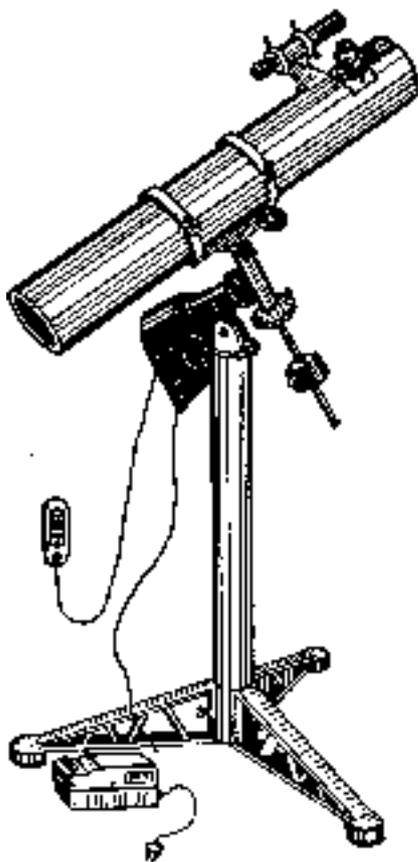


# AMATEUR ASTRONOMER TELESCOPE ТАА-1М (ТАА-1МТ)



Service manual

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**The telescope is subject to continuous development and improvement; consequently it may incorporate minor changes in detail from the information contained herein.**



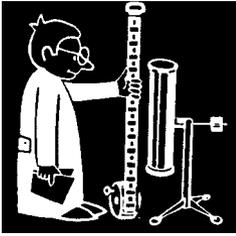
## **1. GENERAL DIRECTIONS**

**The direct observations of the Sun through a black light filter are permitted only with the use of a solar diaphragm.**

Telescope ТАА-1М (ТАА-1МТ) (hereinafter in the text referred to as "telescope") is designed for visual observation of the celestial objects.

The telescope can operate normally at the ambient temperature from 30°C to minus 30°C.

When buying the telescope, one should pay attention to the package safety ensured by the seal of the manufacturing plant. After unsealing the case one should check the compliance of the complete set denoted in the list of enclosure. Prior to using the telescope one gets acquainted with its handling and order of operation.



## 2. SPECIFICATIONS

Diameter of primary mirror	110mm
Focal ratio	f/7.3
Focal length	805mm
Magnification:	
with the eyepiece of $f' = 25\text{mm}$	$32^{\times}$
with the eyepiece of $f' = 10\text{mm}$	$64^{\times}$
with the eyepiece of $f' = 25\text{mm}$ and Barlow lens	$82^{\times}$
with the eyepiece of $f' = 10\text{mm}$ and Barlow lens	$165^{\times}$
Angular field of view of the telescope at magnifications:	
$32^{\times}$	$1^{\circ}29'$
$64^{\times}$	$0^{\circ}43'$
$82^{\times}$	$0^{\circ}33'$
$165^{\times}$	$0^{\circ}16'$
Resolution	$1.3''$
Limiting magnitude	$12^{\text{m}}$
Range of slow-motion control on the declination axis	$\pm 4^{\circ}$
Rotation of the telescope:	
in right ascension	$360^{\circ}(24\text{h})$
in declination	$360^{\circ}$
Polar axis altitude adjustment	$0^{\circ} - 70^{\circ}$
Angular field of view of the finderscope	$8^{\circ}$
Magnification of the finderscope	$6^{\times}$
Minimum distance of observation	$\approx 65$
Voltage of the supplying mains	$220/110\text{V} \pm 10\%$
Current frequency	$50\text{Hz} (60\text{Hz})$
Output voltage of the supply unit	$12\text{V} \pm 10\%$
Overall dimensions of the telescope:	
length tube	850mm
height in the operating position	1650mm
Mass of the telescope	21kg



### 3. STANDARD EQUIPMENT

Name	Qty
Telescope	1
Supply unit	1
Eyepiece of $f'=25\text{mm}$	1
Support	3*
Telescope of $6\times$ magnification	1
Pier	1*
Tripod	1*
Equatorial mounting	1
Bundled conductors	1
Bracket	2
Control panel	1**
Cable for car mains	1**

#### Accessories and Parts

Barlow lens	1
Reticle	1
Eyepiece of $f'=10\text{mm}$	1
Yellow light filter	1
Black light filter (solar)	1
Blue light filter	1
Red light filter	1
Green light filter	1
Neutral light filter (grey, lunar)	1
Blind	1
Holder	1
Stoper	1
Brush	1
Cap diaphragm	1
Screwdriver	1
Napkin	1
Screen (for observation of the Sun)	1

Cover	1
Fuse link ВПТ19-0.16А(220V)	2
Fuse link ВПТ19-0.32А(110V)	2

### **Market Container**

Parking case	1
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### **Service Documents**

Service manual	1
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**\* Telescope can be completed with a metal pier (ТАЛ-1М) or tripod (ТАЛ-1МТ)**

**\*\* Optional accessories**



## 4. TELESCOPE DESIGN AND PRINCIPLE OF OPERATION

The telescope consists of four basic units: the telescope tube, equatorial mounting and pier with supports, supply unit.

**Tube 1** (fig. 1) is the basic part of the telescope which embodies the optical pieces: a primary mirror, a diagonal mirror, finderscope 3 fixed in the locating rings 2, eyepieces and Barlow lens which are inserted in the focusing mechanism 4.

**The primary mirror** (fig. 3) is mounted in the cell and can be adjusted by means of the screws 1 and 2.

**The diagonal mirror.** (fig. 4) is cemented to the cell and fixed in the telescope tube by means of a spider. The inlet hole of the tube is covered with the cap 3 (fig.9) after operation.

**Finderscope 3** (fig.1) is a telescope with  $6\times$  magnification and field of view of  $8^\circ$ .

**The focusing mechanism 4** (fig.1) is composed of a rack and pinion. The pinion axle carries the handwheels which help to move the eyepiece tube. The smoothness of the tube movement can be controlled. For this purpose the left handwheel is held by one hand and the right handwheel is rotated clockwise with some effort relative to the left handwheel by the other hand. The chosen position of the tube can be fixed by the denoted method if necessary.

The telescope is completed with six light filters 7 (fig. 9).

**The equatorial mounting** (fig.5) consists of polar axis 2 and declination axis 6 perpendicular to the polar axis.

Fastened on end of the declination axis is a saddle with hinged clips 4 in which the telescope tube is mounted, fastened on the other end of the axis are counterweights 8 which can move along the axis by thread for balancing the telescope tube. Screen 1 (fig.9) and holder 4 for a camera can be fastened on the same axis as well.

The casing of the polar axis is fastened on bracket 10 (fig.5) provided with a scale of latitudes by which the polar axis is set to the latitude of the observer's site.

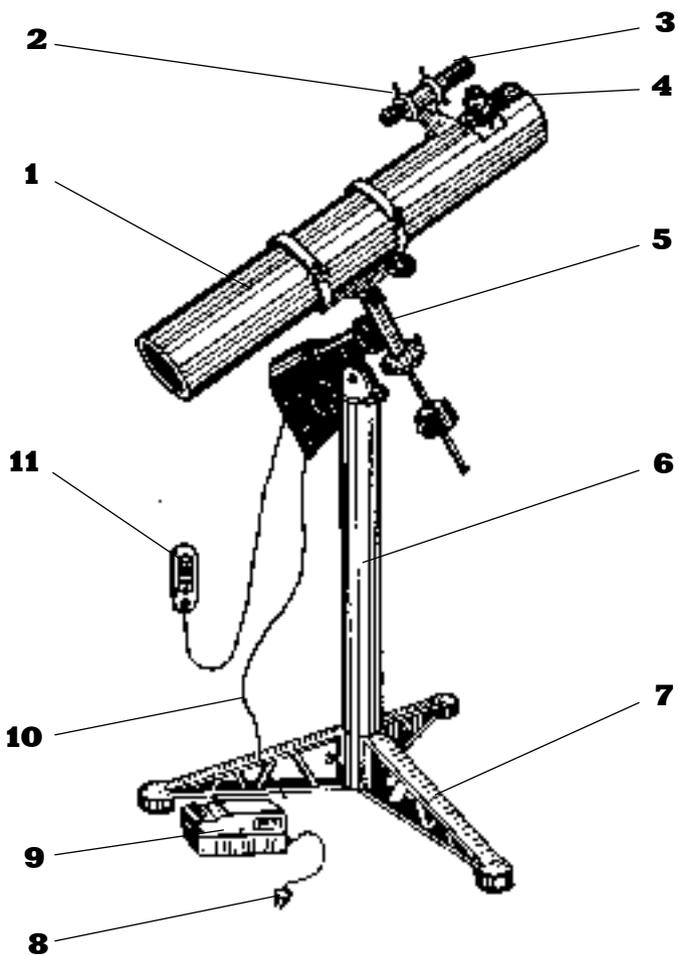


Fig.1. **General view of telescope with metal pier:**

1 - telescope tube; 2 - ring; 3 - finderscope; 4 - focusing mechanism;  
5 - equatorial mounting; 6 - pier; 7 - supports; 8 - cord; 9 - supply unit;  
10 - bundled conductors; 11 - control panel

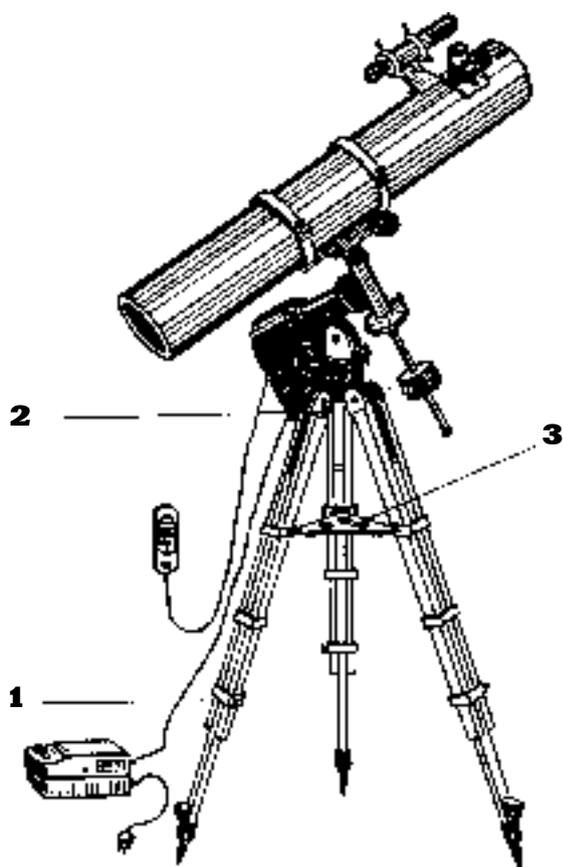


Fig. 2. **General view of telescope with tripod:**

1, 2 - stops; 3 - objects table

The southern (lower) end of the polar axis embodies electric watch drive 11, the northern (upper) end embodies the casing of declination axis 6.

Each axis is provided with a position circle which shows an hour angle and declination of the object visible in the telescope field of view. Position circle 7 on the declination axis which shows the object declination is figured from 0 to 90° with division value of 2°. Circle 1 positioned on the polar axis (the circle of hour angles) is figured from 0 to 24 hours with a division value of 10 min.

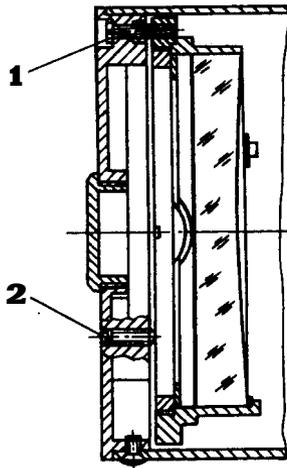


Fig. 3. **Primary mirror:**

1 - set screw; 2 - adjusting screw

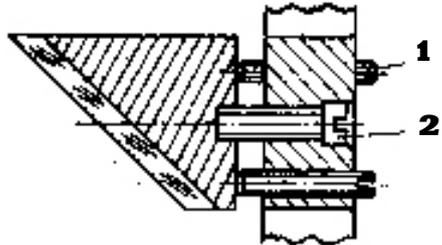


Fig. 4. **Diagonal mirror:**

1 - adjusting screw; 2 - set screw

**The declination axis** has braking screw 3 and mechanism 5 of the fine motion which moves the tube in the range of  $\pm 4^\circ$ . By using this mechanism it is possible to correct the position of the object in the field of view. The equatorial mounting is connected to pier by thread.

**Pier 6** (fig.1) consists of one tube on which three legs are fixed.

**The tripod** (fig. 2) allows to adjust a height of telescope and to fix each leg of tripod with the help of stops 1 and 2.

**Supply unit 9** powers the watch drive tracking the celestial objects. It is designed for 220 V/ 50 Hz (110V/60Hz) mains and activated with the

key. If the control panel is provided the car's mains or storage battery 12V can be used through the car's cable.

**The control panel** (fig.6) is designed to select modes of watch drive by means of buttons 2. The watch drive provides the sun, celestial and moon speed modes. The control panel is equipped with the local lighting which can be switched on by button 4.

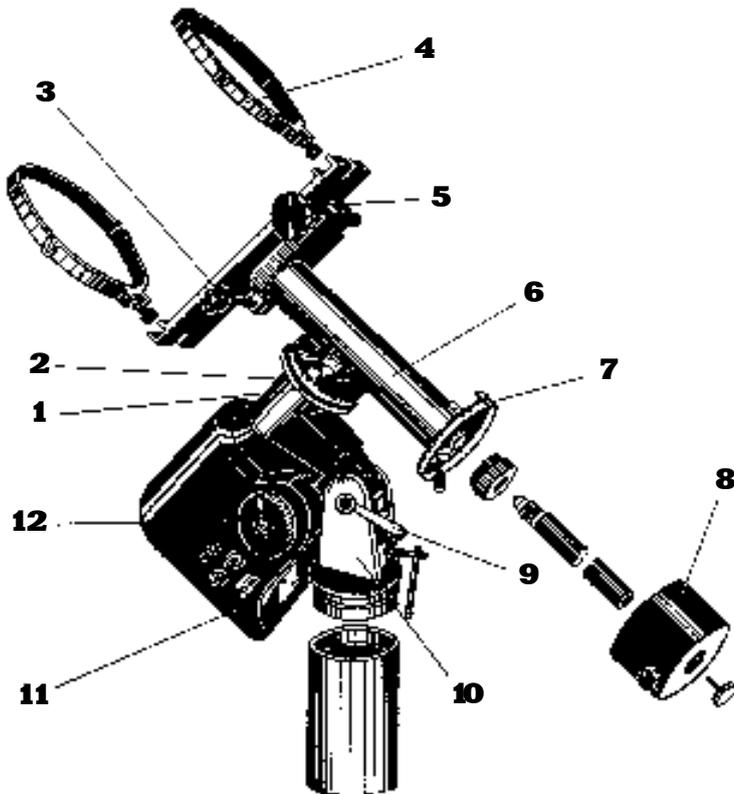


Fig. 5. **Equatorial mounting:**

1 - circle of hour; 2 - polar axis; 3 - screw of axis brake; 4 - folding clips; 5 - hanwheel of slow-motion mechanism; 6 - declination axis; 7 - circle of declination; 8 - counterweights; 9 - handle; 10 - bracket with scale of latitudes; 11 - electric watch drive; 12 - handwheel of polar axis

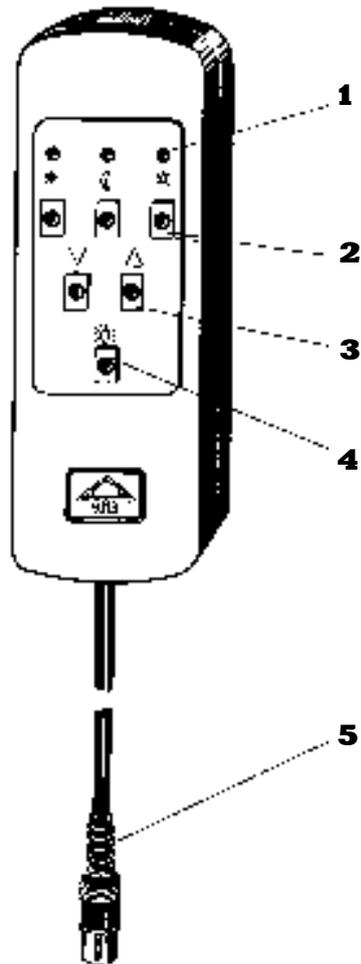
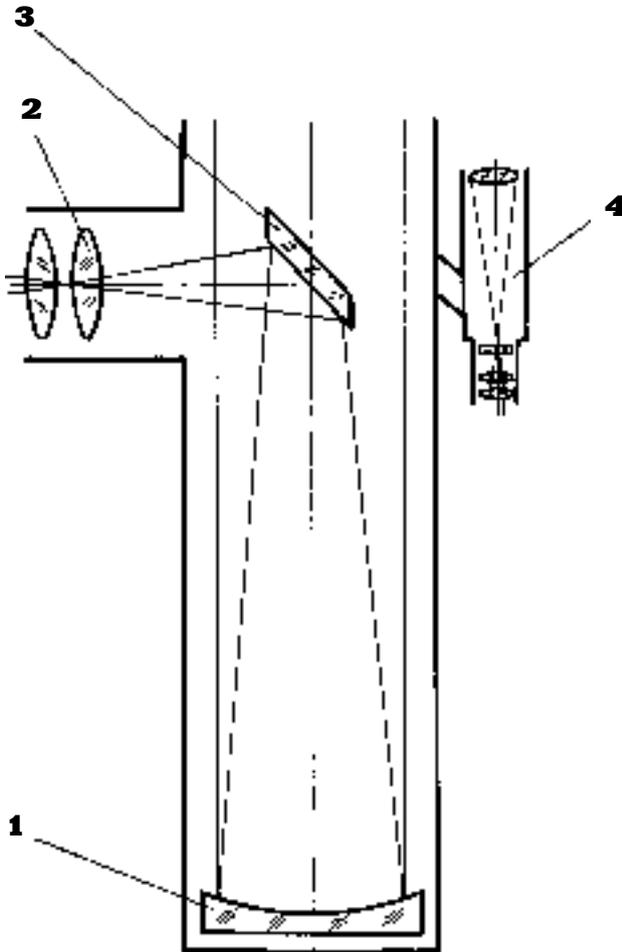


Fig. 6. **Control Panel:**

- 1 - indicator;
- 2 - speed selection buttons;
- 3 - correction buttons;
- 4 - lighting button;
- 5 - plug

**The reflecting telescope is provided with the Newton optical system** (fig.7). A parallel beam of rays enters the telescope tube, falls on primary mirror 1 with a focal length of 805.85mm and, after reflecting from it in diagonal mirror 3, reflects at 90° and is viewed with the help of eyepiece 2.



**Fig. 7. Optical train of telescope:**

1 - primary mirror; 2 - eyepiece; 3 - diagonal mirror; 4 - finderscope

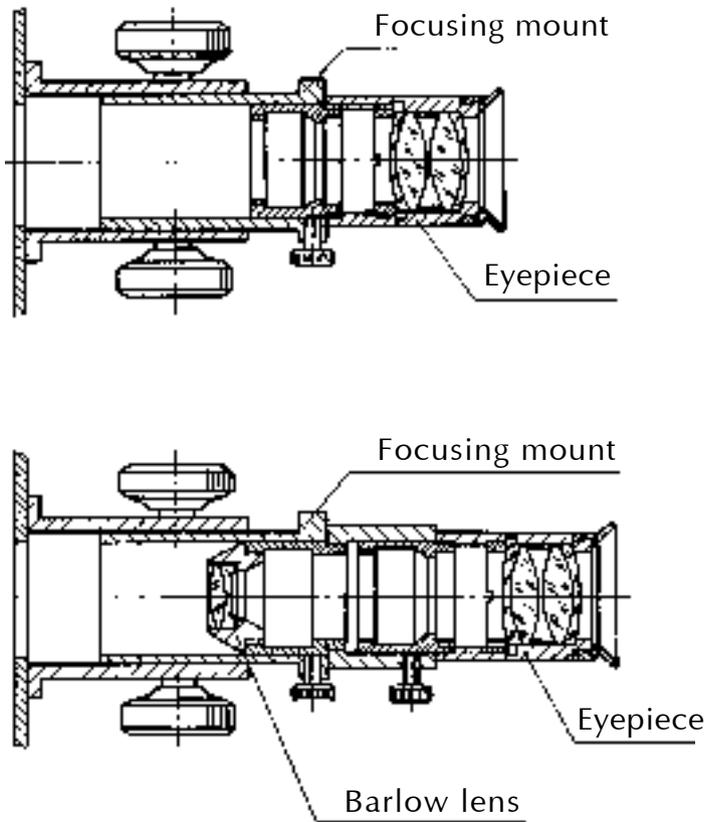
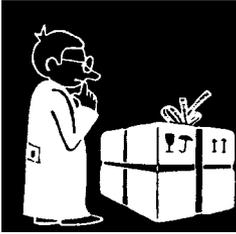


Fig. 8. **Diagram of setting Barlow lens**



## **5. PREPARATION FOR OPERATION**

### **5.1. Telescope assembling**

Before assembling the units and parts should be cleaned from the slushing compound of the plant.

The telescope is assembled in the following way.

Three supports provided with captive screws are fixed to the lower end of the pier through holes. The equatorial mounting is set on the upper end of the pier. At the same way it is fixed on the tripod.

In order to aim the polar axis turn the equatorial mounting by the value of the observation site latitude by means of elevation gear and latitude scale. Lock the direction adjusted with the lock handle.

Mount the axle with the counterweight 5 (fig. 5) on the declination axis unit and fasten it with the nut. Mount the clips 4 on the bracket and then the telescope 1 in them (fig.1).

The telescope tube is mounted on the supports of the saddle and fixed by means of two clips with the help of hinged screws.

The finderscope is mounted on the tube in two rings and fixed with six screws available on the saddle.

In transportation and storage a hole on the eyepiece tube is plugged with a stopper which should be removed and put in the case in preparation for operation.

For obtaining the required magnification of the telescoped the respective eyepiece or the eyepiece with Barlow lens 5 (fig. 9) is inserted in the eyepiece tube.

A toggle switch of the supply unit is to be set in position "0".

Connect bundled conductors 10 (fig.1) to the watch drive and to the supply unit through a socket designated , connect a plug of cord 8 of the supply unit to the main of 220/110V. Set the toggle switch of the supply unit in position "I". A light indicator on the watch driver must light.

The control panel if provided is connected to the mounting by means of the plug 5 (fig. 6).

Set the switch of control panel operation on the mounting into "I" position. The watch drive is activated by one of the buttons 3. When it

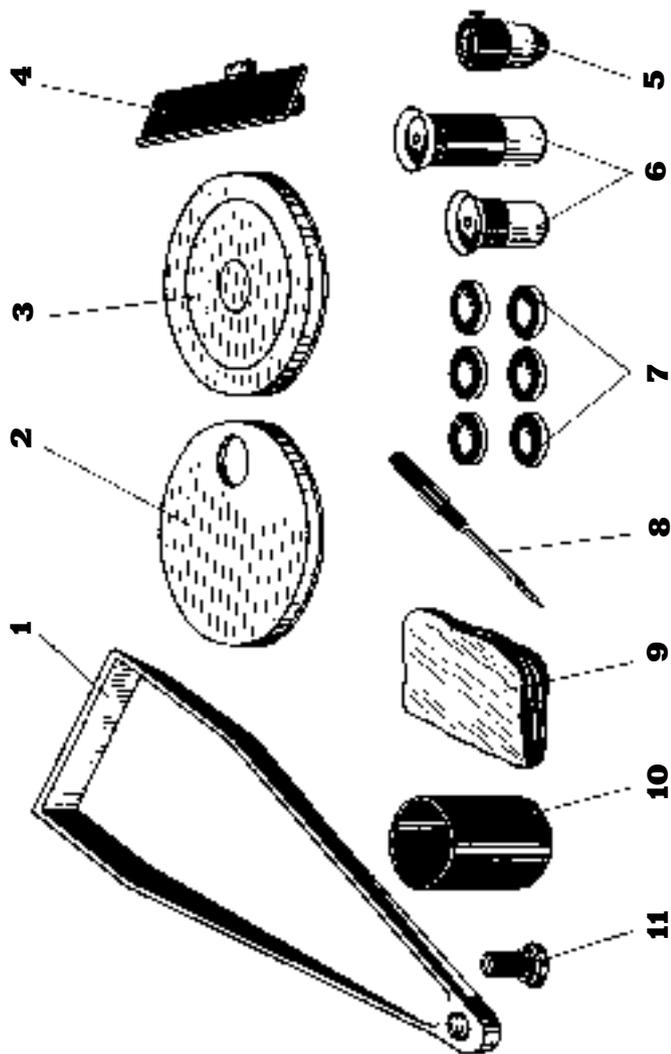


Fig. 9. **Tools and accessories:**

- 1 - solar screen; 2 - cap-diaphragm; 3 - cap; 4 - holder for camera; 5 - Barlow lens; 6 - eyepiece;
- 7 - light filters; 8 - screwdriver; 9 - napkin; 10 - blind; 11 - reticle

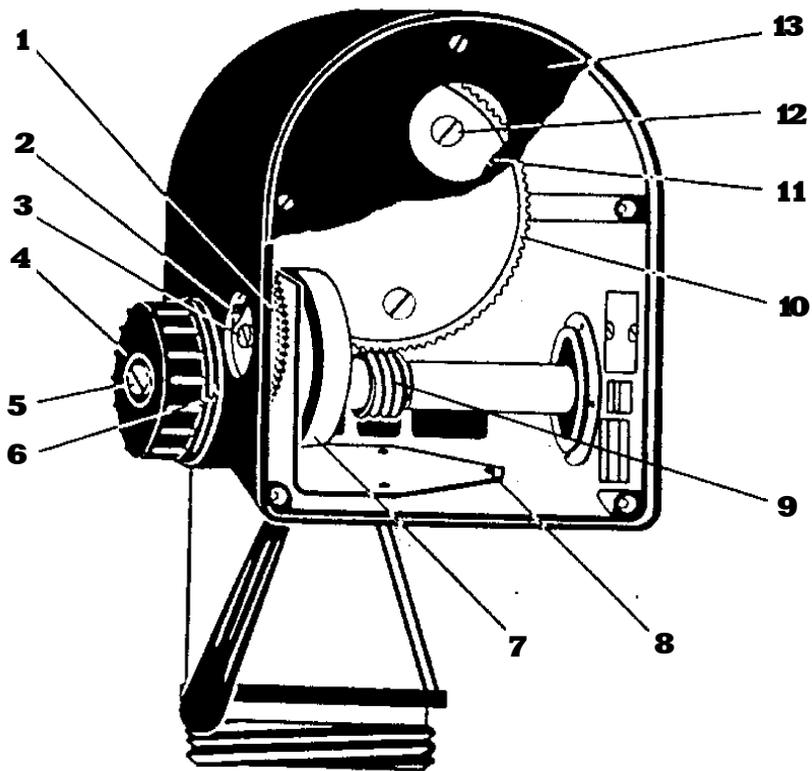


Fig. 10. **Clock drive:**

1 - worm gear wheel; 2 - cap; 3 - screw; 4 - handwheel; 5 - screw;  
 6 - screw; 7 - motor; 8 - screw; 9 - worm with gear wheel; 10 - worm  
 wheel; 11 - cap; 12 - screw; 13 - cover

operates the indicator lights. The switch of autonomous operation on the mounting and the key of supply unit must be set into "1" position previously.

## **5.2. Telescope balancing**

For smooth motion of the telescope and reliable operation of the micrometer screws it is important to balance its movable parts on the axes of the equatorial mounting.

For this purpose one should set the telescope tube in the horizontal position, unscrew the screw of the brake 3 (fig. 5) of the declination axis and, holding slightly the tube by hand, see to it whether it remains in the indifferent equilibrium. If the tube is not in balance, undo the screws of the clips which fix the tube and move the tube along its axis until it will be in balance. After that screws in the screws of the clips.

For balancing the telescope relative to the polar axis it is necessary to set the declination axis in the horizontal position. Then it is necessary to slacken each of three screws 12 after moving cap 11 of the watch drive (fig.10). Holding the axis by hand, see to it whether the telescope is in balance about the polar axis. If the telescope is not in balance, move counterweight 8 (fig.5) along the declination axis. After balancing tighten screws 12 of the friction clutch (fig.10) on the polar axis so that the telescope can not rotate easily.

The adjustment of the friction clutch is considered to be finished if the telescope tube moves due to the minor effort of the hand.

When mounting the various devices on the telescope, for example, the camera, it is required to balance the telescope additionally.

## **5.3. Precautionary measures**

**The rate of the fuse link mounted in the supply unit must be in compliance with the rate denoted under the fuse link holder.**

**Mount the fuse link only after complete disconnection of the supply unit from the main.**

**Connect the bundled conductors to the watch drive and to the supply unit only when the supply unit is disconnected from the mains.**



## **6. ORDER OF OPERATION**

### **6.1.Operationwithtelescope**

Before mounting the telescope it is required to choose the place and prepare a site. It must be even and solid. Mount the telescope on the site and check it for reliable stability.

For pointing to an object the telescope should be rotated about two axis. For rotation of the declination axis it is necessary to undo braking screw 3 (fig.5), rotate the telescope and screw in the braking screw.

In backlash is arisen in the worm gear, it is necessary to disengage motor 7 (fig.10). For this purpose it is required to take off cover 13, slacken three screws 8, displace motor 7 upwards and fix it with screw 8. Remove handwheels 4 after unscrewing screws 5. After that slacken screws 6 wich fasten worm 9 in the bearings. After pressing the worm to worm wheel 10 fix it wich screws 6. Mount handwheels 4 and secure them wich screws 5. Then slacken screws 8, displace the motor downwards until engagement wich the toothed wheel of the worm takes place and secure them with screws 8. Mount cover 13 on the casing.

Smoothness of rotation of toothed wheel 1 together with the toothed wheel of worm 9 is checked by rotation of the handwheels, in doing so probable sliding or jamming of the friction clutch of toothed wheel 1 may take place.

For its adjustment it is required to displace cap 2 and tighten or slacken three screws 3. The friction clutch adjustment is considered to be finished if handwheels 4 rotate smoothly.

The telescope is preliminarily pointed relative to the polar axis by rotation of the tube with the help of a friction mechanism by hand.

The celestial sphere and all astronomical objects perform a complete rotation for twenty-four hours. As a result the object in the telescope field of view displaces constantly. The rate of its displacement increases of the telescope magnification. Therefore the telescope is provided with electric watch drive 11 (fig.5) wich rotates uniformly the telescope wich follows the object As a result, in the process of observation the object remains constantly at the centre of the field of view.

In the process of observation it is often required to perform minor corrections in the diurnal run of the telescope. For this purpose one makes use of handwheels 4 (fig.10) of the polar axis or the buttons 3 (fig. 6) of the control panel. The buttons 3 speed up or slow down the tracking

speed of the watch drive relative to the nominal providing the correction of right ascension angle. The correction modes are activated when one of the buttons 3 is pressed continuously and the indicator 1 blinks. If the button 3 is released the tracking speed returns to the nominal.

The telescope has high magnification and, hence, small fields of view, therefore it is provided with a finderscope.

After mounting the telescope it is necessary to set parallel of the optical axis of the telescope tube and finderscope. For this purpose one should mount a reticle with cross into the eyepiece  $f' = 25$  mm. One should make an adjustment by remote object.

By operating with the set screws of rings 2 (fig.1) of the finderscope one brings the chosen remote object to the centre of the finderscope field of view. This operation is performed once. In the future before observation only a check-up of parallelism of the telescope and finderscope optical axes is needed.

In order to avoid correction of the declination axis during operation of the watch mechanism it is required to set the telescope polar axis in parallel to the celestial axis. In this case the northern (upper) end of the polar axis faces the celestial pole positioned near Polaris ( $\alpha$  Ursae Minoris). For visual observation it is enough to incline the polar axis at an angle equal to the latitude of the observing site and direct it approximately along the line South-the North. With such coarse setting of the telescope the object will "deviate" step by step in declination (it is lifted or lowered in the field view). This error is corrected at times by means of the micrometer screw of the declination axis.

For photographic operations and in the cases when the telescope can be set stationary, the polar axis of the telescope should be set precisely. For this purpose one observes any bright star in the East, then in the South and makes notice of the direction of the star displacement.

If in observation of the star in the East, it is displaced in the telescope field of view so that in its tracking the upper end of the telescope tube sinks slowly, the north end of the polar axis should be somewhat lifted.

If the upper end of the tube is lifted step by step, the north (upper) end of the polar axis should be lowered.

For precise setting of the axis by azimuth one observes the star near the meridian circle (above the South point) in the same way. If in the star tracking one has to lower slowly the upper end of the telescope tube, the north end of the polar axis should be displaced to the West. If in the process of the star tracking the upper end of the telescope tube is lifted, the north end of the polar axis should be displaced to the East.

In 20-30 minutes of such observations one can set the polar axis so that the star will remain on the cross-hairs for 10-15 minutes without correction in declination.

After precise setting of the polar axis one can set the declination and hour circles which must help to search the objects invisible with a naked eye or even through the finderscope.

First of all one should set the hour circle which is fixed on the polar axis. After fine setting of the polar axis set the declination axis horizontally. The horizontal setting should be checked with the aid of a level. After setting of the axis one sets the hour circle so that "0" is found against the index. Fix the circle by means of screws.

For setting the declination circle fixed on the declination axis one should find the declination of two-three bright stars in the star catalogue or make use of the declinations of the planets. With the help of the finderscope one brings the star or the planet to the centre of the field of the telescope at maximum magnification. After that one sets the declination of the required star against the index. The circle is to be fastened with a screw. Then one makes attempt to find the second star by its declination. For this purpose one slackens the screws of the axis brake and adjusts the telescope so that the declination of the star to be sought is set on the declination circle. Fix the declination axis by rotating the telescope tube slowly clockwise around the polar axis, brings the star to the centre of the telescope field of view. After checking of the circle setting one tightens it with a nut.

In order to avoid resetting of the polar axis and circles one should choose the solid horizontal site. Best of all, it is made of some concrete of 1.5x1.5 m size. The position of three supports of the telescope pier should be marked on this site. The telescope is mounted according to the marks on the concrete site.

## **6.2. Photographic observations**

The telescope complete set includes a holder for a camera. It is used for mounting a miniature camera on the equatorial mounting. For this purpose the holder is to be mounted on the declination axis on the side of the counterweight and the camera is fastened to the latter with the help of a screw.

The exposures which are required for photographing the star fields are tenths of minutes without hindrance of the street lighting. Therefore for this period of time one should see to it that the camera follows the sky precisely in its diurnal rotation. In order for this to happen one inserts Barlow lens and a powerful eyepiece with a reticle in the eyepiece tube. Near the centre of the field of view of the camera one chooses the bright star to which the telescope is pointed. To keep the star on the reticle cross-hairs is the problem for an observer for the whole period

of exposure. As the cross-hairs of the telescope is not illuminated, the image of the guide star should be somewhat defocused in order to cross a light circle of the unsharp image of the star by the cross-hairs and to keep the star in this position for the period of exposure.

One applies minor corrections for a clock-work drive with the help of handwheel 12 (fig.5) keeping the star on the crosshairs for the whole period of exposure. One corrects the position of the guide star with the micrometer screw of the declination axis if necessary. To obtain the minimum corrections in declination the polar axis should be set as precisely as possible to the celestial pole. One should remember that if the polar axis is set incorrectly, even in the case when the star image is kept on the cross-hairs, the image of the stars at the edges of the field of view appear as dashes.

The holder makes it possible to use a camera with changeable objectives, if their mass is not too heavy.

### **6.3. Telescope and atmospheric conditions**

At high magnifications together with the increase of the visible dimensions of the object the disturbances due to atmosphere are increased. They are expressed in great blurring of the images of the distant objects, in scintillation and blurring of the star images.

The observations in the cold seasons are possible when all telescope parts acquire the ambient temperature. For air circulation inside the telescope tube there is a hole plugged with a stopper in the cell of the primary mirror. In operation the stopper should be unscrewed from the cell.

But in observations out of door the great disturbance of atmosphere may take place at nights, that leads to bad images of the celestial objects.

It is quite possible that at those nights the observations of the fine details of the planets and of the Moon are unsuccessful.

In case of precipitation and stooping of operation the telescope together with supply unit must be covered.



## 7. MAINTENANCE

For faultless operation the telescope should be kept in cleanness and protected against mechanical damage. The metal surfaces are periodically dusted by using clean soft napkins, then wiped with a napkin impregnated with acidless vaseline, after that with a dry napkin.

The aluminized mirrors require particular care. The accumulated dust is removed only with the use of a soft brush or a cotton wool tampon. Cleaning should be carried out without excessive effort to avoid formation of thin scratches on the mirrors surface which deteriorate the image. If some fat spots are found on the mirrors, never wipe them. In this case the mirrors are washed. The primary mirror (fig. 3) is taken out of the tube after unscrewing the screws which fix the cell to the tube. Without removing the mirror from the cell, the mirror surface is wetted considerably with pure medical alcohol with the help of a cotton wool tampon. By using the same tampon, one wipes slightly the wet mirror without excessive effort and puts it at once under the stream of pure water. After removing alcohol in this way, one puts the mirror on its edge until it is dried. The drops of water are removed with a blotter by touching them slightly with a blotter corner.

The diagonal mirror is cleaned in the same way. After cleaning the mirrors are put in their places.

The lenses of the eyepieces are wiped with a dry linen napkin. The fat spots are removed with a cotton wool piece impregnated with alcohol.

**One should dismantle the optic only in case of necessity.** In non-operating position the telescope tube must be constantly covered with a cap and the eyepiece one is to be plugged with a stopper.



## 8. POSSIBLE DERANGE- AND METHODS OF THEIR ELIMINATION

When manufacturing the telescope at the plant, the optical pieces are carefully set (adjusted) relative to each other. However, in case of transportation or considerable impacts of the telescope the optical parts may be displaced (the adjustment is disturbed). In this case it is required to readjust the telescope. Prior to this operation one should remove the eyepiece from the eyepiece tube and check whether the mirrors are displaced from the given places. For this purpose it is necessary to look through the eyepiece tube from which the eyepiece and the Barlow lens are removed. If the telescope is adjusted, the plane

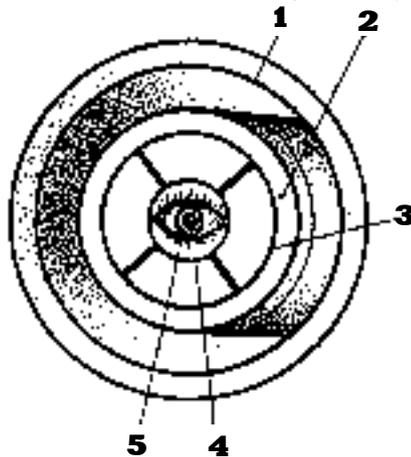


Fig. 11. **Setting concentricly of mirrors:**

- 1 - finner diameter of focusing mount; 2 - diagonal mirror;
- 3 - reflection of primery mirror in the diagonal mirror;
- 4 - reflection of diagonal mirror in the primary one; 5 - observe's eye

diagonal mirror must be concentric relative to the brim of the focusing mount. The reflection of the primary mirror in the diagonal one must be concentric as well. The reflection of the diagonal mirror with the in the primary mirror. The image of the diagonal mirror must be positioned precisely in the middle of the primary. The reflection of an observer's eye (fig. 11) must be seen at the centre of the diagonal mirror reflection.

In adjustment it is required to correct the position of the diagonal mirror or primary one. If the image of the primary mirror in the diagonal one is non-concentric, it is necessary to change the position of the diagonal mirror. For this purpose one unscrews the screw 2 of the cell of the diagonal mirror (fig. 4) and, operating with one of three screws 1, brings the reflection of the primary mirror in the diagonal one to the centre of the diagonal mirror.

If the position of the primary mirror is disturbed, the reflection of the diagonal mirror with the spider in it is seen not at the centre. In this case one unscrews the screws 2 of the cell of the primary mirror and, by operating with three screws 1 (fig. 3), sets the primary mirror so that the reflection of the diagonal mirror in it is found at the centre (it becomes concentric). After setting the mirror in the correct position, one fixes the cell in position by means of the screws 2.

The adjustment of the telescope is delicate and is carried out only in case of emergency, when it is clear that the telescope is misadjusted and its mirrors and reflections from them are not concentric.

## **9. RULES OF STORAGE**

It is recommended practice to store the telescope in the case in the heated premises with relative humidity of maximum 80%, at air temperature from 5 to 40° C.

The impacts and sharp shaking should be avoided.

It is forbidden to store the telescope together with acids, alkalies, materials which liberate moisture or chemically-active gases and vapours.

## **10. ACCEPTANCE CERTIFICATE**

The amateur astronomer telescope, serial No . . . . . is found fit for service

**Date of manufacture and slushing** \_\_\_\_\_

**Signatures** \_\_\_\_\_

**Table of close stellar pairs for testing image quality of the telescope**

Name of star	Coordinates		Magnitude, m	Visible distance, ang. s.	Constellations
	h, m	ang. degrees, ang. min.			
$\alpha$ Psc	1 <sup>h</sup> 59.4 <sup>m</sup>	+02°31'	4.3-5.3	1.9''	Pisces
$\gamma$ Cet	2 <sup>h</sup> 40.7 <sup>m</sup>	+03°02'	3.4-4.4	2.8''	Cetus
$\xi$ Ori	5 <sup>h</sup> 38.2 <sup>m</sup>	-01°58'	2.0-4.2	2.5''	Orion
$\alpha$ Gem	7 <sup>h</sup> 31.4 <sup>m</sup>	+32°00'	2.0-2.8	1.8''	Gemini
$\varepsilon$ Hyd	8 <sup>h</sup> 44.1 <sup>m</sup>	-06°36'	3.5-6.9	2.9''	Hydra
$\sigma^2$ Uma	9 <sup>h</sup> 06.0 <sup>m</sup>	+67°20'	4.9-8.2	2.7''	Ursa Major
38Lyn	9 <sup>h</sup> 15.8 <sup>m</sup>	+37°07'	4.9-6.0	2.8''	Lynx
$\xi$ Uma	11 <sup>h</sup> 15.6 <sup>m</sup>	+31°49'	4.4-4.8	2.9''	Ursa Major
$\xi$ Boo	14 <sup>h</sup> 38.8 <sup>m</sup>	+13°56'	4.6-4.6	1.2''	Bootes
$\varepsilon$ Boo	14 <sup>h</sup> 42.8 <sup>m</sup>	+27°17'	2.7-5.1	3.0''	Bootes
$\mu$ Dra	17 <sup>h</sup> 04.3 <sup>m</sup>	+54°32'	5.8-5.8	2.2''	Draco
$\tau$ Oph	18 <sup>h</sup> 00.4 <sup>m</sup>	-08°11'	5.4-6.0	2.0''	Ophiucus
70 Oph	18 <sup>h</sup> 02.9 <sup>m</sup>	+02°31'	4.0-6.0	2.4''	Ophiucus
$\varepsilon^1$ Lyr	18 <sup>h</sup> 42.7 <sup>m</sup>	+39°37'	5.1-6.2	2.7''	Lyra
$\varepsilon^2$ Lyr	18 <sup>h</sup> 42.7 <sup>m</sup>	+39°37'	5.1-5.4	2.2''	Lyra
$\delta$ Cyg	19 <sup>h</sup> 43.4 <sup>m</sup>	+45°00'	3.0-6.5	2.2''	Cygnus
$\mu$ Cyg	21 <sup>h</sup> 41.9 <sup>m</sup>	+28°30'	4.7-6.1	1.8''	Cygnus
$\xi$ Aqr	22 <sup>h</sup> 26.3 <sup>m</sup>	-00°17'	4.4-4.6	1.8''	Aquarius