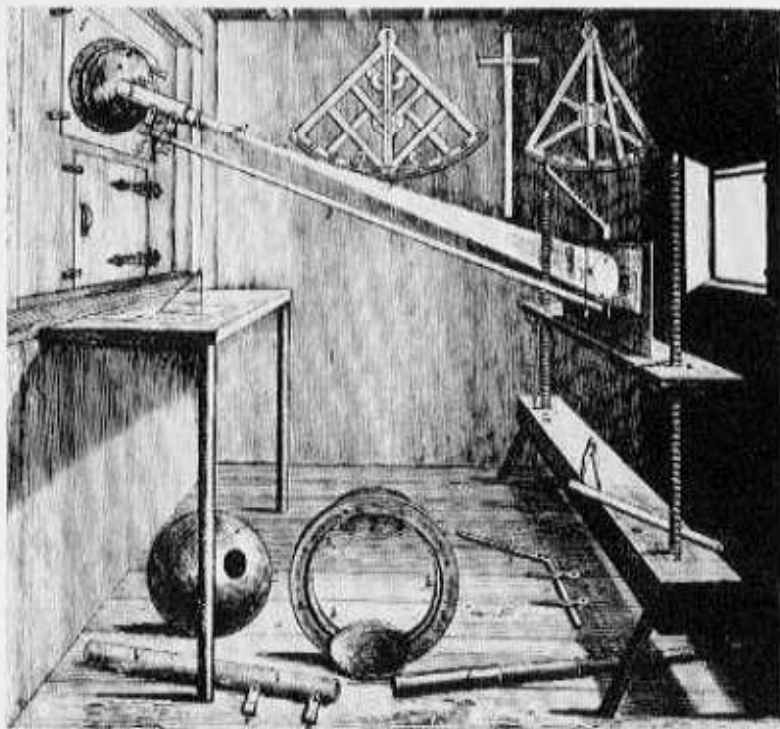
A telescope tube floating in a mercury vessel.
Used for photographic observation of the latitude by
Talcott's method, without a level.

1. Objective
Triplet type lens
Aperture: 178mm
Focal length: 1.78m
Focal ratio: F/10
2. Vessel of mercury
Outer diameter: 1.06 m
Inner diameter: 0.56 m
Weight of mercury: 90 kg



Floating Zenith Telescope





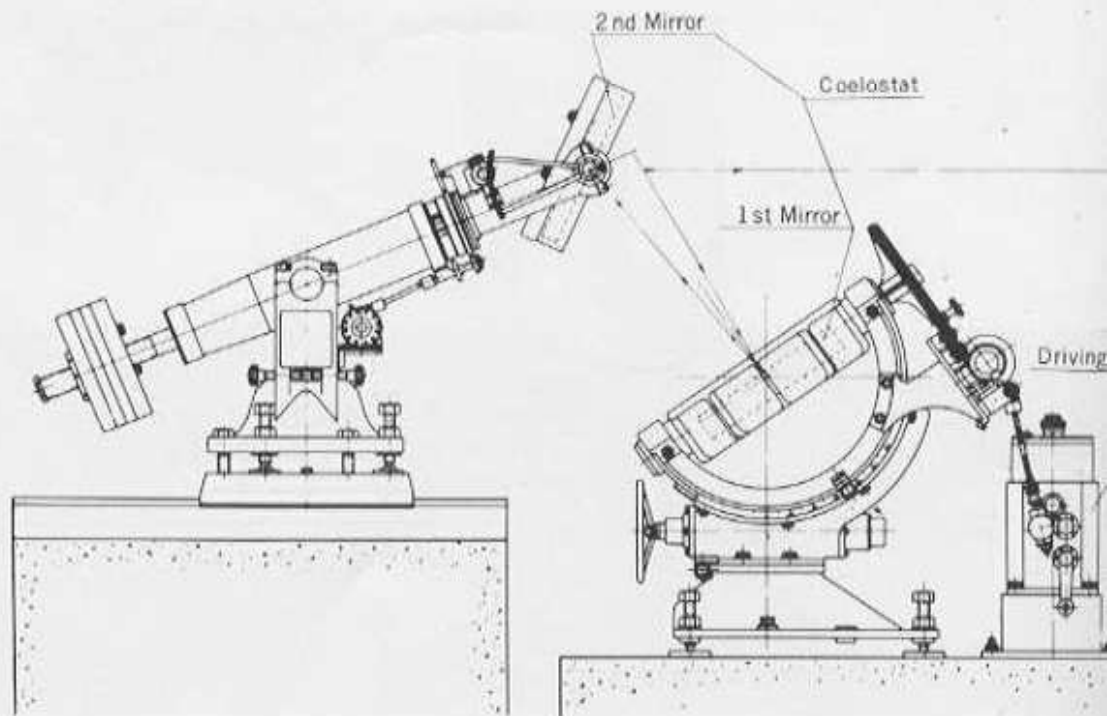
2. SPECTROGRAPHS AND OTHERS

Spectrohelioscope

For visual observation of the solar prominence, flare and other phenomena.

Solar light is introduced to the instrument by a coelostat. A monochromatic solar image is reproduced by means of a spectroscope.

Spectrohelioscope



1. Coelostat of fused quartz (1st and 2nd mirrors)

Aperture: 300 mm

2. Objective (single lens)

Aperture: 130 mm

Focal length: 5 m

3. Dispersion system

a) Collimating mirror

Aperture: 90 mm

Focal length: 5 m

1st slit, length: 30 mm, width: 0-3 mm

Reseau glass is inserted in front of the 1st slit.

b) Grating

Reflection type made by Bausch & Lomb

Grooves/mm: 600

Ruled area: 102 × 128 mm

c) Objective mirror

Aperture: 90 mm

Focal length: 5 m

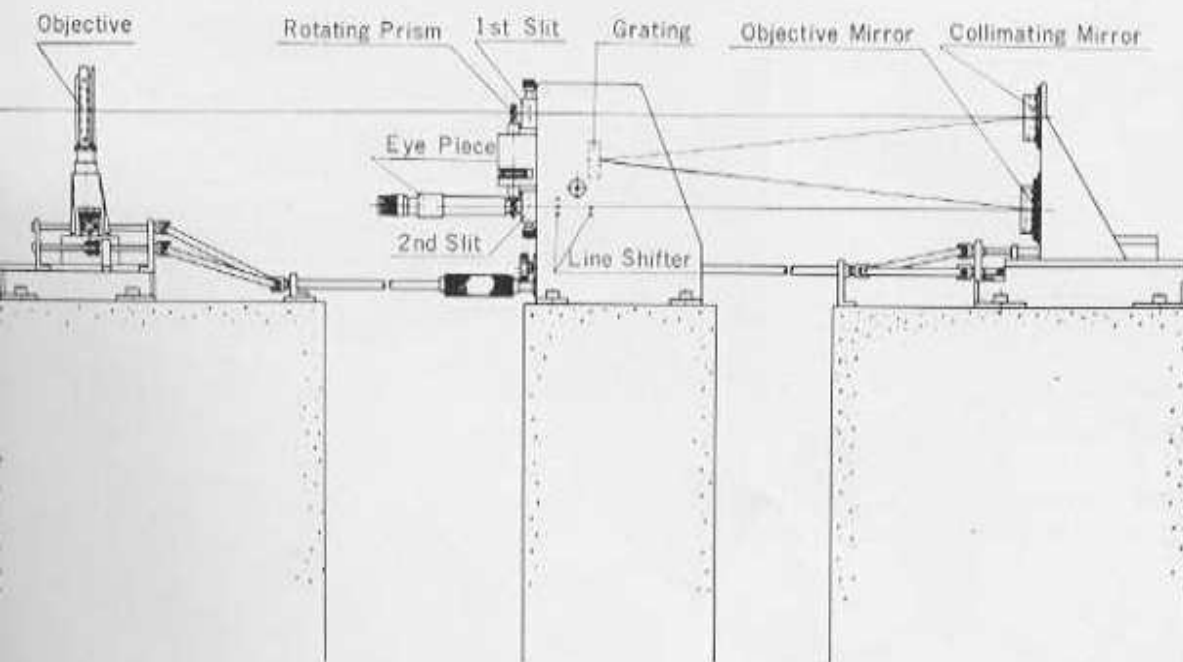
2nd slit, length: 30 mm, width: 0-3 mm

4. Size of image covered by rotating prism: 30 × 30 mm

5. Observing unit

Eyepiece, Magnification 4x and 1.6x

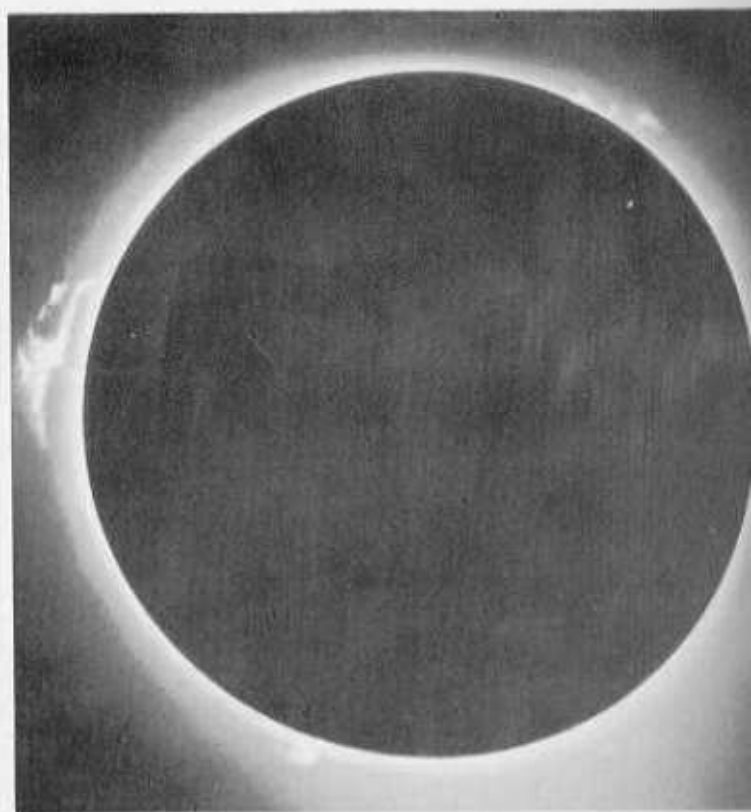
6. Photographic unit with Nikon F 35mm camera

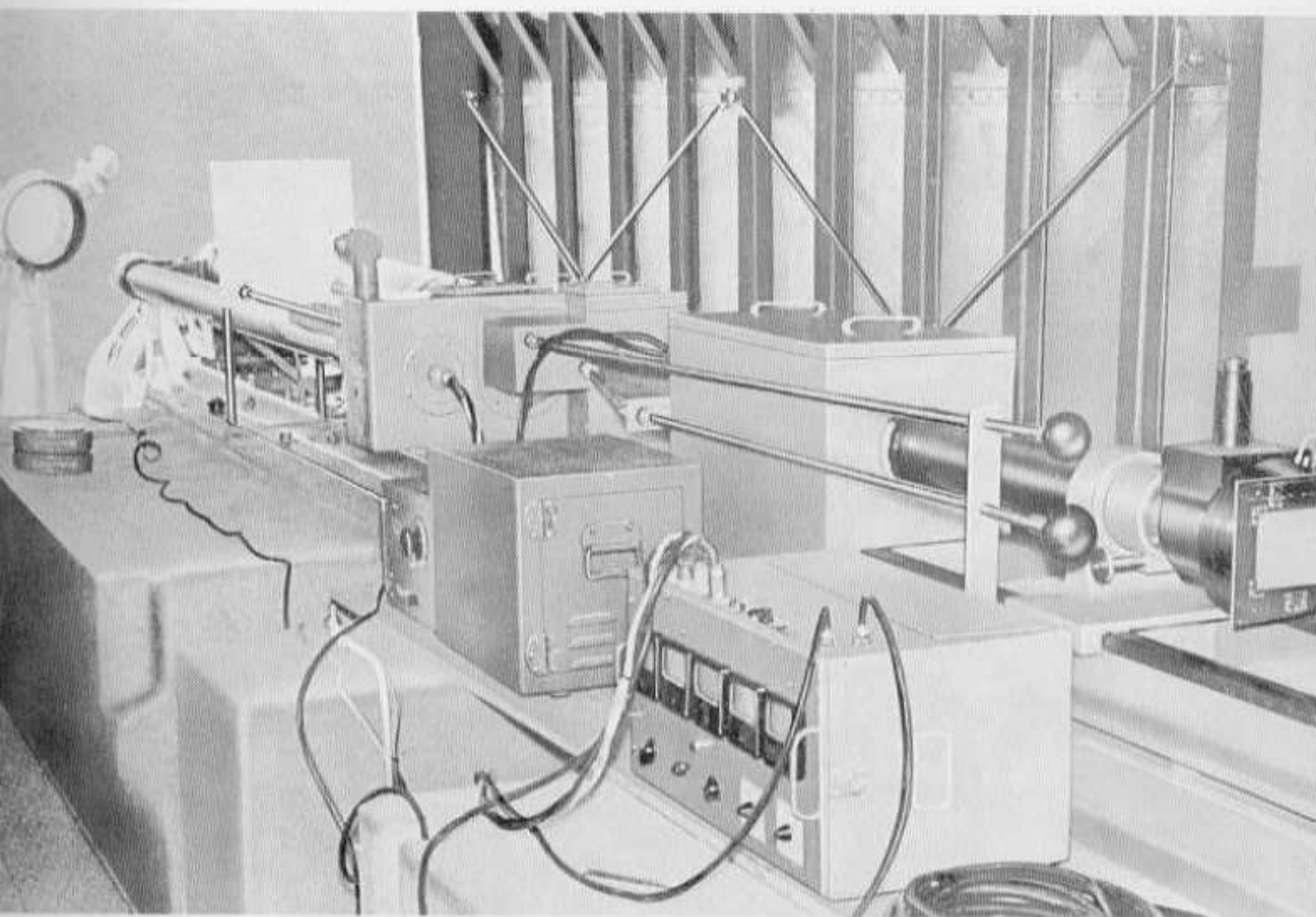


Monochromatic Heliograph

For monochromatic observation and photography of the solar prominence, flare and other phenomena. Monochromatic light ($H\alpha$ -6563A) is selected with a birefringent filter. It consists of a coelostat controlled automatically by a photoelectric guiding device, horizontal telescope, cine camera and box camera.

1. Coelostat of low-expansion glass (1st and 2nd mirrors)
Aperture: 300 mm
2. Objective
Aperture: 130 mm
Focal length: 2.5 m
Size of the solar image: diameter 22 mm
3. Birefringent filter for $H\alpha$ (6563A)
4. Camera lens
Magnification: 2x, 1x or 1/2x (size of the solar image is 44mm, 22mm or 11mm respectively)
5. Cine camera body
35 mm cine camera with reflex finder
6. Box camera body
Plate size 82 × 107 mm
7. Guiding device
Photoelectric automatic guiding device to control the 1st mirror of the coelostat.
Aperture of objective: 50 mm
Focal length of objective: 2.5 m
Magnified image size: 115mm
8. Size
Length of the instrument: 9.4 m
Maximum height: 1.8 m





Monochromatic Heligraph

Coronagraph

Consists of a main telescope, fork type equatorial mounting, clock device, and finder telescope.

It is designed on Lyot's principle.

The solar image produced by the objective is masked by a circular disc. Only peripheral light is admitted to visual, photographic, spectroscopic and photoelectric observation.

1. Objective (single lens)

Finely annealed material is specially selected, free of bubble and striae.

Aperture: 110 mm

Focal length: 1.5 m

2. Circular disc (interchangeable)

14.3–15.4 mm at intervals of 0.1 mm in diameter

3. Relay lens

Focal length: 205 mm

Magnification: 1x–1.5x

4. Direct-vision spectroscope for coronal observation.

a) 3 Amici prisms for 5303A. Difference between dispersion angle at $H\alpha$ and $H\beta$: $13^{\circ}16'$

b) 1 Amici prism for 5303A. Difference between dispersion angle at $H\alpha$ and $H\beta$: $4^{\circ}27'$

c) 3 Amici prisms for 6374A. Difference between dispersion angle at $H\alpha$ and $H\beta$: $14^{\circ}43'$

5. Spectrograph

a) Collimator lens

Aperture: 53 mm

Focal length: 600 mm

b) Plane grating

c) Camera lens

Focal length: 600 mm and 210 mm

Focal ratio: 1:11 and 1:4.5

6. Dine camera

Focal length: 121 mm

Film size: 18 × 24 mm (35 mm film)

Magnification: 1, 2 or 3x

7. Camera with a Lyot filter to photograph the monochromatic image of the corona.

8. Guiding telescope

Aperture: 80 mm

Focal length: 960 mm

Field of view: 22.5'

Magnification: 107x

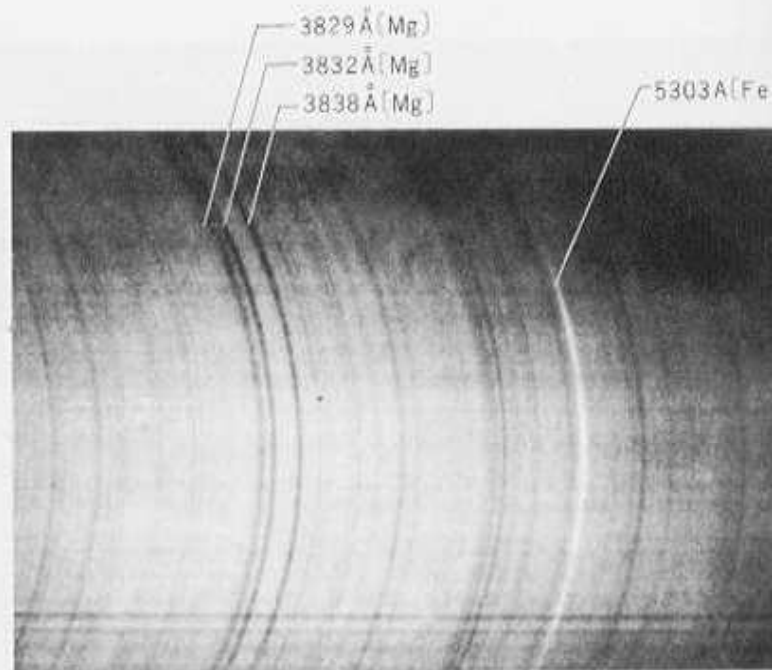
9. Mounting

Fork type equatorial mounting

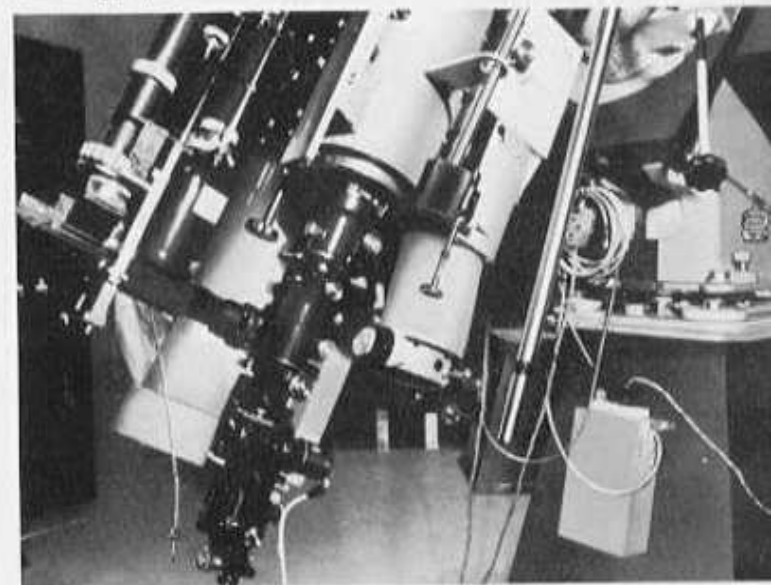
10. Clockwork is driven by weight

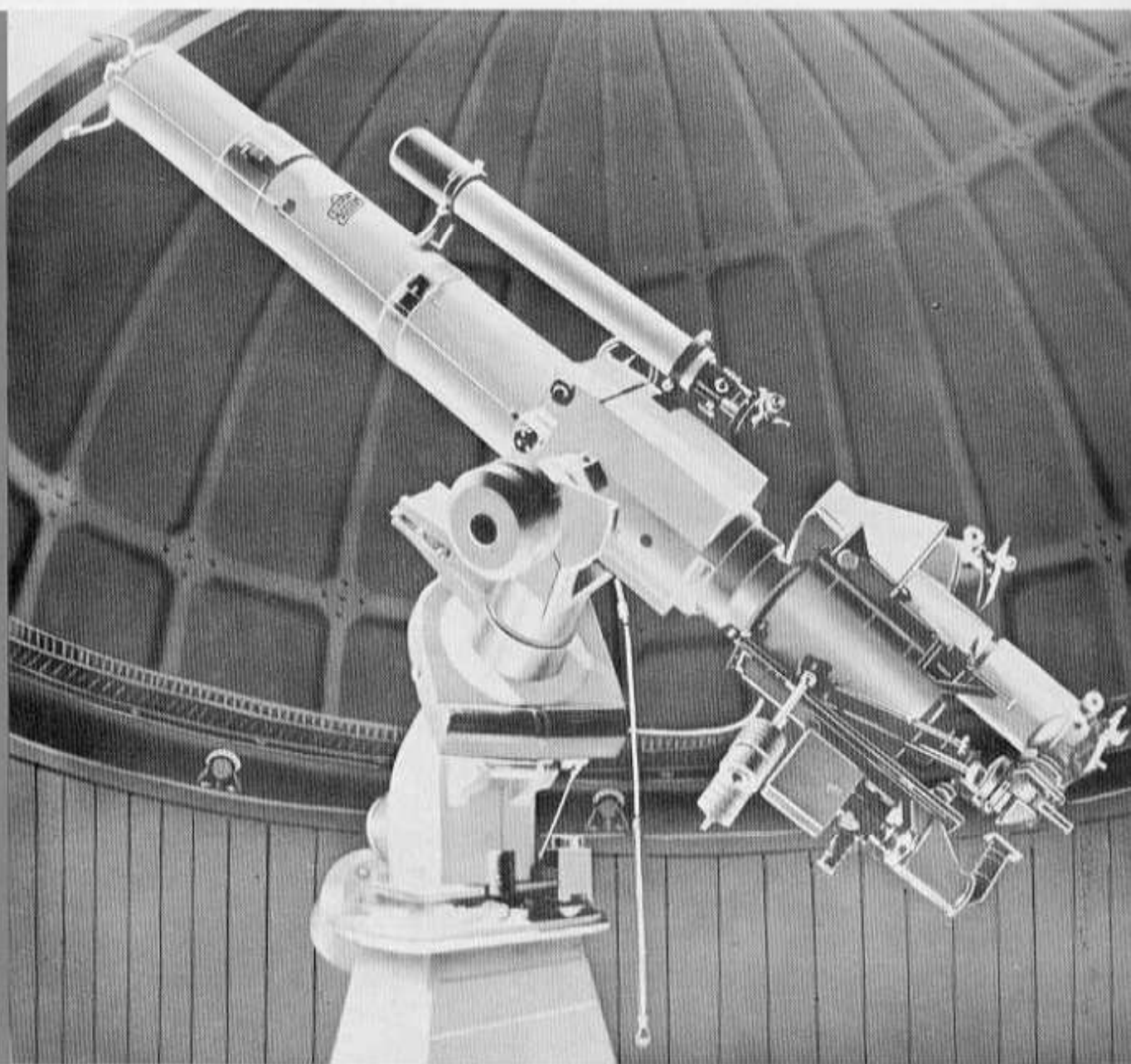
11. Size

Length of main telescope: 2.9 mm



Coronagraph

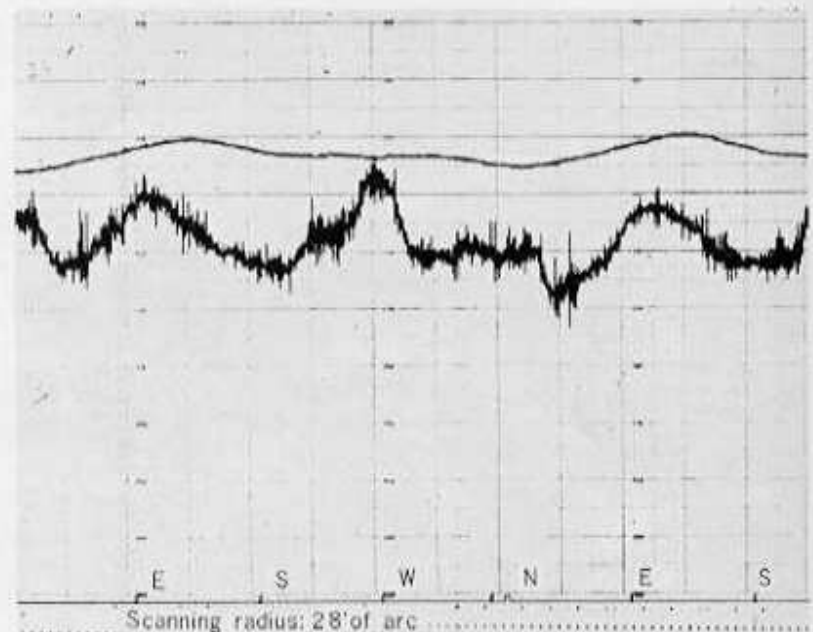


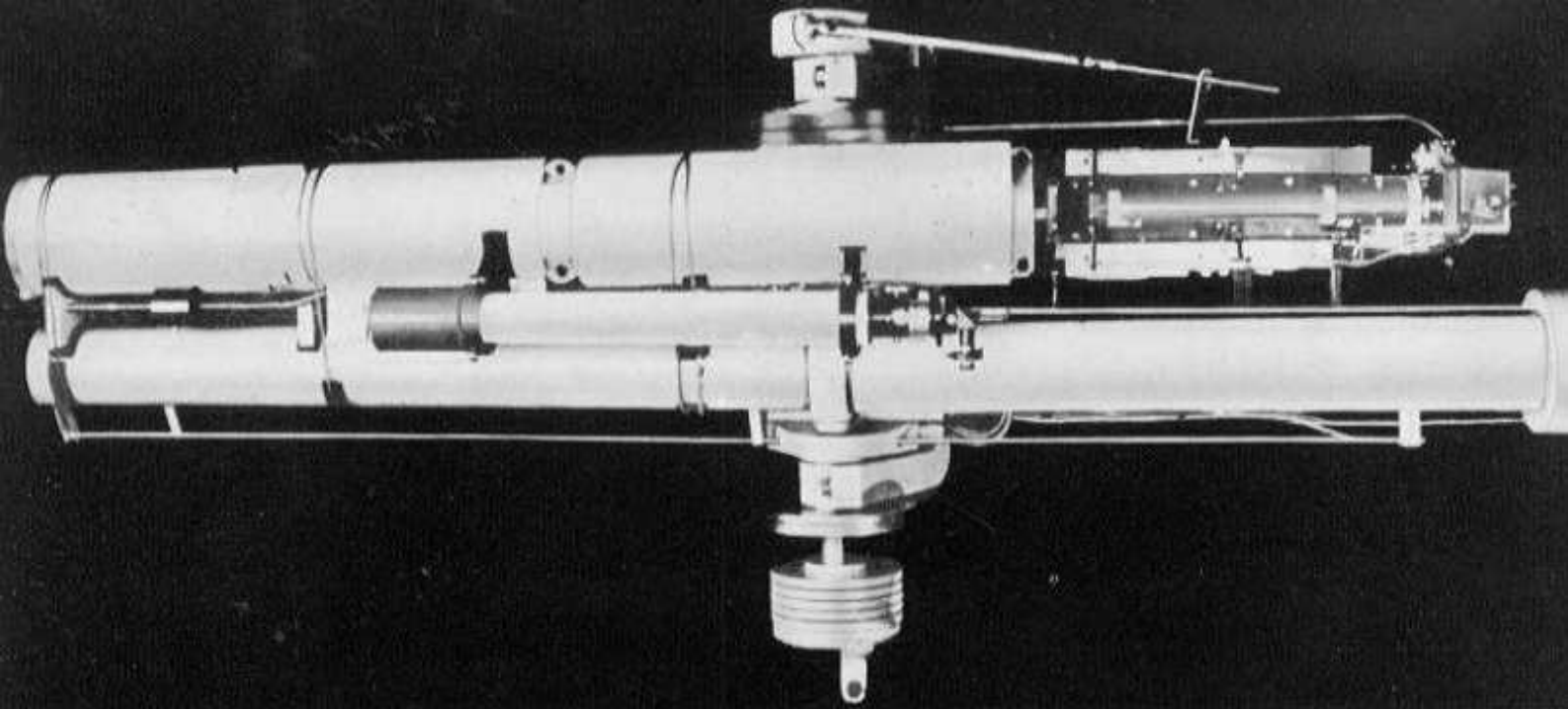


K-Coronameter

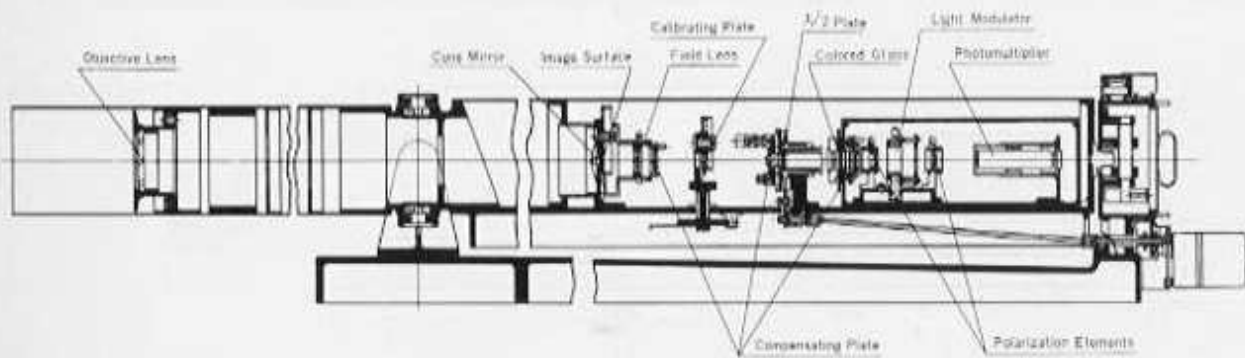
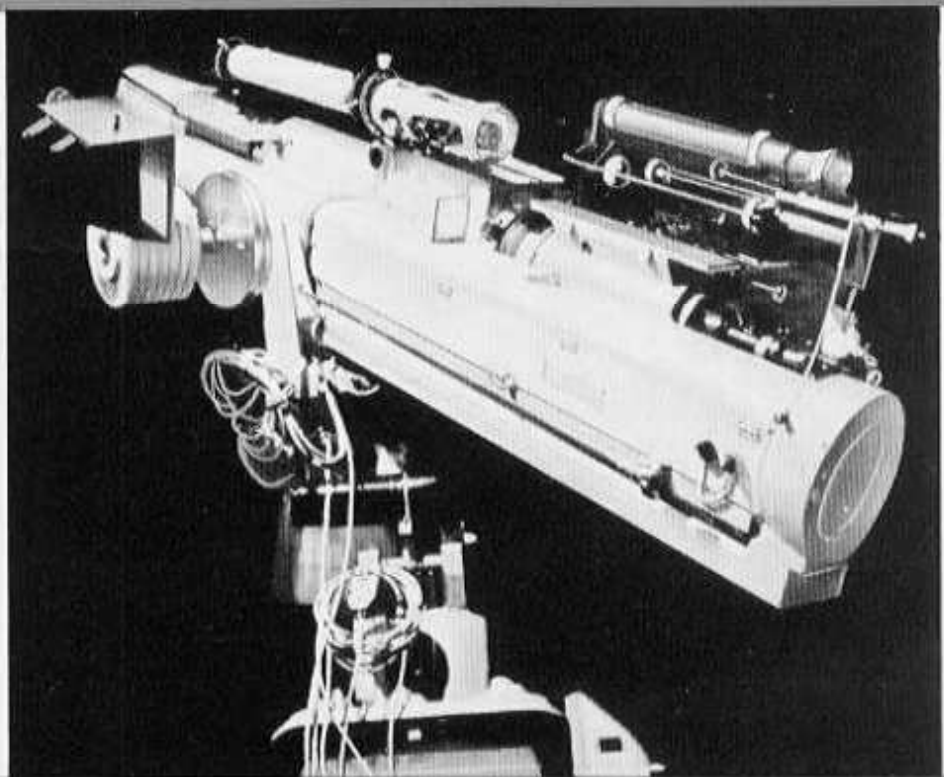
A coronagraph type telescope, with a high-precision polarimeter incorporating an ADP light modulator. This polarimeter accurately measures polarization (down to the order of 10^{-4}) of skylight near sun. It can be used to measure the white corona (K-corona) of a total solar eclipse up to a distance of twice the solar radius. The K-Coronameter is set parallel to the coronagraph on the same mounting.

1. Range of effective wavelength: 4300A-6700A
2. Maximum range of measurement: To the distance of twice the solar radius
3. Scanning time
One scan around the sun requires 4 minutes
4. Precision of the polarimeter
Detects partial polarized light to the order of 10^{-4}
5. Objective (single lens)
Finely annealed material is specially selected, free of bubble and striae.
Aperture: 80mm
Focal length: 2m
6. Light modulator
Applying AC 5KV (70 c/s) to an ADP cell, we have
 $\pm \lambda/4$ retardation alternately
7. Polarization elements
 - a) $\lambda/2$ plate diameter 30mm
 - b) $\lambda/4$ plate diameter 30mm
 - c) Polarizer diameter 30mm
8. Calibrating plate (ND filter)
Density: 3 and 4 Density for 4300-6700A
Inclining range: $\pm 10^\circ$
The angle of inclination can be read to the order of 0.01°
9. Detector
EMI 9524 Photomultiplier
10. Size
Length of main telescope: 3.1m





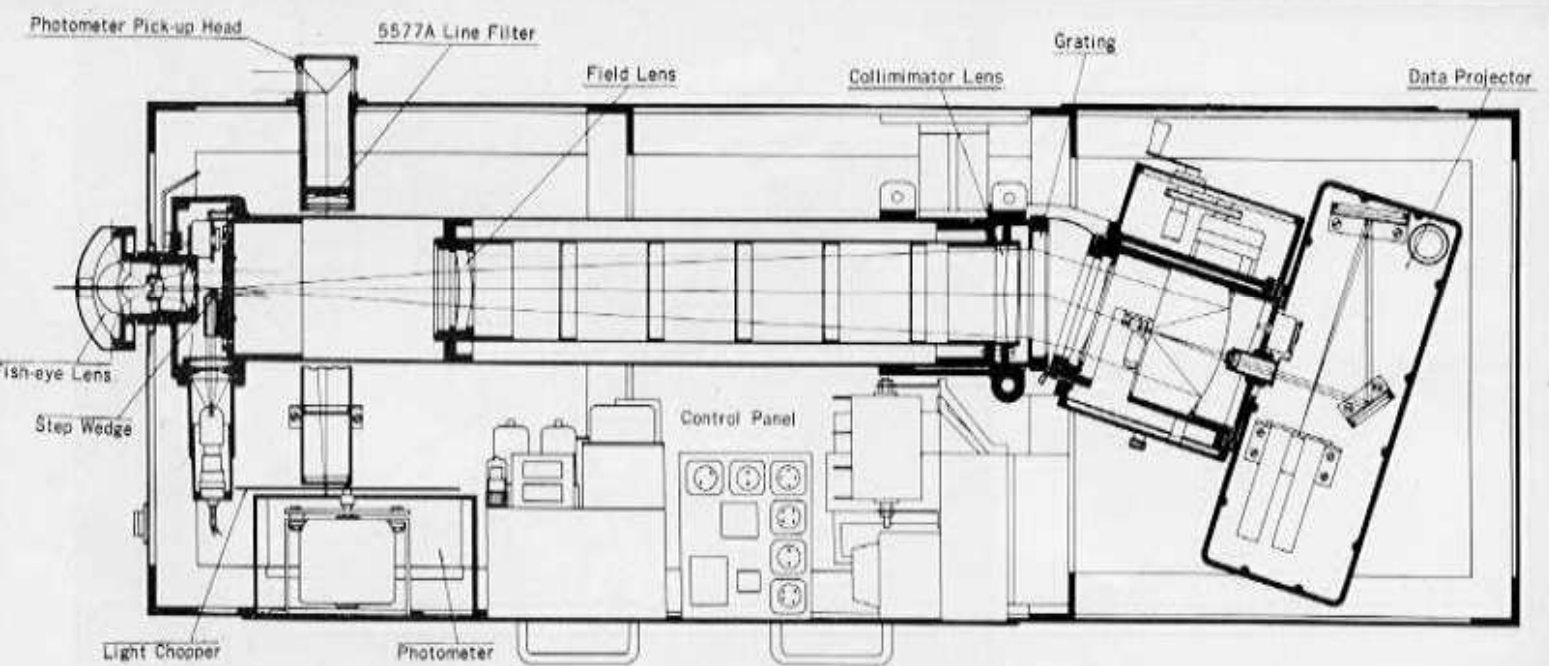
Coronagraph and K-Coronameter



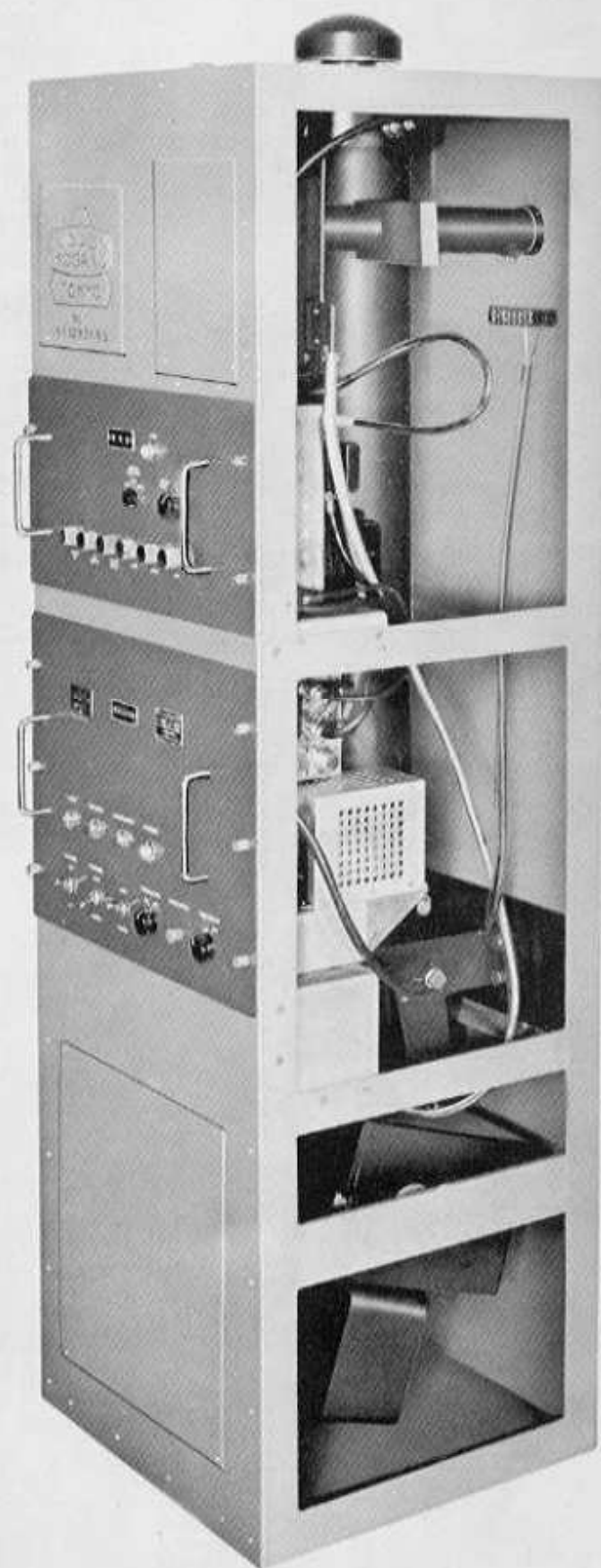
Auroral Spectrograph

Permits continuous automatic or manual photography of the auroral spectrum within a zone of $180^\circ \times 2^\circ$ along a magnetic meridian.

It has a semi-solid Schmidt camera with focal ratio of 1:0.65. Time, film number, number of photons and spectral step wedge are simultaneously recorded on the film. The Auroral Spectrograph shown was designed for the Japanese Antarctic Research Expedition during the International Geophysical Year, 1957-58.



1. Range of wavelength: 3400A—8800A
2. Condenser
Fisheye type
Field of view: $180^{\circ} \times 2^{\circ}$
Focal ratio: 1:7.6
3. Collimator
Aperture: 80mm
Focal length: 610mm
Slit length: 30mm
4. Grating
Transmission type made by Bausch & Lomb.
Grooves/mm: 600m
Ruled area: 75×75 mm
Blaze wavelength: 5000A
Linear dispersion: 330A/mm at 5130A
Resolving power: 45000
5. Camera
Semi-solid Schmidt type
Focal length: 49mm
Focal ratio: 1:0.65
Field of view: 12°
Film: 16mm cine film
100 feet bulk magazine is provided
6. Step wedge for calibration
0—2.1 density (8 steps)
7. Photometer
Number of photons transmitted through 5577A interference filter, is counted and recorded for automatic determination of exposure time. Time and film no. are simultaneously recorded.
a) Interference filter for 5577A
b) Detector: RCA 931-A Photomultiplier
8. Height of this instrument: 1.3m



Auroral Spectrograph

Airglow Spectrograph Type 1

Provided with an altazimuthal mounting and a Schmidt type camera with focal ratio of 1:0.7, permitting extremely short exposure time.

Two collimators are provided to change field of view.

1. Range of wave length: 3600A—8000A

3. Collimators

a) Long focal length collimator

Aperture: 100mm

Focal length: 1.5m

Curved slit

with prism for comparison spectra

Length: 51mm

Field of view: 3°50'

b) Short focal length collimator

Aperture: 100mm

Focal length: 400mm

Curved slit

with prism for comparison spectra

Length: 14mm

Field of view: 14°30'

3. Dispersion prism

Two 30° prisms

Size: 110×55mm

Height: 80mm

Glass material: BaF3 (Schott type)

Linear dispersion: 500A/mm at 5000A

Resolving power: 27000

4. Camera

Schmidt type

Focal ratio: 1:0.7

Focal length: 70mm

Field of view: 4°

Film: 16mm cine film

5. Finder

Magnification: 5×

Field of view: 5°

6. Mounting

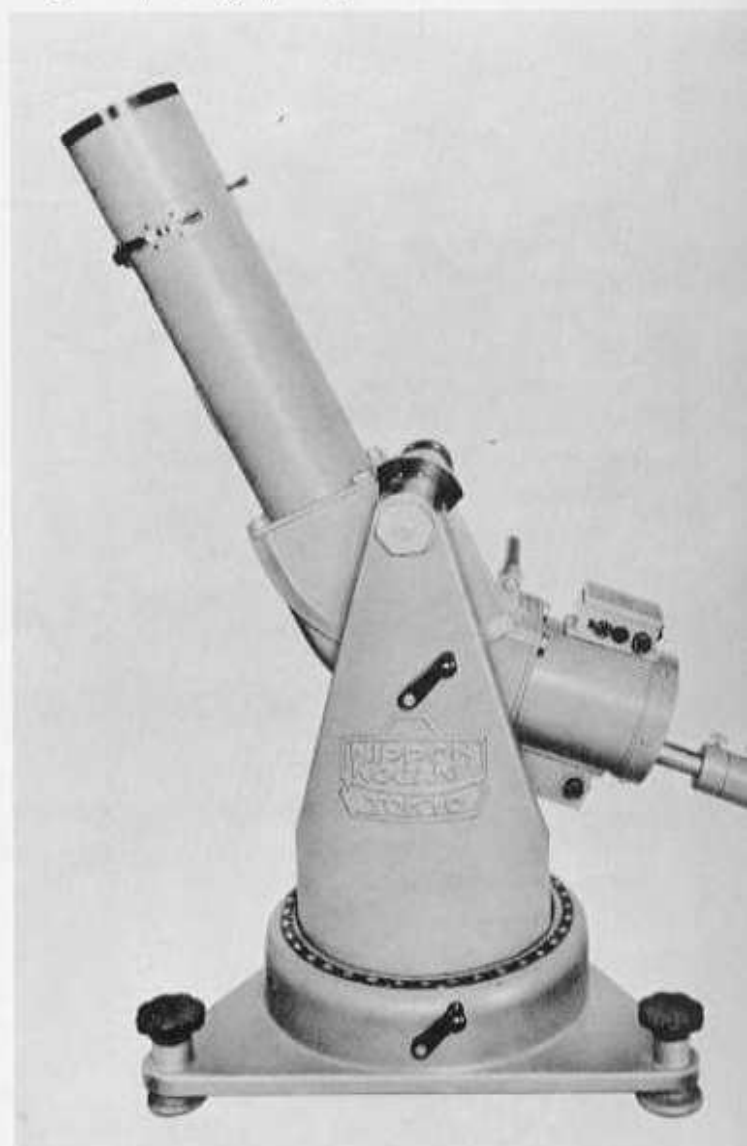
Vertical movement: 0°—90°

Horizontal movement: 0°—360°

7. Height: 2.3m for long focus collimator

1.2m for short focus collimator

Airglow Spectrograph Type 1

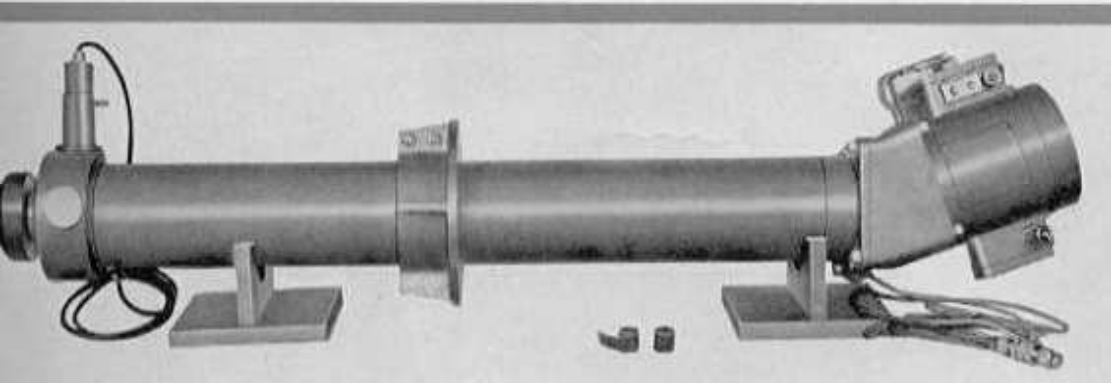


Airglow Spectrograph Type 2

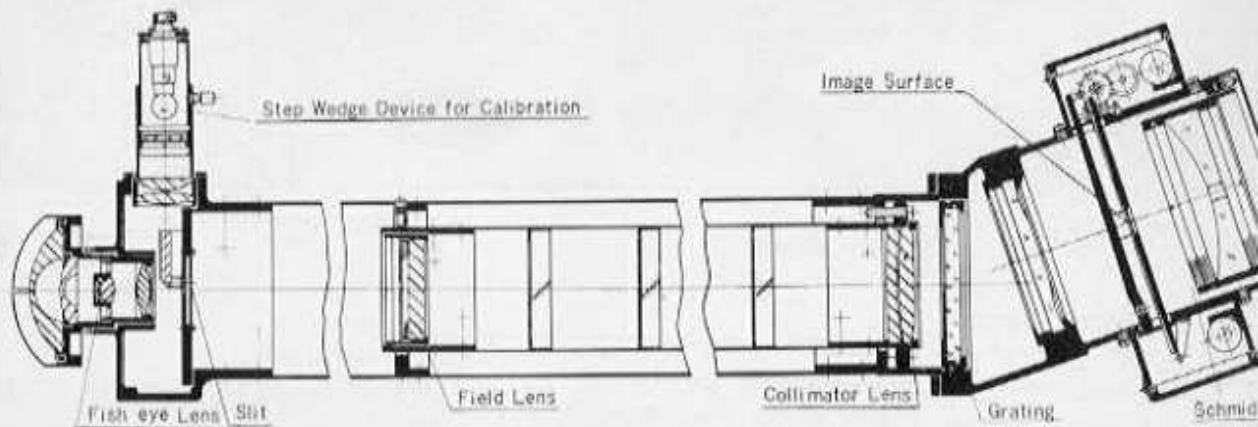
For continuous photography of airglow spectrum. It has a fisheye lens-condenser permitting photography of the spectrum within a zone of $180^\circ \times 2^\circ \dots$ and a Schmidt type camera with focal ratio of 1:0.7 for extremely shortened exposure time.

1. Range of wave length: 3400A - 6800A
2. Condenser
Fisheye type
Field of view: $180^\circ \times 2^\circ$
Focal ratio: 1:7.6
3. Collimator
Aperture: 80mm
Focal length: 610mm
Slit length: 30mm, width: 0-3.6mm

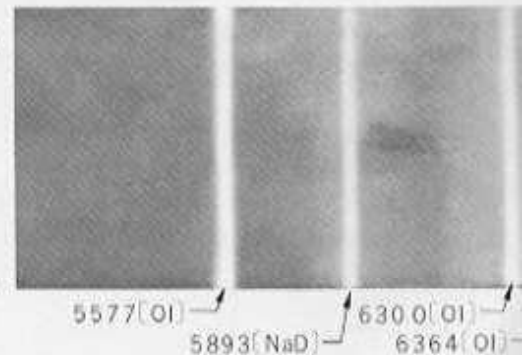
4. Grating
Transmission type made by Basuch & Lomb
Grooves/mm: 600
Ruled area: 75 x 75mm
Blaze wave length: 5000A
Linear dispersion: 330A/mm at 5130A
Resolving power: 45000
5. Camera
Schmidt type
Focal length: 70mm
Focal ratio: 1:0.7
Size of image: 5 x 15mm
Film: 16mm cine film
6. Step wedge for calibration
0-2.1 density (8 steps)
7. Film drive
Interval of automatic film drive: 10-30min.
8. Length of instrument: 1.3m



Airglow Spectrograph Type 2



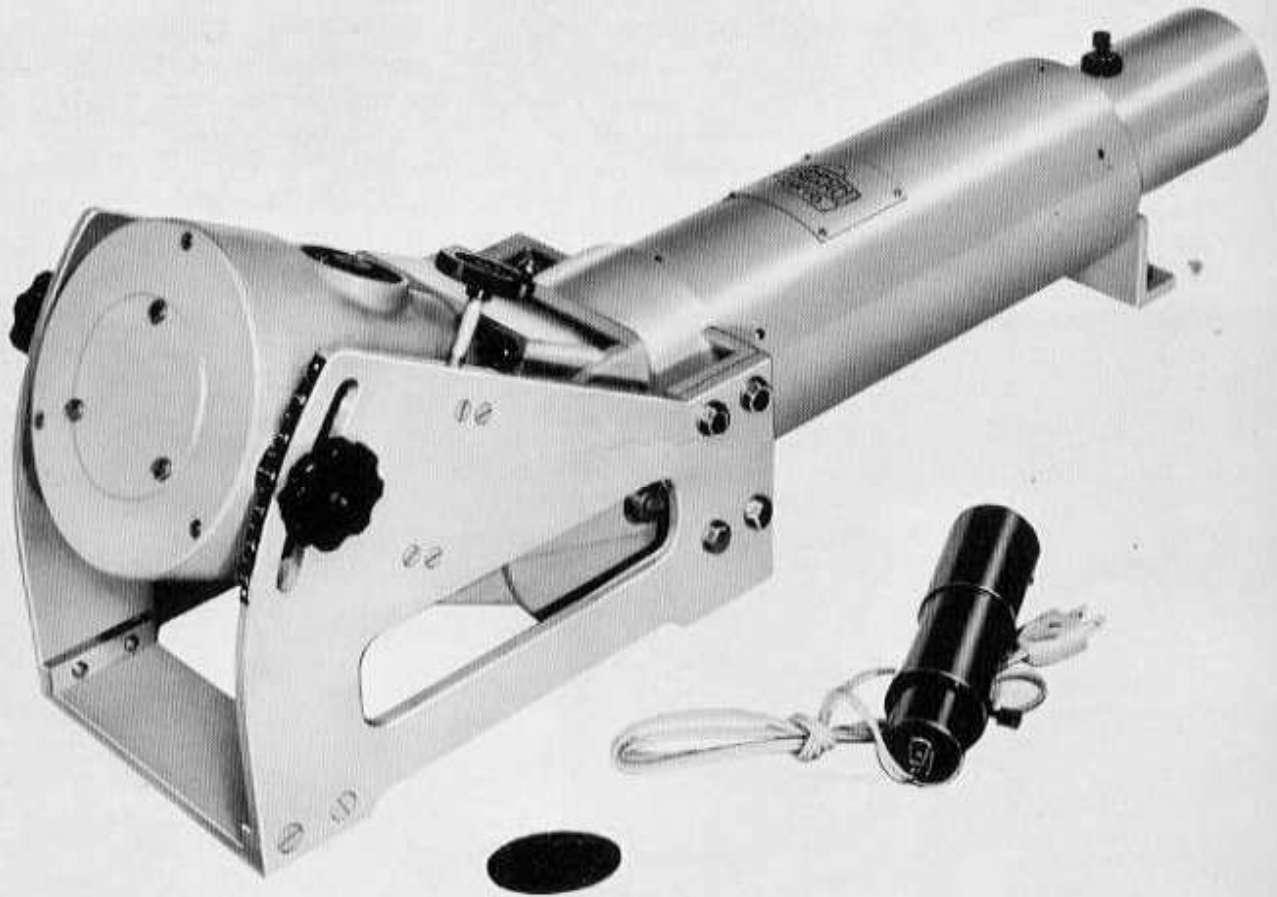
South horizon
Zenith
North horizon



Airglow Spectrograph Type 3

Projects an image of the airglow spectrum on the image converter tube.

It has a Schmidt type camera with focal ratio of 1:0.7, permitting extremely short exposure time.



1. Wavelength range : 5000A - 10500A

2. Slit

Length : 30mm

Width : 0-2.0mm Variable

3. Collimator lens

Achromat-doublet

Aperture : 100mm

Focal length : 450mm

4. Grating

Reflection type made by Bausch & Lomb

Ruled area : 75x75mm

Grooves/mm : 600

Blaze wavelength : 5000A

Linear dispersion : 330A/mm at 5130A

Resolving power : 45000

5. Camera lens

Schmidt type

Aperture : 100mm

Focal length : 70mm

Focal ratio : 1:0.7

Effective film area : 15x5mm (16mm film)

Image surface : Cylindrical

Field of view : 12°

6. Step wedge for calibration

0-2.1 density (8 steps)

7. Size

Height : 0.8m

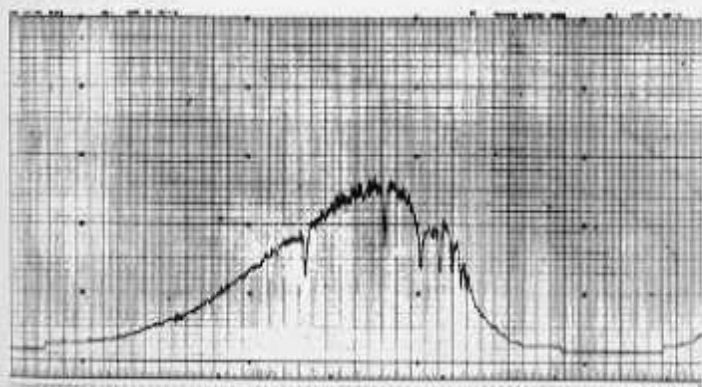
Airglow Spectrograph Type 3

Photoelectric Photometer

May be installed at the focus of any astronomical telescope.
It is used for introducing stellar light to a photoelectric auto-recording unit.
If necessary, a Spectro Scanning Photoelectric Photometer is provided.



Photoelectric Photometer



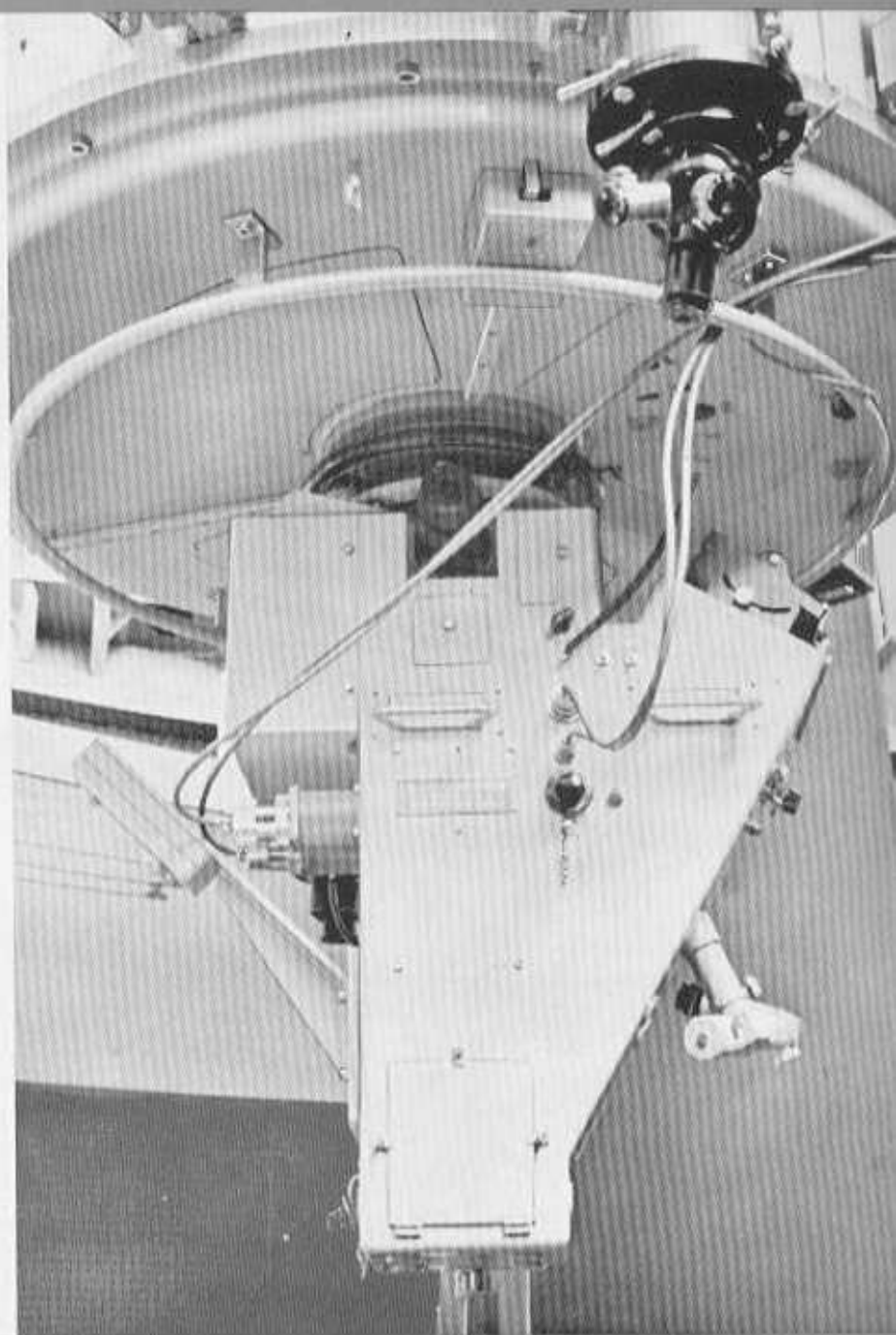
1. Eyepiece (diagonal system)
Focal length: 60mm
Field of view: 30mm diameter
2. Optical system for guiding with reticle
Magnification: 10 \times , 20 \times
Field of view: 9mm
diameter of hole: 0.5, 1.0, 2.0mm
3. Condenser lens of fused quartz
Diameter: 15mm
Focal length: 80mm
4. Filters: U, B, V, filter system
Filters for three or multicolor photometry.

Grating Spectrograph

For taking spectrograms of celestial bodies at the focus of a telescope. For example, as installed in the Cassegrain focus of the 91cm (36 inch) Reflector at Dodaira Station of the Tokyo Astronomical Observatory.

Its grating is interchangeable with other gratings or with Littrow type prism.

The entire spectrograph is hermetically sealed and temperature controlled.



Grating Spectrograph

1. Range of wave length: 3500Å–8000Å
2. Inverted Cassegrain type collimator

Focal length: 850mm
 Focal ratio: 1:15
 Slit length: 10mm (max.)
 Slit width: 0.01–1mm

3. Dispersion system

Grating

- a) Reflection type made by Bausch & Lomb

Grooves/mm: 600
 Blaze wave length: 5000Å
 Ruled area: 65×76mm
 Linear dispersion: 45Å/mm at 4340Å
 Resolving power: 30000

- b) Littrow type 30° prism

Glass material: BaF3 (Schott type)
 Linear dispersion: 60Å/mm at 4340Å
 Resolving power: 13000

4. Camera

Focal length: 350mm
 Focal ratio: 1:3.5
 Field of view: 6°30'
 Plate size: 82×107mm

5. Comparison spectra

Light source: Iron arc and Neon discharge tube
 Optical elements are made of fused quartz

6. Viewfinder

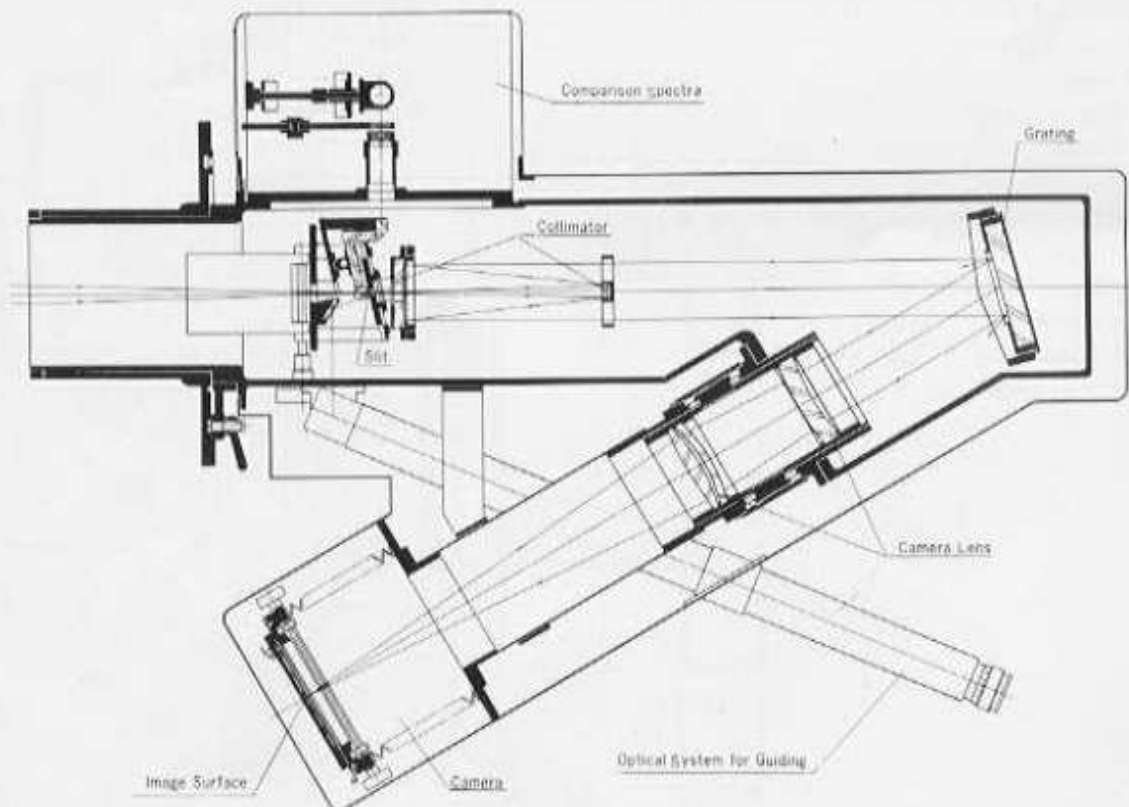
Eye-piece focal length: 80mm
 Field of view: 10°

7. Optical system for guiding with reticle

Magnification: 10×
 Field of view: 10mm on the slit

8. Size and weight

Length: 1m
 Approximate weight: 60kg

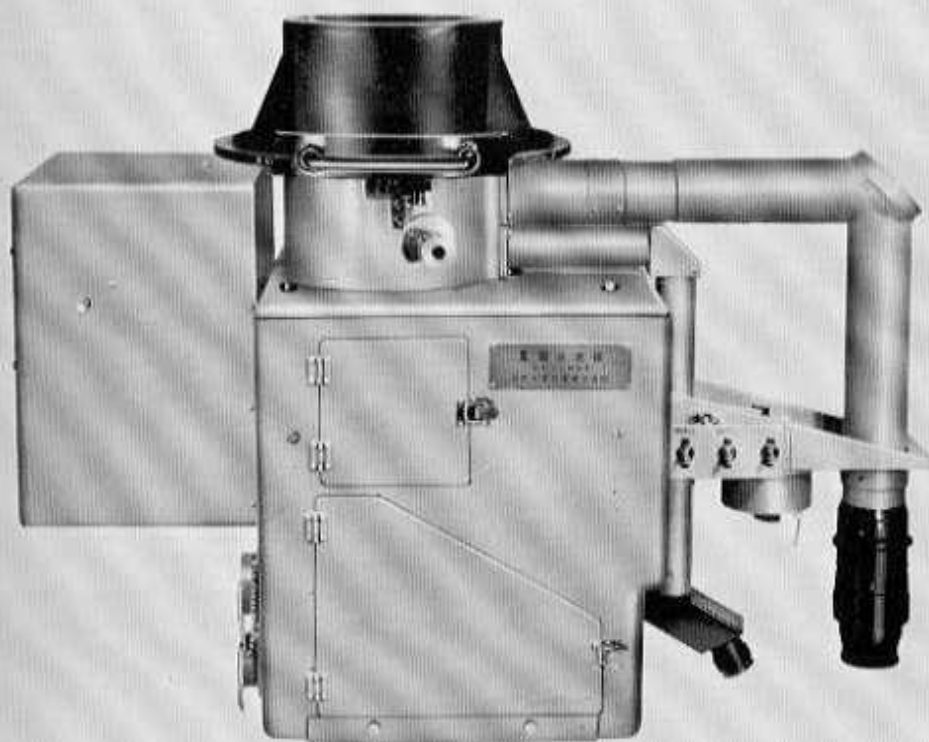


Nebular Spectrograph

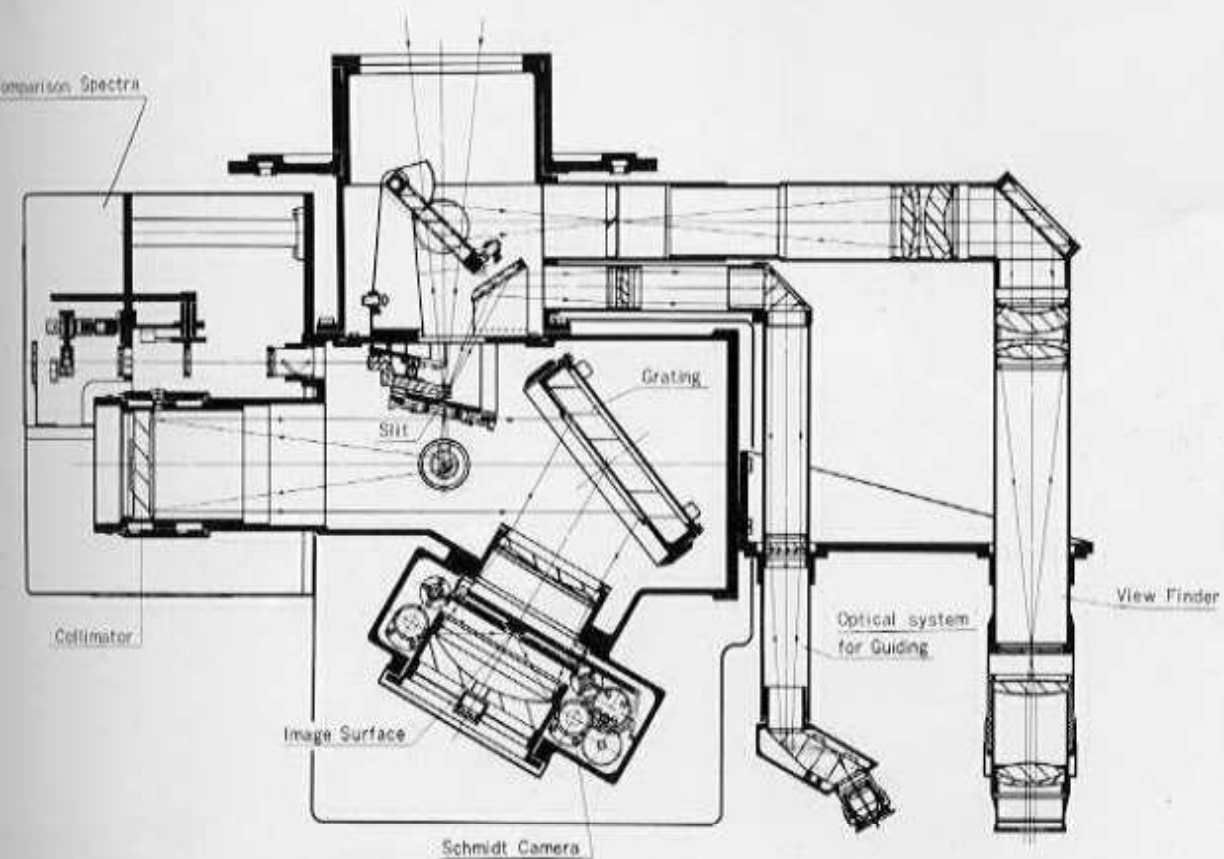
For taking spectrograms of nebulae at the focus of a telescope.

It has a Schmidt type camera lens with focal ratio of 1:0.62 and a 20mm slit that make photography of the weakest nebular light possible.

1. Wavelength range: 3000A–8000A
2. Collimating mirror
 - Aperture: 80mm
 - Focal length: 290mm
 - Slit length: 20mm
 - Slit width: 0.01–2mm
3. Grating
 - Reflection type made by Bausch & Lomb
 - Ruled area: 102×102mm
 - Grooves/mm: 600
 - Blaze wavelength: 5000A
 - Linear dispersion: 290A/mm at 4000A
 - Resolving power: 44000
4. Camera (Schmidt type)
 - Aperture: 85mm
 - Focal length: 52.5mm
 - Focal ratio: F/0.62
 - Field of view: 12°
 - Film size: 11×8mm, total length 1.5m
 - Image surface: cylindrical
5. Comparison spectra
 - All optical elements are made of fused quartz
 - Light source: Iron-arc, Neon and Argon discharge lamp
6. Viewfinder (diagonal system)
 - Eyepiece focal length: 80mm
 - Field of view: 20'
7. Optical system for guiding
 - Magnification: 10×
 - Field of view: 20' with reticle
8. Size and weight
 - Length: 0.7m
 - Weight: 60kg



Nebular Spectrograph

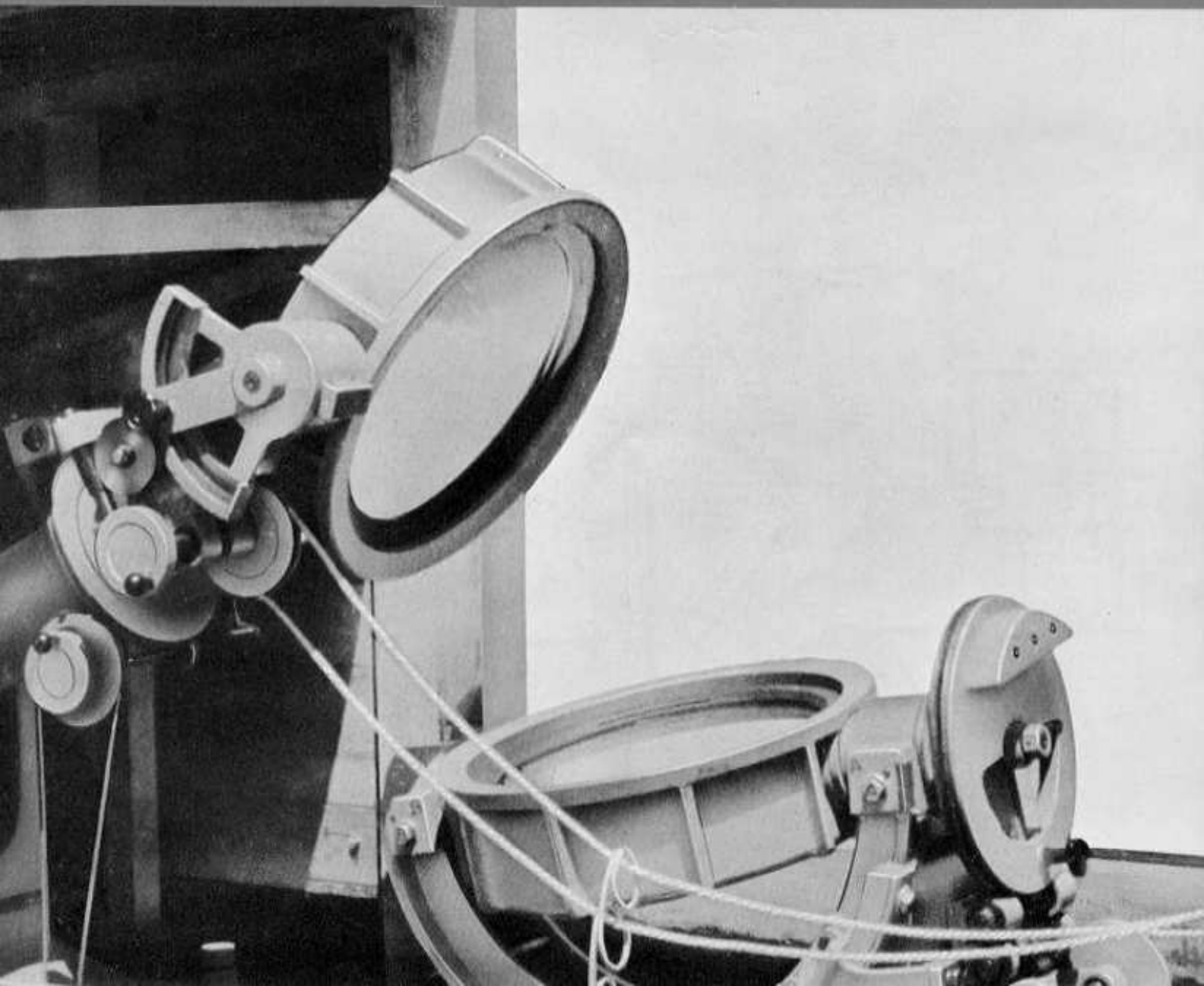


30cm (12 inch) Coelostat

Consists of 300mm primary mirror with a clock driven by weight and a 300mm secondary. It is usually used for solar observation.

1. Primary mirror: Aperture 300mm
2. Secondary mirror: Aperture 300mm
3. Polar axis of primary mirror is adjustable for the latitude $0^{\circ} - 60^{\circ}$
4. Glass material: Low expansion glass ($\alpha = 300 \times 10^{-6}$) or fused quartz supplied on order.
5. Clockwork is driven by weight.

30cm (12 inch) Coelostat



Fisheye Lens Camera for Photographing the Sun

Permits photography of the sun from an airplane. The photographs are used in determining the direction of geomagnetic lines, by measuring the position of the sun and relating this to time and other data.

1. Sun camera

Lens: Fisheye lens
Focal length: 8mm
Focal ratio: F/8
Field of view: 180°
Built-in filter: 6 sorts
Camera: NIKON F with Motor Drive

2. Camera for chronometer and coast line

a) For chronometer

Focal length: 35mm
Focal ratio: F/2.8
Field of view: 62°
Nikon F with Motor Drive

b) For coastline

Focal length: 58mm
Focal ratio: F/1.4
Field of view: 41°
NIKON F with Motor Drive

c) Accessories: Filters

3. Remote control equipment for Motor Drive

4. Regulative equipment

a) *Leveling device*: Consists of a circular and two tubular levels

b) *Plane angle measuring telescope*

Aperture: 15mm
Magnification: 5×
Field of view: 9°30'

5. Film reading device

a) *Magnification*: 10×

b) *Screen size*: diameter 270mm

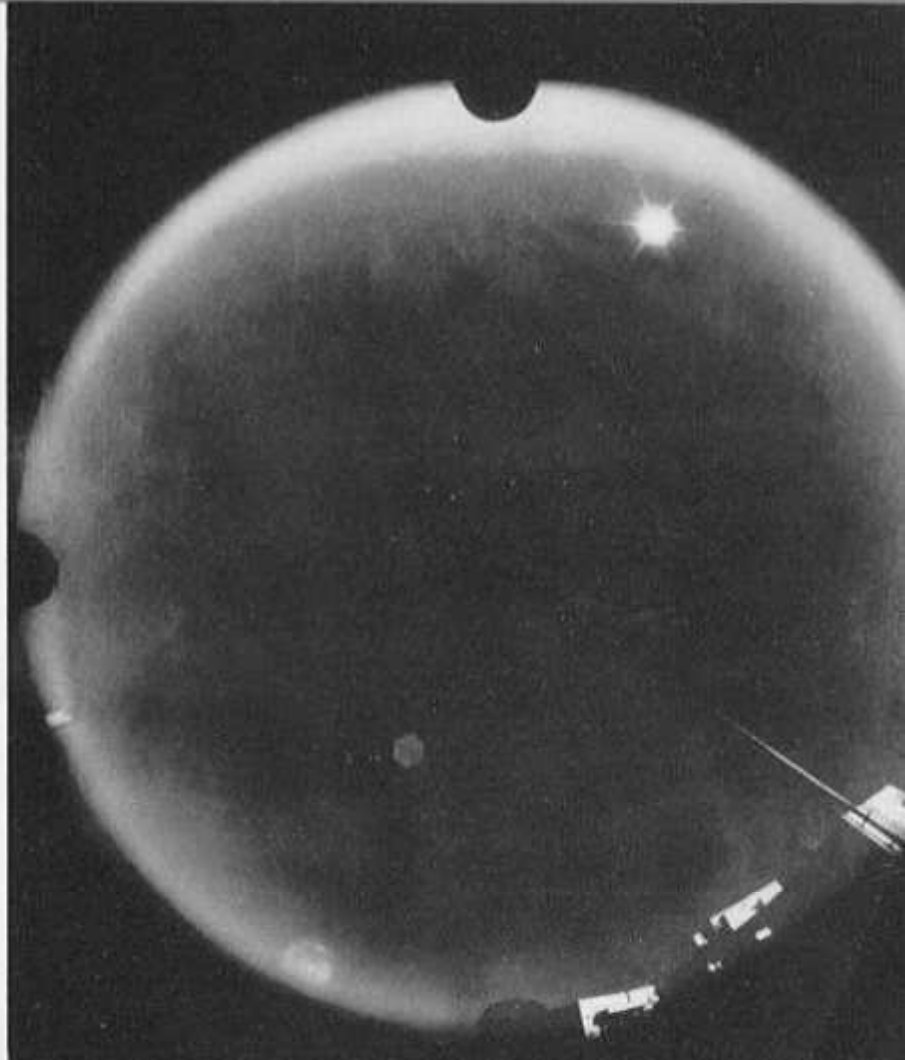
c) *Micrometer stage*

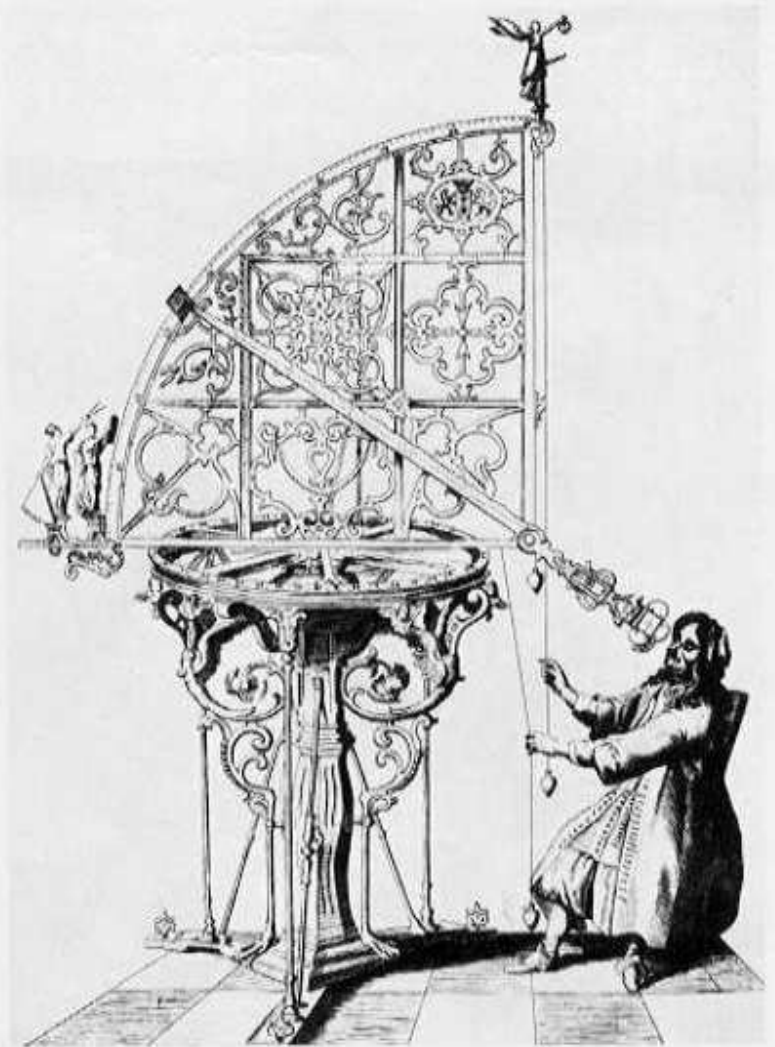
Traveling range: 50×25mm, 1 div. 5μ
Rotation: 360°, 1 div. 1°, reading 2' by vernia

d) *Film leader with a counter*

6. Size: 500×350×250mm

Fisheye Lens Camera for Photographing the Sun





3. MEASURING APPARATUS

Self-Recording Microphotometer

Direct-intensity type used for accurate measurement of stellar spectrograms.

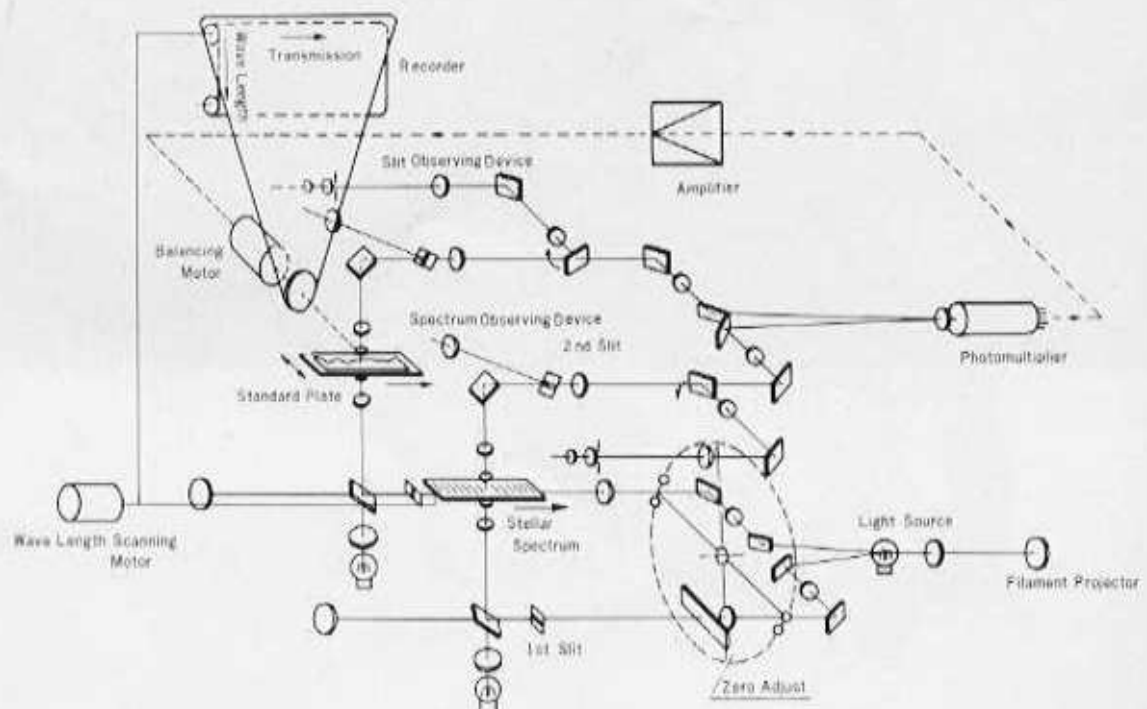
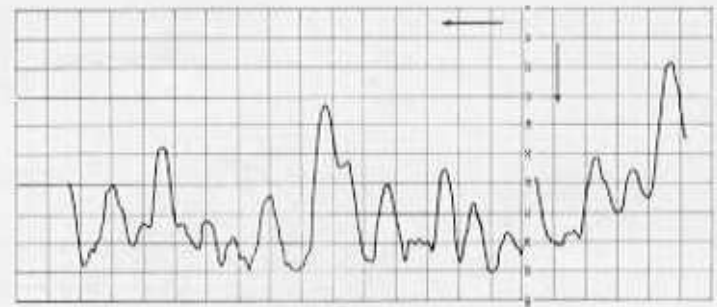
It records linear intensity curves or density curves, effecting automatic comparison of the stellar spectrograms with a standardized plate.

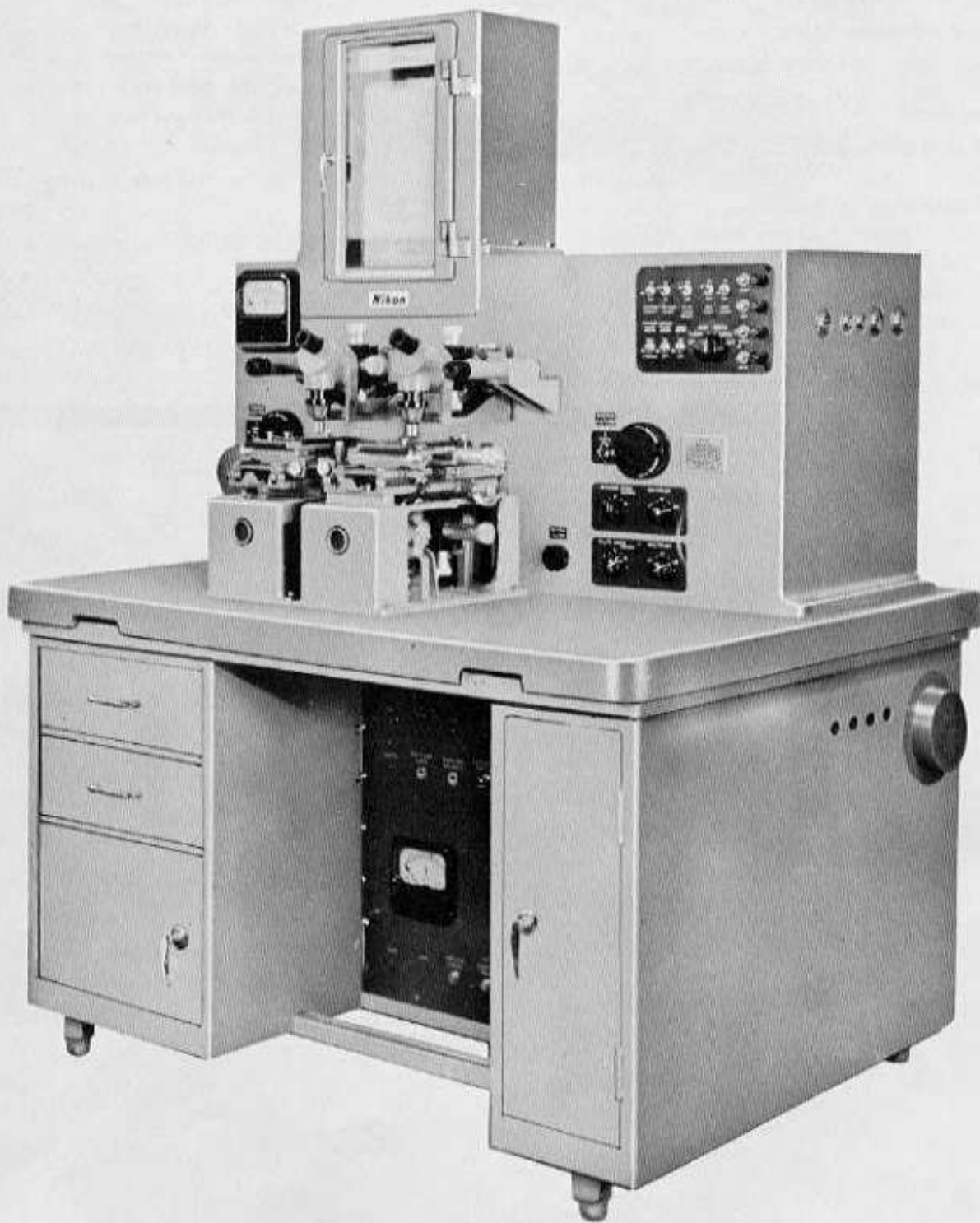
The automatic photometry is accomplished by the zero method with a split and chopped beam and servo-mechanism. Magnification of the motion in the direction of the dispersion is 1/500–500 times.

This microphotometer can also be used as an ordinary densitometer by employing a standard wedge in place of the standardized plate.

1. Range of measurement: 0–3 Density for 3500A–7000A
2. Plate stage
 - Traveling range of measuring plate: 110mm (manual and automatic)
 - Traveling speed of measuring plate: 0.2mm/min. – 100mm/min. (9 steps)
 - Traveling range of standardized plate: 110mm (manual and automatic by programming)
 - Adjustment mechanism to set for both plates
 - Plate size: 107×41mm (max.)

3. Slit
 - a) 1st slit: Width 0.005–1mm, length 0.005–1mm on the plate
 - b) 2nd slit: Width 0.005–1mm, length 0.005–1mm on the plate
4. Detector: EMI 9524 Photomultiplier
5. Pen recorder
 - a) Paper speed: 0.2mm/min. – 100mm/min. (9 steps)
 - b) Pen speed: 2–3 sec. for full scale
Recording with magnification 3× is possible if the density range of measuring plate were narrow.
6. Accessory optical device
 - a) Spectrum observing device
 - b) Slit observing device
7. Light source: 10V, 50W Tungsten lamp with stabilizer
8. Bed is made of steel and cast iron.
9. Size and weight
Size: 1.2×1.0×1.6m
Approximate weight: 700kg





Self-Recording Microphotometer

Plate Standardizing Spectrograph for Self-Recording Microphotometer

For standardizing the plate needed in photometry of stellar spectrograms.

Two types of standardized plates are obtained by changing the diaphragm in front of the collimator:

- a) Linear intensity scale
- b) Logarithmic intensity scale

1. Spectral range: 3500A–7000A
2. Size of spectrum: Dispersion way: 80–100mm
Density way: 15mm

3. Optical system

a) *Slit*: length: 15mm, Width: 0.1–3mm

b) *Collimator lens*:

Aperture: 50mm

Focal length: 450mm

c) *Grating*

Transmission type made by Bausch & Lomb

600 grooves/mm

Ruled area: 52×52mm

Linear dispersion: 370A/mm at 5000A

Resolving power: 31000

d) *Camera lens*

Aperture: 50mm

Focal length: 450mm

4. Light source: 8V, 50W lamp (with ribbon tungsten filament, with stabilizer and time switch)

5. Plate size: Maximum 117×41mm

6. Step wedge for exposure time adjustment: 0–2.0 Density (5 steps)

7. Bed is made of steel

8. Size

Length: 1.6m

Height: 1.3m

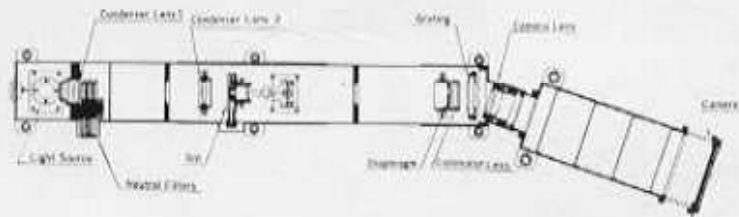
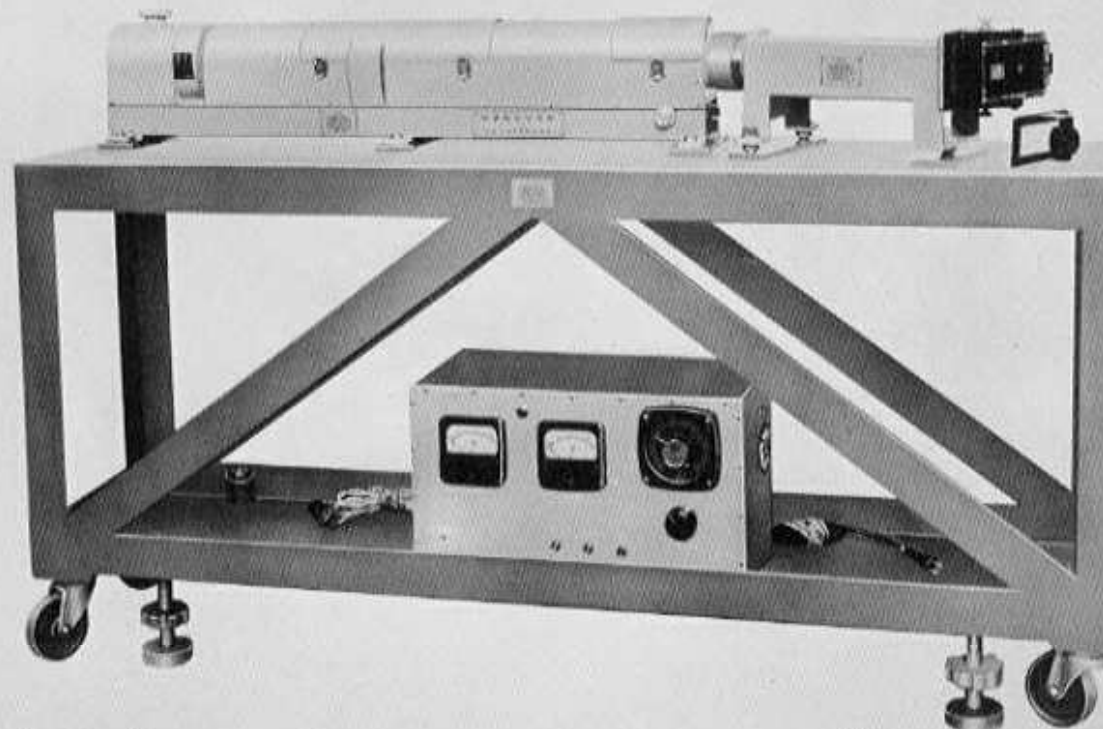


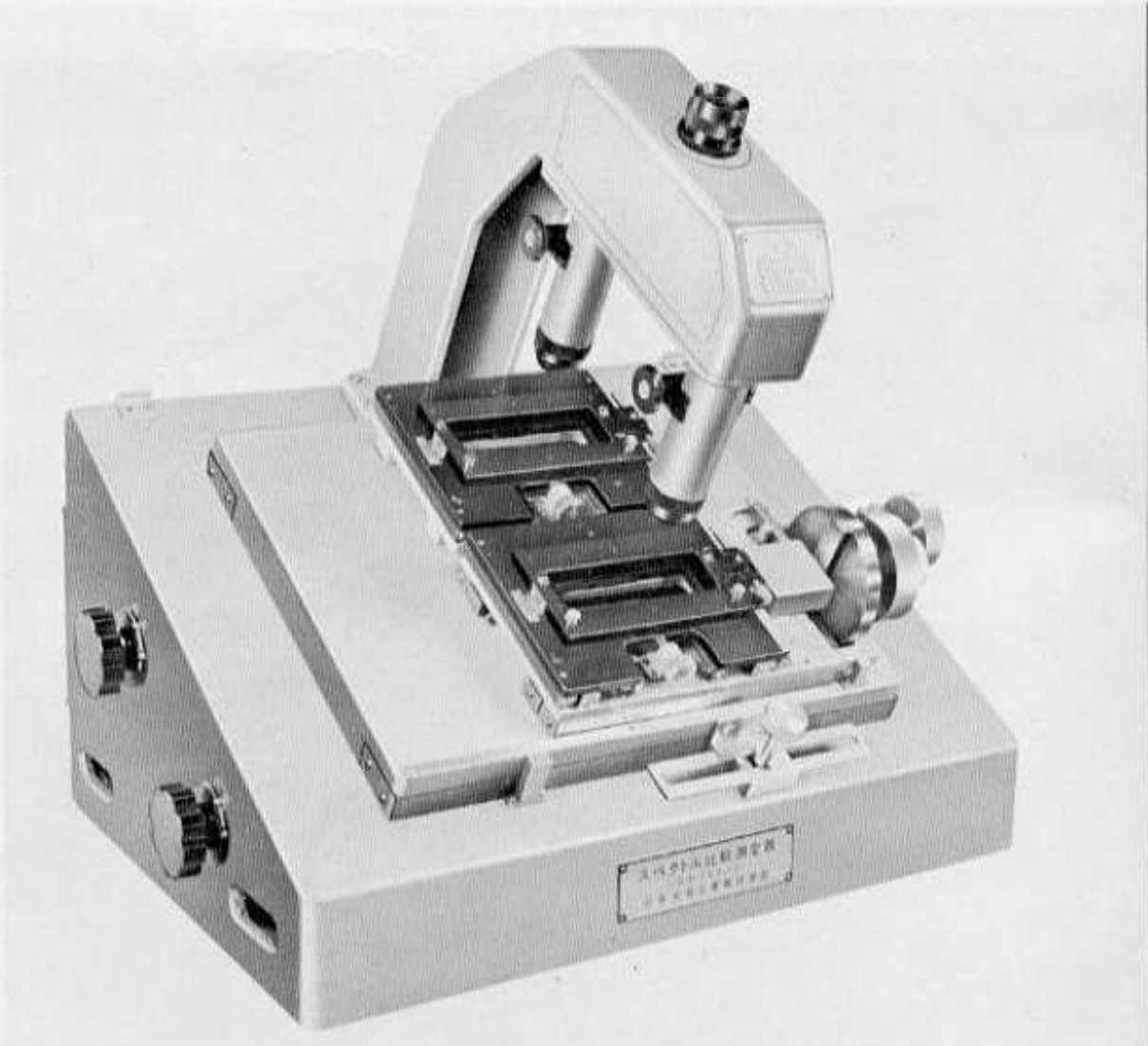
Plate Standardizing Spectrograph for Self-Recording Microphotometer



1. Plate size: max. 41 × 107mm
2. Plate stage
Range of travel: 150mm, 1 div. 0.1mm
Adjustment device: Crosswise travel ± 5mm and rotation ± 3°
3. Micrometer
Measuring Range: 15mm, 1 div. 1μ
4. Optical System
Magnification: 25× and 37.5×
Field of view: diameter 7mm on the plate
Zooming system
Range: ± 25% for standard and measuring plate side simultaneously
± 5% for standard and measuring plate side independently
5. Illumination
2 fluorescent lamps: 100V 10W
6. Size and weight
Size: 570 × 460 × 550mm
Weight: 40kg

Spectro Comparator

A Hartmann type comparator to be used for comparing two stellar spectrograms. It is mainly used for measurement of radial velocity, and is provided with a micrometer accurate to one micron.



Spectro Comparator

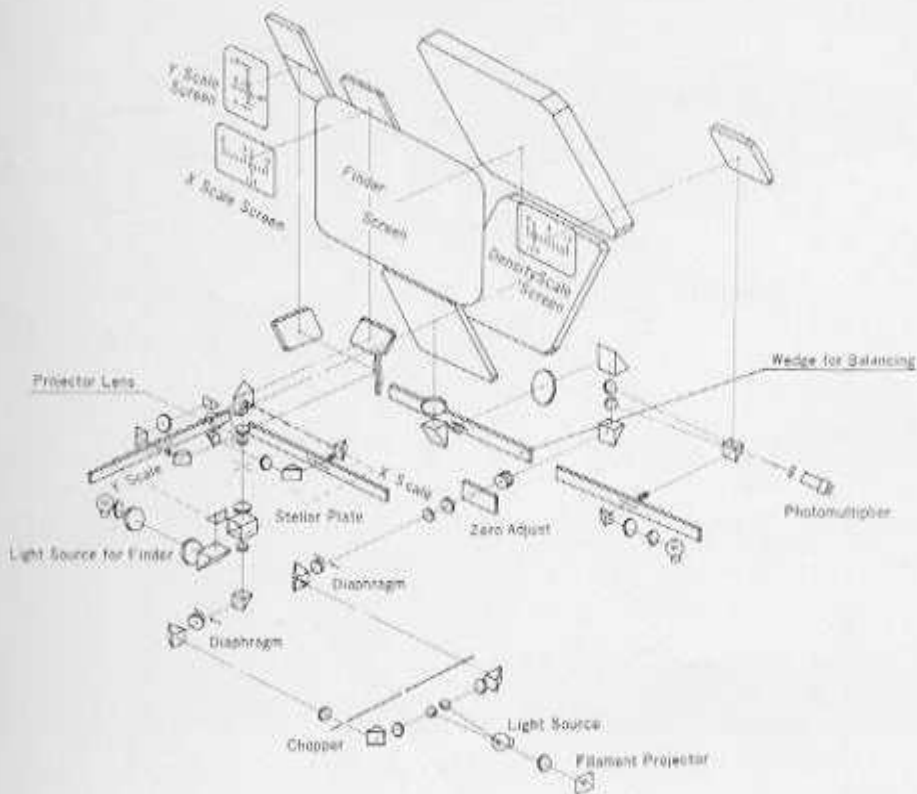
Densitometer for Astrographic Plate

For photographic photometry of stars. Measurement is made by the zero method with split and chopped beams, and servo-mechanism.

It is provided with a viewfinder for accurate setting and several diaphragms which are used in accordance with the sizes of the star images on the plate.

Density value and coordinates are easily read on the screen.

1. Measuring range: 0–3 Density
2. Plate size: max. 150×150mm
3. Plate stage
Traveling range: 160×160mm
Reading scale: Projection system 1 div. 0.1mm
Rotating: 360°, 1 div. 1°
4. Diaphragms: Diameter: 0.1–2mm (5 steps) on the plate
5. Viewfinder
Size of screen: 200×150mm
Magnification: 20x
6. Density measuring part
Wedge for balancing; Length: 150mm for 0–3 Density
Density scale: Projection system 1 div. 0.1mm (0.002 Density)
7. Measuring accuracy: 0.01 stellar magnitude
8. Zero adjusting device: Neutral density wedge and neutral density filters
9. Light source: 10V, 70W lamp (with tungsten filament) with stabilizer
10. Bed is made of steel and cast
11. Size and Weight
Size: 1.2×1.2×1.4m
Approximate weight: 600kg



Densitometer for Astrographic Plate



Blink Comparater

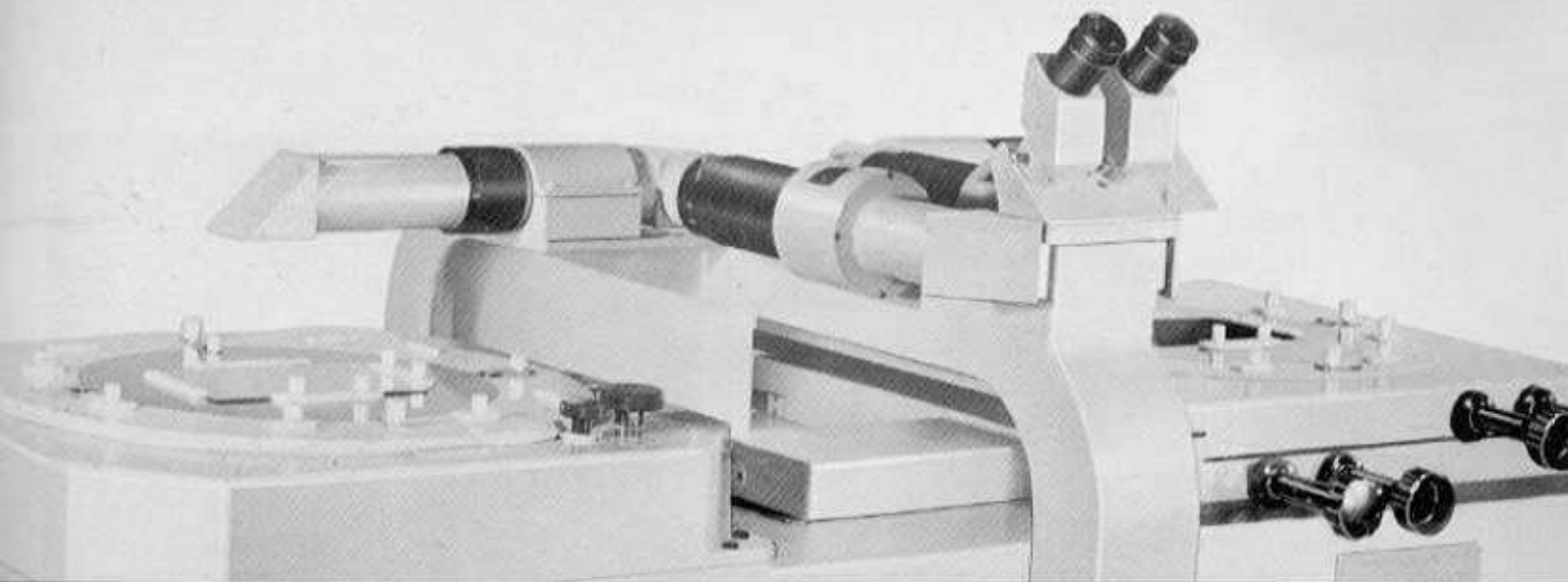
For detection of the movement of stars and discovery of new stars.

In operation, two photographic plates of the same star field are compared with each other by alternate illumination and monocular observation or by constant illumination and stereoscopic observation.

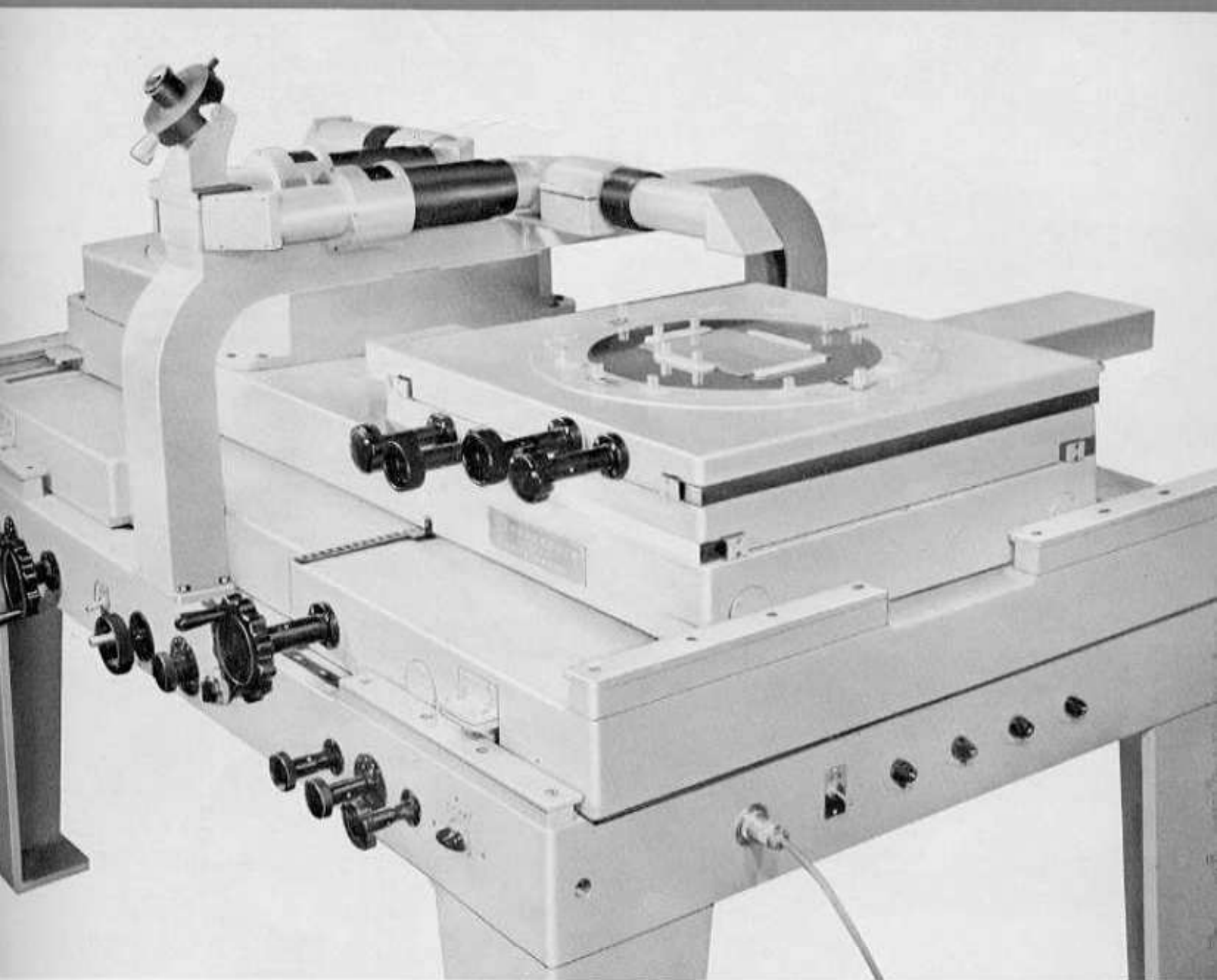
1. Plate size : max. 305 × 305mm
2. Plate stage
 - a) Range of crosswise travel : 300 × 300mm
 - b) Adjusting devices
One by crosswise travel : 160 × 160mm
and the other by rotation : 360°

3. Optical system

- a) **Eyepieces**
For monocular and binocular
Magnification : 5 ×, 10 ×, 15 × and 20 ×
Field of view : 20mm, 12mm and 8mm
- b) **Zooming system** : Ratio 2
- c) **Filar micrometer**
Measuring range : 10 × 10mm
4. Blink period : 0, 1/2, 1/5 and 1/10 second
5. Image rotating prism is provided in both paths individually
6. Illumination
2 projector lamps : 100V, 100W
7. Bed is made of cast iron.
8. Size : 1.5 × 1.0 × 1.2m



Blink Comparator

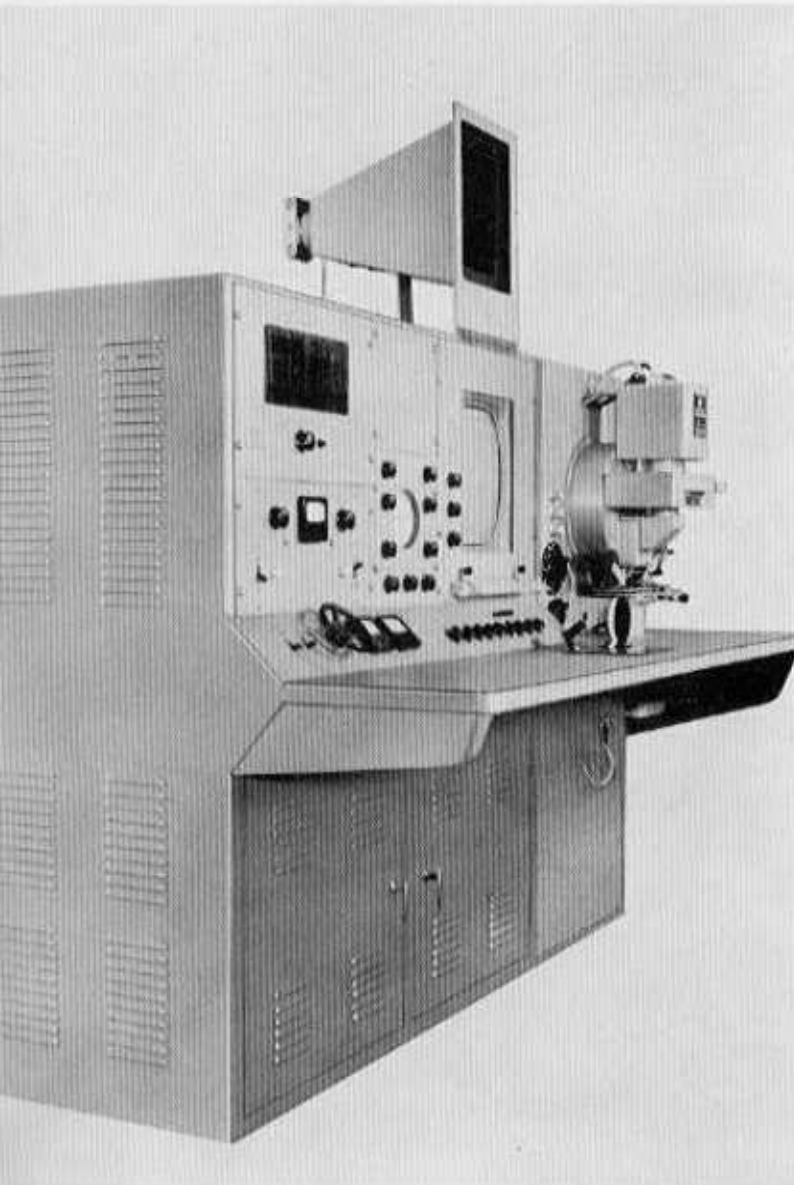
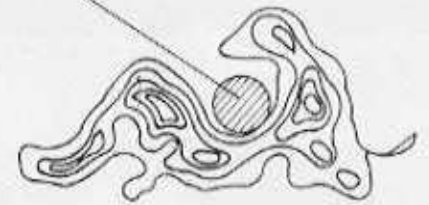


Electronic Isophotometer

Provides an isophoto of solar flare in 0.1 minute by automatically measuring the photographic density of the solar image taken with the H α Monochromatic Heliograph. It consists of a flying-spot cathode ray tube as light source, an optical system, two photomultipliers, a pulse counter, a cathode ray measuring tube and a recording camera.



Sunspot



1. Accuracy
 - a) Density: ± 0.01 for the photographic density in the range from 0 to 1.0
 - b) Area: $\pm 3\%$
2. Measuring time: 0.1 sec. for 1 isophoto-curve
3. Flying-spot cathode ray tube: RCA 5ZP16
4. Wavelength of maximum brightness: 3700A
5. Magnification of image: 1 \times , 3 \times , 6 \times
6. Detector: RCA 6217 Photomultiplier
7. Cathode ray tube for measuring: "National AW36-21" (14 type)
8. Counter
A pulse counter for the area measurement is provided.
9. Power supply
10. Size: 1.5 \times 1.5 \times 0.4m

Electronic Isophotometer

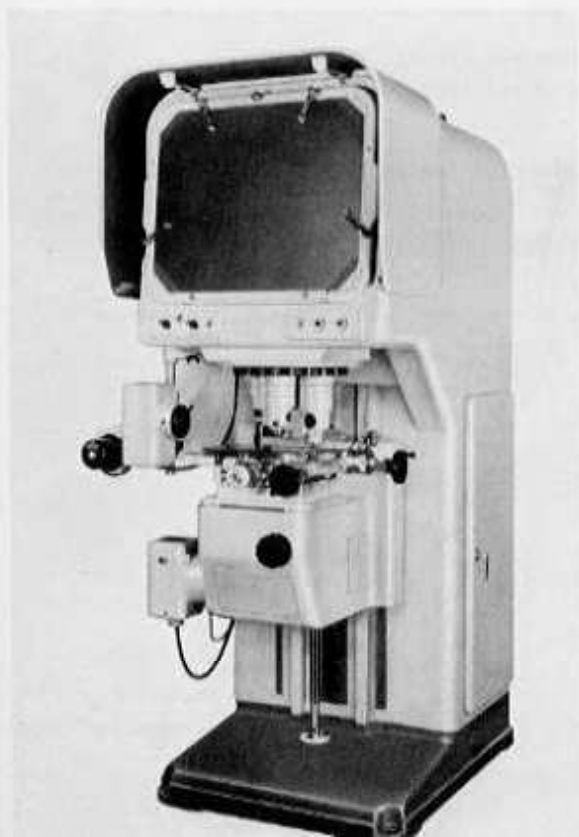
SHADOWGRAPHS

The Shadowgraph is an optical projector, originally designed for producing correctly enlarged images of a variety of minute objects, is efficiently used for astronomical purposes, for example, for observing and measuring photographic images of stars, sunspots, prominences, flares, stellar spectrograms, etc. On request of the user, the instrument may be subjected to accommodation of attachments such as a micrometer stage with minimum division 1μ , a crosswise travelling stage with the range of $50\text{mm} \times 50\text{mm}$ for coordinate measurement in astronomy, etc.

Shadowgraph Model 5A

Floor type model designed for large capacity and heavy duty

- Accuracy of magnification of projected image
 - Within $\pm 0.1\%$ in transmitting illumination
 - Within $\pm 0.15\%$ in reflecting illumination
- Viewing screen
Size of ground glass: $450 \times 550\text{mm}$
Interchangeable with protractor or photographing screen
- Projection lenses
Magnification: $10 \times$ $20 \times$ $25 \times$ $31.25 \times$
Object field: 60mm 30mm 24mm 19.2mm
(With attachable half-reflecting mirror)
Magnification: $50 \times$ $62.5 \times$ $100 \times$ $200 \times$
Object field: 12mm 9.6mm 6mm 3mm
(Built in half-reflecting mirror)
- Micrometer stage type P
Available in metric or inch system
Surface area: $360 \times 150\text{mm}$
Crosswise travel: $150 \times 50\text{mm}$
Minimum micrometer division: 0.005mm
Travel range over 25mm is obtained by use of block gages which are supplied with the stage.
- Size and weight
Size: $1.8 \times 0.9 \times 1.1\text{m}$
Approximate weight: 680kg



Shadowgraph Model 6C

Bench type design makes this model particularly comfortable for continuous seated operation.

- Accuracy of magnification of projected image
 - Within $\pm 0.1\%$ in transmitting illumination
 - Within $\pm 0.15\%$ in reflecting illumination
- Viewing screen
Diameter of ground glass: 300mm
Interchangeable with protractor or photographing screen
- Projector lens
Magnification: $10 \times$ $20 \times$
Object field: 30mm 15mm
(with attachable half-reflecting mirror)
Magnification: $50 \times$ $75 \times$ $100 \times$
Object field: 6mm 4mm 3mm
(Built in half-reflecting mirror)
- Stage
 - Crosswise traveling stage
Surface area: $200 \times 150\text{mm}$
Stage glass: $80 \times 120\text{mm}$
Crosswise travel: $25 \times 40\text{mm}$
 - Micrometer stage
Available in metric or inch system

	Type A	Type O	Type E
Surface area:	160mm in dia.	$150 \times 280\text{mm}$	150mm in dia.
Stage glass:	90mm in dia.	$120 \times 140\text{mm}$	
Crosswise travel:	$50 \times 25\text{mm}$	$100 \times 50\text{mm}$	$25 \times 25\text{mm}$
Minimum micrometer division:	0.005mm	0.005mm	0.01mm
Angular graduation:	One division		
	$1''$ ($2'$ with vernier)		$1''$ ($2'$ with vernier)
Travel range over 25mm is obtained by block gages supplied with the stage.			
- Size and weight
Size: $0.9 \times 0.5 \times 0.7\text{m}$
Approximate weight: 60kg



SUPPLY LIST

1. TELESCOPES

91 cm (36 inch) Reflector for Photoelectric Photometer	Okayama Astrophysical Observatory of the Tokyo Astronomical Observatory	19
91 cm (36 inch) Reflector	Dodaira Station of the Tokyo Astronomical Observatory	19
30 cm (12 inch) Reflector	Tokyo Astronomical Observatory	19
	Okayama Astrophysical Observatory of the Tokyo Astronomical Observatory	19
	Tohoku University (Sendai)	19
	Konan High School (Ashiya) and others	19
20 cm (8 inch) Refractor	National Science Museum (Tokyo) and others	19
15 cm (6 inch) Refractor	Akashi Astronomical Museum	19
	Nagoya Astronomical Observatory	19
	The Defence Academy (Yokosuka) and others	19
Solar Tower Telescope	Gotoh Planetarium & Astronomical Museum (Tokyo)	19
Floating Zenith Telescope	Latitude Observatory (Mizusawa)	19

2. SPECTROGRAPHS AND OTHERS

Spectroheliograph	Tokyo Astronomical Observatory	19
Monochromatic Heliograph	Magnetic Observatory (Kakioka)	19
Coronagraph	Norikura Corona Station of the Tokyo Astronomical Observatory	19
K-Coronameter	"	19
Auroral Spectrograph	Tokyo Astronomical Observatory	19
Airglow Spectrograph Type 1	Niigata University	19
Airglow Spectrograph Type 2	University of Tokyo (Kakioka)	19
Airglow Spectrograph Type 3	Tokyo Astronomical Observatory	19
Photoelectric Photometer	"	19
Grating Spectrograph	Dodaira Station of the Tokyo Astronomical Observatory	19
Nebular Spectrograph	Okayama Astrophysical Observatory of the Tokyo Astronomical Observatory	19
30 cm (12 inch) Coelostat	Tokyo Astronomical Observatory	19
Fisheye Lens Camera for Photographing the Sun	The Maritime Safety Agency Hydrographical Department	19
50cm Schmidt Telescope	Dodaira Station of the Tokyo Astronomical Observatory	19

3. MEASURING APPARATUSES

Self-Recording Microphotometer	Okayama Astrophysical Observatory of the Tokyo Astronomical Observatory	19
Plate Standardizing Spectrograph for Self-Recording Microphotometer	"	19
Spectro Comparator	"	19
Densitometer for Astrographic Plate	"	19
Blink Comparator	Tokyo Astronomical Observatory	19
Electronic Isophotometer	"	19



Inv. n. 13549 / BA0A

Photo Credit: All astronomical photos by
Tokyo Astronomical Observa

NIKON PRODUCTS

Cameras & Lenses	Fully Automatic Single Lens Reflex. Nikon F Standard Nikon F Photomic (with built-in exposure meter) Nikkorex F Nikkorex Zoom 35 All Weather Camera: Nikonos 8mm Cine Cameras: Nikkorex Zoom 8, Nikkorex 8F Photographing Lenses: Nikkor Interchangeable Lenses Cine Lenses: Cine-Nikkor & Cine-Zoom Nikkor for 16mm Cine Camera
Microscopes	Nikon Biological Microscopes Nikon Hand Microscope Nikon School Microscopes Nikon Stereoscopic Microscopes Nikon Inverted Microscope (for metallographic & biological microscopy)
Shadowgraphs	Nikon Shadowgraphs (Optical Comparators) Circular screen 300mm bench type 356mm floor type 400mm floor type Rectangular screen 450mm x 550mm floor, heavy duty type
Measuring Instruments	Nikon Autocollimators Nikon Measurescope (Tool-maker's Microscope) Microtester (Optical thickness measurer) Optical Flat, Optical Parallel Glass scales Nikon Dioptrimeter (Vertexometer)
Special Purpose Lenses	APD-Nikkor (photo-engraving lenses) Fax-Nikkor (Electro-fan lenses) Pro-Nikkor (35mm film projector lenses) TV-Nikkor (Television camera lenses) Nikon Video Remote Control Fundus Camera
Surveying Instruments	Nikon Transit Nikon Theodolite Nikon Tilting Levels Nikon Auto Level
Binoculars	Nikon Binoculars 5 x 15, 7 x 15, 7 x 35, 8 x 30, 7 x 50, 9 x 35 Nikon Sports Glass Nikon Binocular Telescopes
Spectacles	Nikon Spectacle Lenses Optical Glasses & Radiation Shielding Glasses Radiation Periscopes & Hot Cell Microscope



NIPPON KOGAKU K. K.

Nishikawa Bldg., Nihonbasi, Tokyo, Japan. 272-3311

NIPPON KOGAKU (USA) INC. 111 Fifth Avenue, New York 3, N.Y., U.S.A. GR 3-675

NIKON AG. Limmattalstrasse 177, Zürich, Switzerland. 562690-1



NIPPON KOGAKU K.K. Tokyo, Japan

Since 1917

Manufacturers of NIKON & NIKKOREX CAMERAS · NIKKOR LENSES · BINOCULARS · TELESCOPES · TRANSITS & LEVELS
MICROSCOPES · OPTICAL MEASURING INSTRUMENTS · OPHTHALMIC LENSES · OPTICAL GLASS