ARTICLE 1N11

Technical Specification
and Service Manual

AL3.803.051 TO

CONTENTS

1 INTRODUCTION

1.1 Technical Specification is intended for study of the article 1N11 and contains the performance specification, information about the article and the principles of its operation.

1.2 The following extra documentation should be used while studying and operating the article 1N11:

"Charge Unit Set. Service Manual AL4.799.001 RE".

TECHNICAL SPECIFICATION

2 PURPOSE

2.1 Artillery reconnaissance article ARP, with index mark 1N11, has conventional name 1N11 (hereinafter referred to as the article) is intended for aims reconnaissance and for locality observation during daytime.

The article allows to measure angles in horizontal and vertical planes.

2.2 The article is operated in ambient temperature from + 50° to – 50 °C and relative humidity up to 100 % at temperature 25 °C.

3 PERFORMANCE FEATURES

3.1 The performance features are shown at the table 3.1.

Table 3.1

Name of characteristics	Value
Magnification, x	10 and 20 (discrete)
Angular field of the optical system in the object area	6 ° and 3 °*
Exit pupil diameter, mm	6.4 and 3.2 *
Eye relief, mm	20.7
Diopter adjustment of the oculars, dioptres	±5
Resolution limit, sec	3.5 *
Periscopic ability, mm	385
Interpupillary adjustment, mm	from 58 to 72
Angles measuring limits:	
in the horizontal plane	60-00
in the vertical plane	±3-00
Measuring error:	
of the horizontal angles	0-01
of the vertical angles	0-02
Graduation mark of the fine reading scale:	
for the horizontal angles	0-01
for the vertical angles	0-01
Maximum consumption current, mA	25
Supply voltage, V	6

* The values at the 20^{x} visible magnification.

Overall dimensions, mm:	
length	300
height (without a tripod)	690
width	210
Weight, kg:	
in operable position	23
in carrying position	35
Continuous operation time, min h:	
without accumulator battery replacement:	
at temperature of 20 °C	8
at temperature of – 50 °C	2

3.2 The container K-316 AL6.086.012 with three accumulators NLTs-0.9-1 is used for the power supply of the article.

It is allowed to use the elements of standard size AA-R6 instead of the accumulators.

4 COMPOSITION OF DEVICE

4.1 Article contents correspond to the table 4.1.

Table 4.1

Code	Item	Qty	Note
AL5.803.038	Binocular	1	
AL6.050.061	Limb	1	
AL6.120.486	Bottom	1	
AL6.156.033	Tripod	1	
AL4.070.317	Individual STA kit	1	

5 DESCRIPTION AND OPERATION OF THE ARTICLE

5.1 Description of the article

5.1.1 The article presents a binocular observation angle-measuring optomechanical device consisting of the binocular 1 (Fig. 1), limb 2 and bottom 3, which are rigidly connected between each other and mounted on the tripod 4.

5.2 Optical scheme

5.2.1 Optical scheme consists of two parts: binocular system and limb with projective system.

5.2.2 Binocular system is intended for observation of the objects in the locality. It consists of two identical telescopic arrangements connected by the protective glass 1 (Fig. 2) and mirror 55.

5.2.3 Each telescopic arrangement contains object-glass 53, lens 46, erector 42 and ocular consisting of rigid part 17 and moving part 15.

The object-glass 53 and the lens 46 presenting the association, are intended for imaging of the objects under observation in the focal plane of the system object-glass – association.

The erector 42 is intended for the image reversal and change of telescopic arrangement magnification. Magnification change is carried out with the help of moving of the erector 42 along the optical axis.

The ocular is intended for observation of objects images. Image sharpness fixing of the oculars is carried out with the help of travel of the moving part 15 along the optical axis.

Besides, each telescopic arrangement has a wedge 54, light filter 52, mirror 43 and prism BS-0° 22.

The wedge 54 is intended for the regulation of optical axes parallelism when the article is assembled.

The light filter 52 is intended for protection of the observer's eyes from laser emission with the wave length of 1.06 mkm.

The mirror 43 is intended for changing of ray paths.

The prisms BS-0° 22 are intended for regulation of the distance between the outlet pupils centers. Regulation according to this distance is carried out by turning the prism BS-0° 22 in the left telescopic arrangement simultaneously with the ocular 16.

5.2.4 The limb 23 and the projecting system are intended for reading of the measured angles in the horizontal plane.

Reading is carried out on the scale of the limb 23 and on the scale 38.

The projecting system consisting of the object-glasses 39 and 49 and of the prisms 40, 41, 50 and 51 creates the image of the scale 38 and of the limb 23 scale in the focal plane of the ocular 16. Scales image is observed through the ocular 16.

Illumination of the limb 23 and of the scale 38 is carried out either by natural light through the plate 35 and prisms 34, 36 and 37, or by the socap-state lamp HL3 through the prism 37.

5.2.5 The image of the reticule indicated on the lens 46 in the right telescopic arrangement is seen in the field of view of the ocular 13.

The picture of the field of view of the right branch is shown in the figure 3.

The horizontal line B and the vertical line A form the cross in the center of the field of view. The vertical bisector B is located under the cross. The angle value of the bisector is 0-01.

There are eight divisions both to the right and to the left, and up and down from the cross. The graduation mark value is 0-05. Divisions 0-10 are presented in the form of longer lines.

5.2.6 The image of the scale A (Fig. 4) and the scale of horizontal angles reading B is seen in the field of view of the ocular 16 (Fig. 2) when the rays from the prism 50 appear.

The scale A is drawn on the limb 23 (Fig. 2), it consists of 600 lines evenly marked in the form of a circle. The scale A (Fig. 4) has double numbering. Each mark having value of 1-00 is indicated by the numbers from 0 to 59 (the upper row of numbers). Each mark having value of 0-10 within the limits of the interval of 1-00 value is indicated by the numbers from 0 to 10 (the lower row of numbers).

Numbering of the upper row is repeated for each second line, as not more than four lines of the scale A can be seen in the field of view simultaneously. This is done for right reading.

The scale B is drawn on the scale 38 (Fig. 2) and has 10 lines. Each line has value of 0-01. The lines 0, 0-05, 0-10 are marked out with the help of longer lines and are numbered.

Reading of the horizontal angles is carried out in the following way:

1) define the reading on the scale A (Fig. 4) on both upper and lower row, for this see the number against the line which coincides with the zero or any other line of the scale B except the last one;

2) define the number of lines on the scale B from the zero line to the line which coincides with the line on the scale A.

Examples of different mutual position of the scales A (Fig. 4) and B are shown in the figure 5. Zero line of the scale B coincides with the line on the scale A having number 45 and 3 in the upper figure (Fig. 5). Reading is 45-30.

The line with the number 30 and 5 on the scale A coincides with the seventh line of the scale B in the middle figure. Reading is 30-57.

The line 4 of the scale A lies between the lines of the scale B in the lower figure. Reading is 32-43.5.

5.3 Kinematic scheme

5.3.1 Kinematic scheme provides the following:

1) measuring angles in the vertical plane;
2) measuring angles in the horizontal plane;
3) changing of zero position of the limb;
4) changing of magnification;
5) changing of the diopter setting of the oculars;
6) startup of the rays of the projecting system prism.

5.3.2 Measuring of the angles in the vertical plane is carried out by swinging of the mirror 55 (Fig. 2). Swinging of the mirror takes place when the handwheel 7 is turned through the worm wheel 5, worm 6, tooth wheels 9, 10 and control-rod 2. Reading of the angles in the vertical plane is done on the rough reading scale 4 and on the fine reading scale 3.

Scale division value of the scale 4 is 1-00. Numbering is given for each line from 0 to 3-00 up and down.

Scale division value of the scale 3 is 0-01. The lines with values 0-05 and 0-10 are marked out with longer lines. The lines with value 0-10 are numbered.

Angles measuring range limitation is done with the help of a washer limiter consisting of washers 8.

5.3.3 Binocular rotates simultaneously with the scale 38 around the vertical axis in regard to the rigid limb 23 for measuring of the angles in the horizontal plane.

Rotation is carried out with the help of the handwheel 24 rigidly connected with the worm 27. The worm 27 together with the binocular revolves around the worm wheel 26 when the handwheel 24 rotates.

If it is necessary to revolve binocular quickly, the worm 27 is disengaged from the worm wheel 26 by turning of the handwheel 29. The worm in disengaged position is fixed with the help of the latch 28.

5.3.4 Changing of limb zero position is carried out with the help of the handwheel 32. The tooth wheel 30 is engaged with the tooth wheel 25 by pushing on the handwheel 32, and is held in this position. Then, the limb 23 is revolved by rotating of the handwheel 32 through the tooth-wheels 25 and 30. Binocular does not move, which is provided by engaging of the worm 27 with the worm-wheel 26. Returning of the handwheel 32 into the original position and disengaging of the tooth wheel 30 are carried out by the spring 31.

5.3.5 Visible magnification changing is carried out by turning of the handle 11. Movement through the sector 19 and the rack 20 goes to the holder 12 which contains erectors 42 of both telescopic arrangements. The holder 12 moves forward along the bush 18.

The engaging of the holder in two positions is carried out with the help of the block 21.

5.3.6 Changing of the ocular diopter setting is carried out by turning of the scales 14.

Dioptricity setting is carried out on the scales 14. Scales-division value is 1 dioptre.

5.3.7 Rays input from the prism 50 on the projecting system is carried out with the help of the handle 45 through the tooth-wheels 47 and 48. The position of the handle 45 is blocked by the latch 44.

5.4 Electric circuit

5.4.1 Electric circuit of the article is intended for the illumination of the scales and reticule at night and at dusk.

5.4.2 Electric circuit power supply is carried out by the container A1 with three accumulators GB1 (Fig. 6). Supply voltage is applied to the socap-state lamps HL1 and HL2 of the reticule illumination and HL3 of the limb illumination through the tumbler SA1 LIMB and RETICULE.

5.4.3 Illuminating of the vertical angles scales is carried out with the help of the socap-state lamps HL4, HL5 and HL6 of the illuminator, which is connected with the container A1 through the plug XP1 and socket XS1. The tumbler SA2 ILLUMINATOR turns socap-state lamps HL4, HL5 and HL6 on.

6 DESCRIPTION OF THE ARTICLE COMPONENTS

6.1 Binocular

6.1.1 The binocular is intended for observation of locality and measuring of the angles in the vertical plane.

6.1.2 The case 23 (Fig. 7) contains the elements of the optical arrangement of the binocular and of the projecting system, and of electrical circuit, as well as the mechanisms providing their interaction.

6.1.3 The scales 3 and 4 covered with protective glass are on the front side of the holder 23. The scale 3 is used for rough reading of vertical angles and the scale 4 is used for fine reading of vertical angles.

6.1.4 The left side of the case 23 contains aiming circle holder 21; handle 17 for taking the article out of the pack, which is blocked in the non-operating position with the help of the latch 18; handle 16 for directing input rays into the projecting system prism when the readings of the horizontal angles are done.

6.1.5 The right side of the case 23 contains the tumblers 35 LIMB and RETICULE and the tumbler 36 ILLUMINATOR which are covered with caps 34; the plug XP1 covered with the cap 33 for the connection with the illuminator 1 (Fig. 12) from the single STA kit; the handle 31 (Fig. 7) for magnification changing; the handwheel 32 for the vertical angles measuring; the level 30 and the cap 37 for covering the compartment of the electric power supply blocked with the help of the latch 38.

The main power supply of the article is the container K-316 4 with three accumulators 5 (Fig. 12).

6.1.6 The back side of the case 23 (Fig. 7) contains the protective glass 25 and desiccator 26.

6.1.7 The holder 1 (Fig. 7) for the support 9 setting (Fig. 12) is located in the upper part of the binocular. The support is taken from the single STA kit.

6.1.8 The board 6 (Fig. 7) is connected with the front side of the case 23. The board 6 contains the oculars 7 and 15, the scale 19, the index 20 for setting distance between the oculars and the clamp 5 for fixation of the set distance between the oculars. The lines corresponding to the distance from 58 to 72 mm are drawn on the scale 19. The lines for the distance of 60 mm and 70 mm are numbered. Setting of the ocular according to the distance between eyes centers is carried out with the help of rotating of the ocular 15.

The scales 8 for dioptricity setting and eye shades 9 are located on the oculars.

The board 6 also contains the bush 1 (Fig. 8) which is directing for the holder 2 with lenses of the erector. The holder 2 moves along the bush 1 when the magnification is changed. The holder is fixed with the help of the block 3. The light filters from the single STA kit are mounted on the projection A of the holder 4.

6.2 Limb and bottom

6.2.1 The limb 2 (Fig. 1) is intended for measuring of the angles in the horizontal plane and rotating of the binocular around the vertical axis. The bottom 3 is intended for leveling of the binocular with the limb.

6.2.2 The following parts are located outside the case 3 (Fig. 10) of the limb:

1) the handwheels 10 (Fig. 7) for rotating of the binocular;
2) the handwheel 11 for disengaging of the worm;
3) the stop 28 of the handwheel 11;
4) the handwheel 14 for changing of the zero position of the limb;
5) the desiccator 26;
6) the mirror 27 for the regulation of limb illumination (in daylight).

6.2.3 There are the following elements inside the case 3 (Fig. 10):

1) the limb 1;
2) the worm 5 and the worm-wheel 4 for rotating the binocular along the horizon;
3) the tooth wheel 2 for changing of the limb zero position;
4) the elements of the bearing on which the moving element of the limb together with the binocular rotates.

6.2.4 The bottom case 7 is rigidly connected with the bearing cage 6 of the limb.

The case 7 contains three lifting screws 8 whose bottom ends set against the base 9.

Permanent contact of the screws with the end is provided by the plate 10.

6.2.5 When the article is leveled, the rotation of the lifting screws is carried out with the help of the handwheels 12 (Fig. 7).

6.2.6 When the article is mounted on the tripod, the base 9 (Fig. 10) is mounted on the base 1 of the tripod (Fig.11) and the pin 2 is screwed into the threaded opening A (Fig. 10) with the help of the handle 4 (Fig. 11).

6.3 Tripod

6.3.1 The tripod 4 (Fig. 1) is intended for putting article on the ground or any fixed basis.

6.3.2 The tripod consists of the base 1 (Fig. 11) and three rods 9 which are connected hingedly with the base 1. The rod 9 contains the rod 5 inside, which can move along the rod 9. Blocking of the rod 5 in regard to the rod 9 is carried out with the help of the thumbscrew 10. The support 6 for firm fixation of the article on the tripod on the ground is set on the end of the rod 5.

6.3.3 The binocular with the limb and the bottom is fixed to the tripod with the help of the pin 2. The handle 4 is rigidly connected with the pin 2.

6.3.4 The strap 8 is used for the tripod carrying and the strap 7 is used for tightening of the supports.

7 SINGLE STA KIT

7.1 The single STA kit is intended for providing the article operation and replacement of failed parts of the article which got out of action during operation.

7.2 The single STA kit contains spare parts for replacement of the following failed parts of the item:

1) container K-316 4 (Fig. 12);

2) cup 12;

3) accumulators 5;

4) caps 15.

7.3 The single STA kit contains the following tools:

1) key spanner 6 for replacement of moisture eliminators which are out of order;

2) key spanner 7 for regulating of aiming circle and level.

7.4 The single STA kit contains the following outfit:

1) the illuminator 1 for illumination of the scales and inscriptions if the light is insufficient;

2) the light filter 10 (code – C) for image contrast increase during observation in haze;

3) the light filter 11 (code – R) for protecting of the observer's eyes form the laser emission with the wave length of 0.53; 0.69 and 1.06 mkm. The light filters 10 and 11 are mounted on the eye shade 9 (Fig. 7) on the projection A of the holder 4 (Fig. 8);

4) the visor 2 (Fig. 12) for protection from direct sun rays. The visor 2 is mounted on the binocular 1 (Fig. 1), the projection in its bottom being directed into the groove in the protective glass 25 holder (Fig. 7). The visor is fixed with the help of two hinges on the screws 24;

5) the support 9 (Fig. 12) is intended for the mutual leveling of the items. The support 9 is mounted on the holder 1(Fig. 7) along the bayonet grooves;

6) the soft cover 14 (Fig. 12) for protecting the article from dust and precipitation when the article is mounted on the tripod;

7) napkin 13 for cleaning outer optic components;

8) the aiming circle 8 is intended for leveling of the article in regard to the magnetic meridian in the North-South direction.

The aiming circle consists of the case 1 (Fig. 9), steeple 4, index 7, needle 3, arrester 9, handwheel 8 and cap 2.

The needle 3 in operable position rests on the steeple 4 point.

The needle 3 in non-operating position is taken off the steeple 4 by the arrester 9 with the help of the handwheel 8 and is pressed to the cap 2.

The case 1 is fixed on the holder 10 with the help of the screws 11 and 12. The holder 10 is intended for mounting the aiming circle on the article, the screw 13 is intended for its fixing on the article;

9) the charge unit 3 (Fig. 12) is intended for charging of the accumulators 5;

10) the battery tester 16 is intended for identification of the accumulators NLTs-0.9-1charge level.

Four luminodiodes are located on the front panel of the battery tester YK-316. The numbers against them show the voltage in volts.

If it is necessary to identify the charge level, the accumulator must be set according to the marking on the case YK-316. Lighting up of the luminodiode shows the charge level.

7.5 The individual set is put together with the article into the pack 1 (Fig. 13).

8 DESIGNATIONS AND SEALS

8.1 Marking of the article is made on the cap 2 (Fig. 7), it shows:

1) logo of the manufacturer;

2) article index – 1N11;

3) serial number.

8.2 The following marking is made on the side of the pack 1 (Fig. 13):

1) article index – 1N11;

2) serial number.

8.3 The pack with the article inside is sealed if delivered from the manufacturer.

9 PACKAGE

9.1 The pack 1 (Fig. 13) is intended for transportation and storage of the article and the single STA kit.

9.2 The tripod is disconnected from the article and is transported separately from it.

9.3 The article is put into the pack 1 and is fixed with the help of the clamps 8, 11 and 12.

9.4 The boxes 7 and 14 which are rigidly fixed at the bottom of the pack 1 are intended for putting the single STA kit.

The light filter 10,11 (Fig. 12) and the aiming circle 8 are put into the box 14 (Fig. 13); the containers K-316 4 (Fig.12), the accumulators 5 and cups 12 are put into the box 7 (Fig. 13).

9.5 The illuminator 1 (Fig. 12), key spanners 6, 7, napkin 13 and caps 15 are put into the bag 5 (Fig. 13) fixed on the side of the pack.

9.6 The charge units 3 (Fig. 12), the battery tester YK-316 16 are put between the side of the pack and the partition 10 (Fig. 13) and are fixed with the help of the strap 9.

9.7 The support 9 (Fig. 12) is put into the pocket 4 (Fig. 13), the maintenance documentation is put under the spring 3 on the side of the pack.

9.8 The visor 2 (Fig. 12) is put into the box 7 (Fig. 13) and is fixed with the cap 2.

9.9 The soft cover 14 (Fig. 12) is put into the free space of the pack 1 (Fig. 13).

9.10 The pack is closed by the cap 2, which is fixed by the locks 13.

9.11 The list of enclosure 15 is put into the inner side of the cap of pack 1.

10 GENERAL

10.1 For providing the safe work of the article one must follow the instructions:
1) study the technical specification and the service manual of the article 1N11, as well as the service manual of the charge article set;
2) protect the article from hits and damage;
3) do not touch the optic elements with hands;
4) systematically remove dust, dirt and moisture from the optic elements with a clean flannel napkin;
5) keep the tumblers LIMB and RETICULE and ILLUMINATOR in the position OFF if the article is in non-operating position;
6) keep the aiming circle always caged. One can release the aiming circle only during work with it;
7) keep the accumulators charged in time.

10.2 The article and the single STA kit are delivered with uncharged accumulators.

The accumulators 5 (Fig. 12) must be charged according to the order of the commander not more than one month before using the article.

10.3 Before putting accumulators in the container K-316 4, one must carry out five discharge-charge cycles for the accumulators 5, if they were not in operation. This is done on the Charge Unit Set 3 according to the Service Manual AL4.799.001 RE.

10.4 After work with article, it is recommended to remove the container K-316 4 with the accumulators from the article and to store it in the pocket of overcoat or shirt. This is done for providing longer service of the container K-316 if the temperature of ambient air is below zero.

10.5 Short-circuit of the accumulators must be avoided.

10.6 If the charged accumulators 5 were not used during 28 days, they must be discharged and charged again with the help of the Charge Unit Set 3 according to the Service Manual AL4.799.001 RE.

11 WORK PREPARATIONS

11.1 Unfasten the strap 7 (Fig. 11) which tightens the tripod supports, loosen the thumbscrews 10, set the rods 5 to the necessary height, block the rods up with the help of the thumbscrews 10.

Set the tripod, one support being directed to the side of observation, and two others being directed towards the observer. While setting the tripod, make sure that the upper base surface 1 is set more or less horizontally.

11.2 Take the article out of the pack and mount it on the base 1 of the tripod. Fasten the article with the help of the rod 2, screwing it up to the stop.

11.3 Level the article. Loosen the thumbscrews 10, carry out preliminary leveling of the article by changing the length of the pull-out rods 5.

Set the level 30 (Fig. 7) nearly parallel to two screws of the bottom. Move the bubble of the level 30 to the middle by rotating the handwheels 12 of these screws in opposite directions.

Disengage the limb worm by rotating the handwheel 11 and revolve the binocular to 15-00. Move the bubble of the level 30 to the middle by rotating the handwheel 12 of the third lifting screw of the bottom. Do not change the position of two first lifting screws.

Check the stability of the level bubble in the middle in different rotation angles of the binocular. If the level bubble moves from the middle, set it again or check the level according to the instructions of the chapter 13 of the present manual.

11.4 Set the image sharpness of the oculars 7 and 15 by rotating of the scales 8 and according to the distance between eyes centers by rotating of the ocular 15.

If the sight data is unknown to the observer, the oculars must be set in the following way:

1) aim the article at some object with sharp outlines located at the distance of not less than 500 m from the observer;

2) obtain sharp image of the object in both oculars in turn by rotating the scales 8;

3) rotate the ocular 15 till the fields of view of both oculars come into one circle;

4) read the meters on the diopter scales 8 of the both oculars and according to the distance between eyes centers scale 19. Further, use this data for setting oculars.

11.5 If the light is not sufficient, take the illuminator 1 (Fig. 12) from the pack when preparing to work. Remove the cap 33 (Fig. 7) from the plug XP1 (Fig. 7). Connect the plug XP1 to the illuminator 1 (Fig.12).

11.6 Check if the socap-state lamps of the reticule and limb illumination operate normally when the tumbler 35 is in the position ON. Check if the illuminator operates when the tumbler 36 is in the position ON.

11.7 If daylight is used for limb illumination, adjust the illumination by rotating the mirror 27 watching in the ocular 15.

11.8 Check the position of the tumblers 35 and 36. Before the operation, they must be in the position OFF.

11.9 Set the light filters 10 (Fig. 12) from the single STA kit (code -C) on the oculars if it is necessary to increase the contrast while observing. The order of their setting is described in the chapter 15 of this manual.

11.10 Set the light filters 11 from the single STA kit (code - R) on the oculars if there is a danger of eye damage by laser emission of unknown length. The order of their setting is described in the chapter 15 of the present manual.

11.11 Set the tumbler 35 (Fig. 7) in the position ON if the observation is to be done at night or at dusk.

11.12 Set the sun visor 2 (Fig. 12) from the single STA kit on the head part of the article, if necessary. The order of its setting is described in the chapter 15 of this manual.

11.13 Set the support 9 into the holder 1 (Fig. 7) along the bayonet grooves if articles mutual leveling is necessary. If mutual leveling is carried out in the deficient light, set the illuminator 1 into the hole at the top of the support 9 (Fig. 12) and turn it on.

11.14 During preparation for work with the aiming circle, remove all things which can influence the magnetic needle of the aiming circle (weapons, metal boxes, etc.) to the distance of not less than 2 m. Cars and other machinery must be not closer than 40 m. Take the aiming circle out of the pack and mount it on the article. The order of its setting is described in the chapter 15 of the present manual.

12 WORK ORDER

12.1 General instructions

12.1.1 While measuring angles, periodically control the article setting in regard to the horizon with the help of the level 30 (Fig. 7). When you disturb the setting, level the article according to the p.11.3 of the present manual.

12.1.2 Set the magnification of 10^x or 20^x convenient for observation by turning the handle 31.

12.2 Defining of the aim magnetic azimuth

12.2.1 Set the aiming circle 8 (Fig. 12) on the article.

12.2.1 Disengage the worm 5 (Fig. 10) by rotating the handwheel 11 (Fig. 7). Rotate the binocular 1 (Fig. 1) directing its protective glass to the North. Loosen the handwheel 11 by pushing the stop 28 (Fig. 7) and engage the worm again by rotating the handwheel 11.

12.2.3 Loosen the needle 3 (Fig. 9) by rotating the handwheel 8 to the left.

12.2.4 Rotate the handwheel 10 (Fig. 7) till the needle 3 (Fig. 9) and the index 7 coincide.

12.2.5 Turn the handle 16 (Fig. 7) to the position ON.

Push the handwheel 14 along the pin and set the reading 00-00 on the scales A and B (Fig. 4) by rotating the handwheel 14 (Fig. 7).

Turn the handle 16 to the position OFF.

12.2.6 Disengage the worm 5 (Fig. 10) by rotating the handwheel 11 (Fig. 7) and turn the binocular 1 (Fig. 1) to the direction of the aim. Return the worm to the initial position by turning the handwheel 10 (Fig. 7) and superpose the vertical bisector B of the reticule (Fig. 3) with the aim.

12.2.7 Set the handle 16 (Fig. 7) to the position ON and read the scales in the field of view of the ocular 15. Turn the handle 16 to the position OFF.

12.2. 8 Calculate the aim magnetic azimuth as average from three or four readings. At each measuring disturb the setting and repeat the actions from the point 12.2.2 to 12.2.7.

12.3 Measuring of the horizontal angles

12.3.1 Disengage the worm 5 (Fig. 10) by rotating the handwheel 11 (Fig. 7). Turn the binocular 1 (Fig. 1), the protective glass being directed to one of the aims between which the angle is measured. Loosen the handwheel 11 by pushing the stop 28 (Fig. 7), engage the worm by turning the handwheel 11. Point the vertical bisector B (Fig. 3) of the reticule at the aim by rotating the handwheel 10. Turn the handle 16 (Fig 7) to the position ON and read the scales in the field of view of the ocular 15. After reading meters, return the handle 16 to the position OFF. The rules of reading meters are given in the chapter 5 of this manual. Repeat all steps for the second aim.

12.3.2 The value of the horizontal angle which is being measured is equal to the difference of the readings on the right and left aims. If the reading on the right aim is less than the reading on the left one, then 60-00 must be added to the right reading.

12.4 Measuring of the vertical angles

12.4.1 Superpose the horizontal line B of the reticule (Fig. 3) on the aim base by rotating the handwheel 32 (Fig. 7). Read the scales 3 and 4 (Fig. 7).

If the index of the scale 3 is against the red lines, the angle is negative.

If the index of the scale 3 is against the black lines, the angle is positive.

12.4.2 Follow the instructions given in the point 12.4.1 for each point when measuring the vertical angle between two points.

Calculate the angle as the difference between the received readings taking into account whether it is positive or negative.

12.5 Measuring the angles on the reticule

12.5.1 The horizontal and vertical angles can be measured on the reticule of the article.

Scale-division value of the reticule is 0-05. The maximum measured angle is 0-80.

12.6 Setting the article into stowed position

12.6.1 Set the tumblers 35 and 36 (Fig. 7) to the position OFF.

12.6.2 Remove the light filters from the oculars if they were adjusted and put them into the pack.

12.6.3 Disconnect the illuminator from the plug XP1 (Fig. 6). Put the illuminator into the pack. Screw the cap 33 (Fig. 7) onto the plug XP1.

12.6.4 Cage the aiming circle by turning the handwheel 8 (Fig. 9) to the right. Dismount the aiming circle from the article and put it into the pack.

12.6.5 Remove the visor and support from the article if they were adjusted and put them into the pack.

12.6.6 Disconnect the tripod 4 (Fig. 1) by screwing the pin 2 out (Fig. 11). Put the article into the pack and fasten it.

12.6.7 Close the pack cap and lock it. Make sure that the article set is fastened well.

12.6.8 Loosen the thumbscrews 10 on the tripod, pull the rods 5 up to the stop, block the thumbscrews 10 up. Push the supports together and fasten the strap 7.

13 CHECKING AND REGULATING OF AIMING CIRCLE AND LEVEL

13.1 Prepare the aiming circle to checking. For that do the following:

1) mount the aiming circle to the article;

2) level the article with the help of the level 30 (Fig. 7);

3) aim the observing line of the article at the checkpoint, the direction of which (the magnetic azimuth) is defined beforehand;

4) turn the handle 16 to the position ON;

5) push the handwheel 14; set the reading on the scales which are seen in the field of view of the ocular 15 by turning the handwheel. The reading must correspond to the known direction to the chosen checkpoint. Push the screw 13 head and return the handwheel 14 to the original position;

6) set the reading 0-00 on the scales 3 and 4 by turning the handwheel 32 (Fig. 7);

7) turn the handwheel 10 till setting the reading 0-00 on the scales which are seen in the field of view of the ocular 15. The observing line of the article is directed to the North.

13.2 Release the aiming circle by turning the handwheel 8 (Fig. 9) left and check superposition of the needle 3 on the index 7 according to the direction. If the needle 3 does not coincide with the index 7, superpose it on the index by turning the handwheel 10 (Fig. 7) and read the scales in the field of view of the ocular 15.

If the reading is less than 0-10, the aiming circle does not require direction regulation. Otherwise, carry out the coordination of the needle of the aiming circle and the observing line of the article according to the instructions given in the point 13.5.

13.3 Check the superposition of the upper plane of the needle 3 (Fig. 9) and the index 7 plane. Checking is carried out by sight, assumed lack of coincidence is not more than 0.5 mm. If the lack of coincidence is more than this, regulate the aiming circle according to the instructions from the point 13.6.

Mismatch of the aiming circle needle and the height index occurs because of work at different latitudes.

13.4 Check the stagnation angle and decay time of the aiming circle needle. For this do the following:

1) move a small steel object to the case 1. The needle 3 must move till touching the case sides;

2) remove the steel object; the needle 3 must have not more than 6 swings and stop moving within the interval of not more than 50 sec. After moving, the needle 3 must return to the original position.

If the needle does not return to the original position after moving, turn the article till the needle returns to the original position by rotating the handwheel 10 (Fig. 7) and read the scales in the field of view of the ocular 15. The measured angle is the stagnation angle. It must not be more than 0-03.

Otherwise send the aiming circle to the maintenance organization.

13.5 Direction control of the aiming circle must be carried out in the following way:

1) prepare the article for the aiming circle regulation according to the instructions given in the point 13.1;

2) loosen the screws 11 and 12 (Fig. 9) which fasten the aiming circle to the holder 10;

3) turn the aiming circle on the holder 10, the needle 3 and the index 7 must coincide;

4) fasten the aiming circle with the help of the screws 11 and 12;

5) match the aiming circle needle and the article observing line. Lack of coincidence of the aiming circle and the index must be not more than 0-10.

13.6 Height control of the aiming circle is carried out in the following way:

1) prepare the article for the aiming circle regulation according to the instructions given in the point 13.1;

2) loosen the screws 22 (Fig. 7) of the holder 21;

3) turn the holder 21, the needle 3 (Fig. 9) must coincide with the index 7 in height;

4) keeping the position of the holder 21 (Fig. 7) fasten it with the help of the screws 22;

5) check the coincidence of the aiming circle needle with the index in height; the lack of coincidence can be not more than 0.5 mm;

13.7 If the bubble of the level 30 does not move to the middle position with accuracy of up to one point, while the article is leveled, the level control must be carried out in the following way:

1) set the level 30 parallel to the bottom case 7 side (Fig. 10) and move the bubble of the level to the middle by rotating of two lifting screws 8;

2) turn the binocular to 30-00;

3) choose half of the error on the scale on the level 30 vial with the help of the screws 29 (Fig. 7);

4) turn the binocular to 30-00;

5) choose the remaining part of the error with the help of the lifting screws 8 of the bottom (Fig. 10) which are located parallel to the level holder;

6) turn the binocular again to 30-00 and check the bubble position. If the bubble stops in the middle position accurate within one point of the level vial scale, the regulation has been done correctly. If the error is more, repeat the regulation again.

14 TECHNICAL CONDITION CONTROL, MAINTENANCE AND PRESERVATION

14.1 General

14.1 It is necessary to carry out maintenance check and servicing of the article in time. It is done for keeping it in permanent operational readiness, for providing operational safety, increasing of inter-repair time, as well as for opportune revealing and elimination of the causes which can lead to premature wear and damage of the article components. The maintenance check and servicing of the article include the following works:

1) running service (RS);

2) maintenance procedure 1 (M.-1);

3) maintenance procedure 2 (M.-2).

14.2 Maintenance check

14.2.1 Maintenance check is carried out before and after operation according to the table 14.2

Table 14.2

Component being checked. Checking procedure	Technical requirements
1 Nomenclature list. Use the logbook for checking availability	Nomenclature list must correspond to the logbook AL 3.803.051 FO
2 Outer surfaces condition. Check it by external examination	There must not be any dust, dirt, cracks, dents, traces of corrosion on the outer surfaces
3 Optical instruments and devices condition. Check it by external examination	There must not be any dirt, popout, cracks, films, grease stains on the outer surfaces of the optical elements (protective glasses, ocular)
4 Condition of silica gel indicator in the moisture eliminators. Check it by external examination	Silica gel indicator must be of intensive blue colour
5 Operation of the limb illumination socap-state lamp. Check it by watching in the ocular 15 (Fig. 7), the tumbler 35 and the handle 16 being in the position ON	Light lines of the scales for measuring horizontal angles must be seen on the dark background in the field of view of the ocular 15

Continue the table 14.2

Component being checked. Checking procedure	Technical requirements
6 Operation of the reticule illumination socap-state lamps. Check it by watching in the ocular 7, the input window being overshadowed and the tumbler 35 being in the position ON	Light lines of the reticule must be seen on the dark background in the field of view of the ocular 7
7 Operation of the illuminator 1 (Fig. 12). Check it by external examination, the tumbler 36 (Fig. 7) being in the position ON. The illuminator must be connected to the plug XP1 (Fig. 6)	The illuminator must be alight when the tumbler is on
8 Condition of the contacts of the power supply in the article, of the container K-316 4 and of the accumulators NLTs-0.9-1 5 (Fig. 12). Check it by external examination	There must be neither oxidation nor salt films on the contacts
9 Condition of the level. Check it by external examination	There must not be any scratches on the level vial. The size of bubbles must not exceed the limits of the measuring hairlines
10 Operating of mechanisms. Check it by testing	Rotation of the handwheels and handles must be smooth

14.3 Running service

14.3.1 Running service of the article which is in operation is carried out before and after work with the article, not less than once in two weeks.

14.3.2 During RS, maintenance check is carried out, as well as the works mentioned in the table 14.3.

Table 14.3

Works	Technical requirements	Tools, outfit and materials necessary for the works
1 Clean the article set from dust and dirt	The article and the set must be clean	Napkin 13 from the single STA kit
2 Clean metal surfaces which are not painted	Metal surfaces which are not painted must not have any traces of corrosion	the same
3 Clean the outer surfaces of the optical elements	The outer optical elements surfaces must be clean	the same

Continue the table 14.3

Works	Technical requirements	Tools, outfit and materials necessary for the works
4 Replace the defective container K-316 4 for the operable one from the single STA kit. Replacement must be carried out according to the point 15.2.4	Socap-state lamps must operate when the corresponding tumblers are on	Container K-316 4 from the single STA kit
5 Charge the accumulators 5 according to the Service Manual for the Charge Unit Set AL4.799.001 RE		The Charge Unit Set 3 from the single STA kit
6 Replace the moisture eliminators which absorbed moisture by others from the single STA kit . Replacement must be carried out according to the point 15.2.3	Silica gel indicator must be of intensive blue colour	Key spanner 6, cups 12 from the single STA kit

Note: The napkin which has been used for cleaning metal details must not be used further for cleaning optical elements.

14.4 Maintenance procedure 1

14.4.1 M.-1 is carried out not less than once a year. It must be carried out in the following cases:

1) after the article was delivered to the military-article;

2) after exercises and combat training;

3) when the article is sent for short-term storage.

Make note in the logbook about carrying out M.-1.

14.4.2 When carrying out M.-1, the works are done as prescribed in the running service and additionally those shown in the table 14.4.

M.-1 is carried out in the military-articles where the article is run, the maintenance organizations being engaged if necessary.

Table 14.4

Works	Technical requirements	Tools, outfit and materials necessary for the works
1 Paint metal surfaces if paint coat is damaged	The article must not have traces of corrosion and damage on its outer surface coating	Protective enamel ML-165PM (GOST 12034-77), petroleum solvent S2 80/120

Continue the table 14.4

Works	Technical requirements	Tools, outfit and materials necessary for the works
2 Ignite silica gel indicator. Unscrew the cap from the container with silica gel dehumidifier, put the dehumidifier into a clean metal container. Put the container on the heat source (stove or electric range) with temperature of 160 – 180 °C. Ignite it during 4 hours	Silica gel indicator must be of intensive blue colour	
3 Clean the outer surfaces of the optic details with alcohol-ether blend (10% of alcohol, 90% of ether) or with alcohol	The outer optical details surfaces must be clean	Absorbent cotton for optic elements. First-class rectified technical ethyl alcohol (GOST 18300-87), anesthesia ether
4 Check the aiming circle and regulate it if necessary according to the point 13 of this manual	Non-coincidence of the aiming circle needle with the index must not be more than 0-10 in direction and not more than 0.5 mm in height. Stagnation angle must be not more than 0-03	Key spanner 7 from the single STA kit
5 Check the level and regulate it if necessary according to the point 13 of this manual	When the binocular rotates, the level bubble must not deviate from the middle for not more than one scale division of the level vial	Key spanner 7 from the single STA kit
6 Check the condition of the power supply contacts and the accumulators 5 contacts in the article. If necessary, remove the films from the contacts	There must not be any traces of oxidation and salt films on the contacts	First-class rectified technical ethyl alcohol (GOST 18300-87), absorbent cotton for optic elements

14.5 Maintenance procedure 2

14.5.1 M.-2 of the article is carried out not less than once in two years including:

1) servicing according to the results of M.-1;

2) when the article is sent to the long-term storage. Make note about carrying out M.-2 in the logbook.

14.5.2 While carrying out M.-2, it is necessary to carry out the tests and works required for M.-1 and additionally according to the table 14.5.

Table 14.5

Works	Technical requirements	Tools, outfit and materials necessary for the works
Check if there is backlash in the lifting screws of the bottom. If necessary, eliminate backlash according to the point 15 of this manual	The bottom case must not sway in regard to the lifting screws. The level bubble position must be stable when the binocular is rotated. The permitted deviation is one point of the level vial scale	Key spanner 7 (Fig. 12) from the single STA kit

14.6 Preservation

14.6.1 The article set preservation is carried out before its being sent to the short-term or long-term storage.

14.6.2 Carry out the works prescribed in M.-2 before the preservation.

14.6.3 The article and single STA kit preservation must be carried out in the following way:

1) Coat metal surfaces of the article and single STA kit which are not painted with viscous lubrication GOI-54p (GOST 3276-89). Spread it in thin layer, the old lubrication being removed beforehand;

2) wrap the lubricated metal surfaces in parchment P-45 (GOST 1760-86);

3) wrap the optic surfaces and light filters from the spare parts set in cotton wool for optic industry and parchment P-45;

4) pack the documentation into plastic pocket Ts 0,2 first-class GOST 10354-82.

14.6.4 Mark note about preservation in the logbook.

14.6.5 The given way of preservation provides article safety during 5 years of storage if all storage recommendations from the chapter 16 of this manual are observed.

Represervation of the article must be implemented in 5 years.

15 TYPICAL FAILURES AND WAYS OF THEIR HANDLING

15.1 List of failures and ways of their handling

15.1.1 If there are some problems during work with the article, it is necessary to check whether it is correctly prepared for work according to the chapter 11 of this manual.

15.1.2 If preparing of the article for work was carried out correctly, reveal possible reason of the failure and eliminate it. For that use the table 15.1.

Table 15.1

Failure, external manifestation, additional signs	Possible reason	Way of elimination	Notes
1 When the tumbler 35 (Fig. 7) is on, the scale image is not seen in the ocular 15. The reticule lines observed in the ocular 7 are not alight	The accumulator battery is discharged	1 Replace the accumulator battery for the operable one from the single STA kit 2 Charge the accumulators according to the Service Manual for the Charge Unit Set AL4.799.001 RE	
2 Locality image in the oculars of the article is blurred and of bad quality	Formation of dew on the oculars and protective glass	1 Wipe the outer optical surfaces with the napkin from the single STA kit 2 Check the condition of the silica gel indicator in the article the moisture eliminators. Replace the them for operable ones from the single STA kit, if necessary	
3 The bottom case sways in regard to the lifting screw. The level bubble position is unstable during rotating	Backlash in the lifting screws of the bottom	Superpose the hole B (Fig. 10) with the hole C of the screw-nut 11. Put the key spanner 7 (Fig. 12) from the single STA kit to the hole B (Fig. 10). Eliminate backlash by turning the screw-nut 11 anticlockwise. Eliminate backlash in all three lifting screws in turn. After regulating, twist of the lifting screws must be smooth, the level bubble position must be stable during rotating	

15.2 Using of single STA kit

15.2.1 In field conditions, it is allowed to replace only the parts which are mentioned in this chapter.

It is allowed to carry out minor repair of the tripod and the pack if possible.

15.2.2 If there is some failure which cannot be eliminated by the ways mentioned in this chapter, send the article to the maintenance organization.

15.2.3 Replacement of the moisture eliminators must be carried out only if the air outside or in the room is dry. It is done in the following way:

1) take cups 12 (Fig. 12) from the single STA kit ;

2) screw the moisture eliminators out of the cups with the help of the wrench 6;

3) screw the moisture eliminators 26 (Fig. 7) which are out of order out of the article with the help of the wrench 6;

4) screw the operable moisture eliminators into the article with the help of the key spanner 6 (Fig. 12). Screw till noticeable deformation of the rubber edges.

Silica gel indicator not saturated with moisture in the operable moisture eliminators has intensive blue colour. Silica gel indicator saturated with moisture in the moisture eliminators which are out of order has dirty pink colour.

15.2.4 Replace the container K-316 in the following way:

1) set the tumblers 35 (Fig. 7) and 36 to the position OFF;

2) move the stop 38 aside and open the cap 37;

3) remove the container K-316 which is out of order from the article, put operable container K-316 4 (Fig. 12) with charged accumulators 5 from the single STA kit instead;

4) close the cap 37 (Fig. 7) and block it with the stop 38;

5) check if the container K-316 operates well by turning the tumbler 35 on.

15.2.5 Set the aiming circle 8 (Fig. 12) in the following way:

1) superpose the projection of the holder 10 (Fig. 9) and the groove of the holder 21 (Fig. 7) and push the holder 10 (Fig. 9) up to the stop;

2) screw the screw 13 up to the stop.

15.2.6 Set the light filters 10 and 11 (Fig. 12) under the eye shade on the projection A of the holder 4 (Fig. 8).

15.2.7 Set the visor 2 (Fig. 12) on the head part of the binocular. The projection on the bottom of the visor must move into the groove on the holder of the protective glass 25 (Fig. 7). Push the visor up to the stop and put two hinges of the visor on the screws 24.

15.2.8 Set the support 9 (Fig. 12) on the holder 1 (Fig. 7) along the bayonet grooves.

15.2.9 Replace the cap 34 (Fig. 7) in the following way:

1) screw the cap 34 out holding its cylindrical surface;

2) take operable cap 15 (Fig. 12) from the individual spare pars set and screw it instead of the removed one. Put some yellow mastic 65M under the end of the cap.

16 STORAGE

16.1 The article and the single STA kit are stored in the pack.

16.2 Send for storage only operable articles after carrying out service M.-2 and preservation.

16.3 Store the articles in heated rooms, ambient air temperature being from + 1 to + 40 °C, and relative humidity being not more than 85 %.

16.4 It is prohibited to store the articles near heat sources, deleterious substances (chemicals), near electric ovens, etc.

16.5 Accumulators must be stored in the pack.

It is not recommended to store the accumulators in the container K-316.

17 TRANSPORTING

17.1 The article in pack can be transported to any distance in the cargo compartments of any kind of transport without any speed limitations.

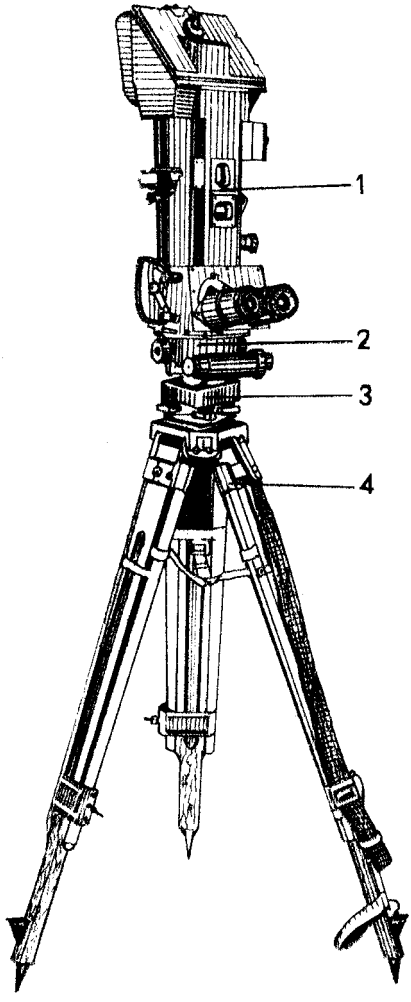
17.2 Before transportation, check if the article and the set are tightened well enough in the pack. All latches, buttons and fasteners must be in good condition.

17.3 During transportation, do not allow the packs bump against each other or against any other objects.

17.4 Put the pack with its cap upwards during transportation.

APPENDIX 1

FIGURES



1 – binocular; 2 – limb; 3 – bottom; 4 – tripod

Fig. 1 **Article 1N11**

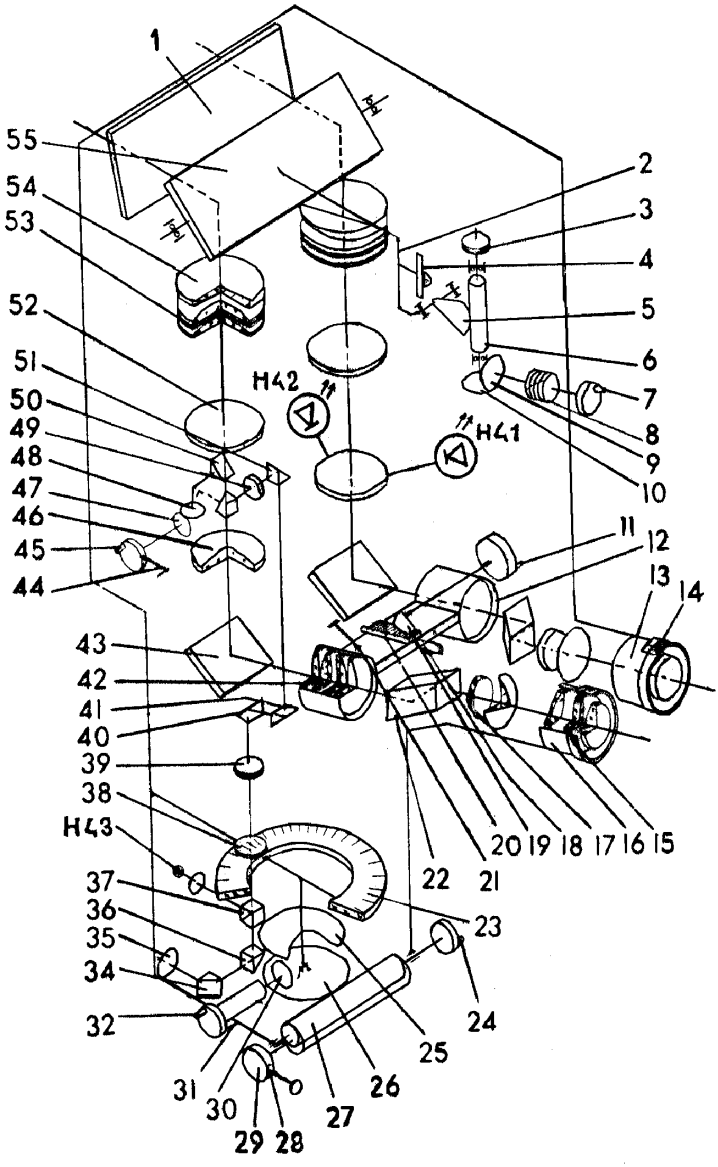


Fig. 2 **Article 1N11. Kinematic scheme**

1 – protective glass; 2 – control-rod; 3 – scale; 4 – scale; 5 – worm wheel;
6 – worm; 7 – handwheel; 8 – washer; 9 – tooth-wheel; 10 – tooth-wheel;
11 – handle; 12 – holder ; 13 – ocular; 14 – scale; 15 – moving part of the ocular;
16 – ocular; 17 – rigid part of the ocular; 18 – bush; 19 – sector; 20 – rack;
21 – block; 22 – prism BS-0°; 23 – limb; 24 – handwheel; 25 – tooth-wheel;
26 – worm-wheel; 27 – worm; 28 – stop; 29 – handwheel; 30 – tooth-wheel;
31 – spring; 32 – handwheel; 34 – prism; 35 – plate; 36 – prism; 37 – prism;
38 – scale; 39 – object-glass; 40 – prism; 41 – prism; 42 – erector; 43 – mirror;
44 – stop; 45 – handle; 46 – lens; 47 – tooth-wheel; 48 – tooth-wheel;
49 – object-glass; 50 – prism; 51 – prism; 52 – light filter; 53 – object-glass;
54 – wedge; 55 – mirror

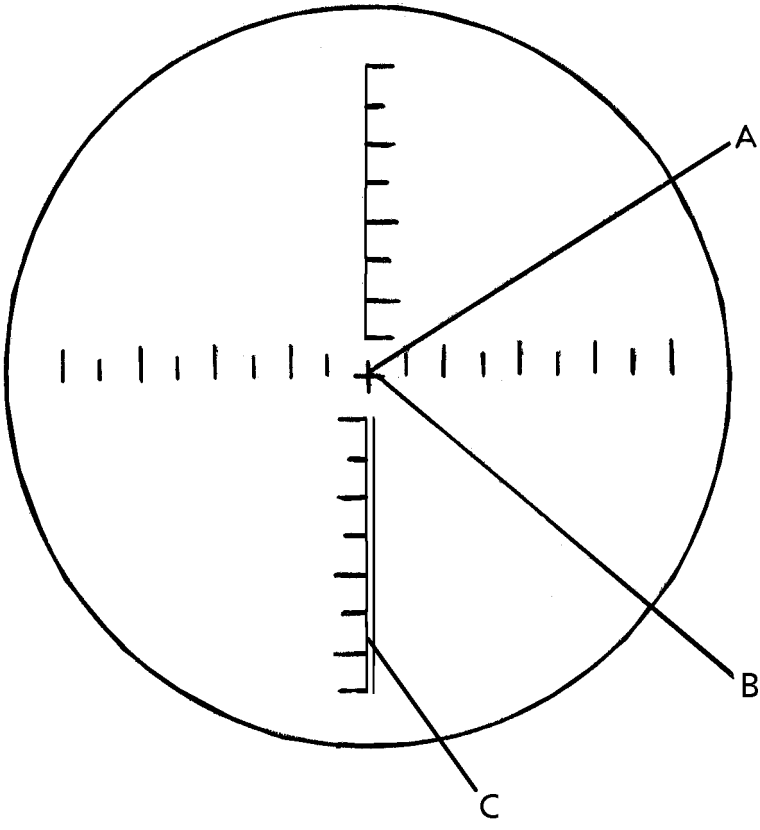


Fig. 3 **Field of view of the right branch**

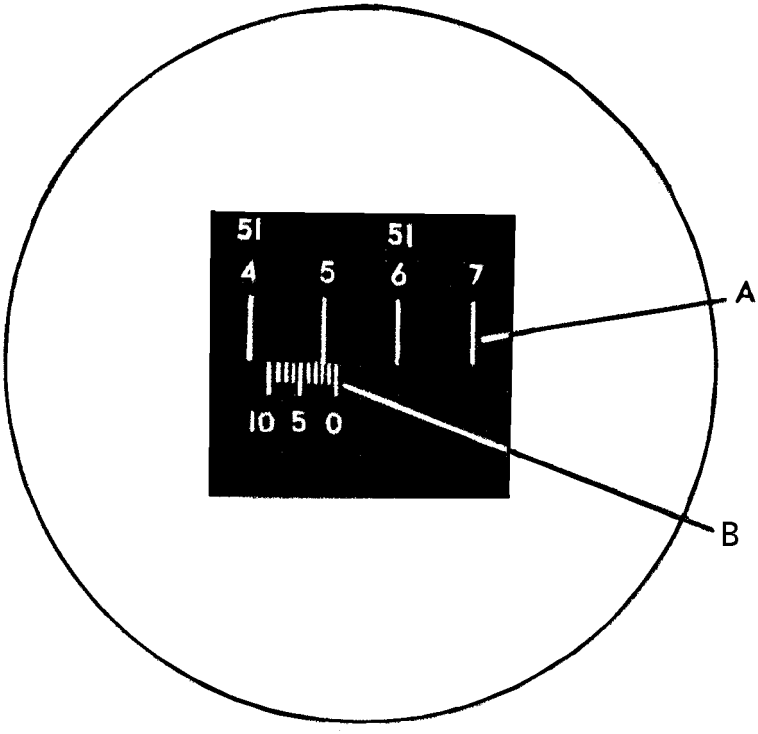
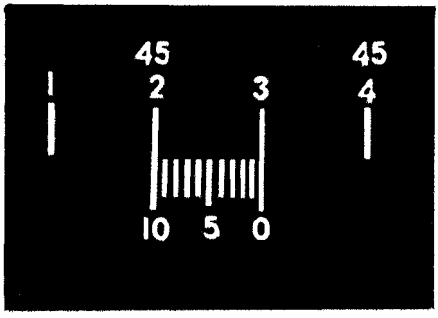
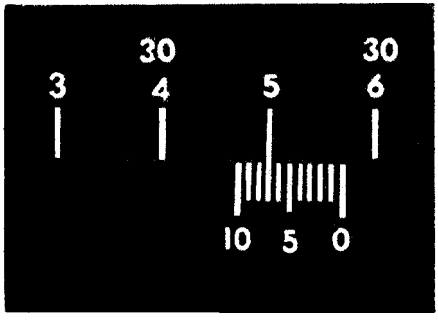


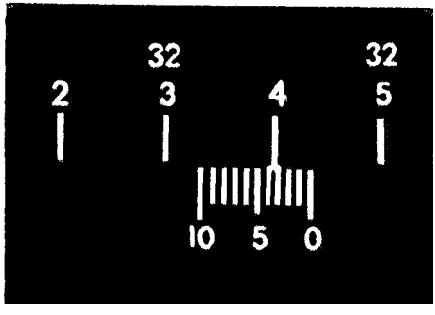
Fig. 4 **Field of view of the left branch**



Reading 45-30

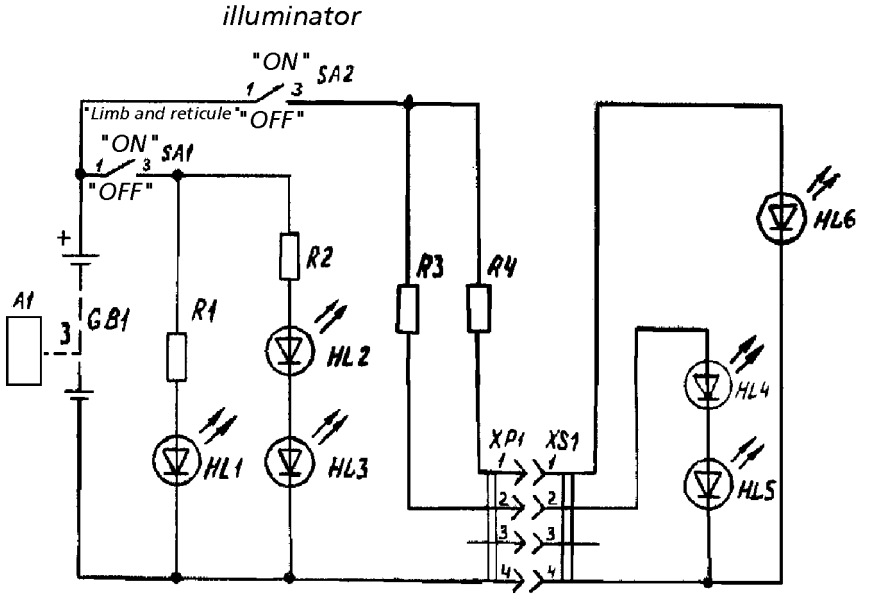


Reading 30-57



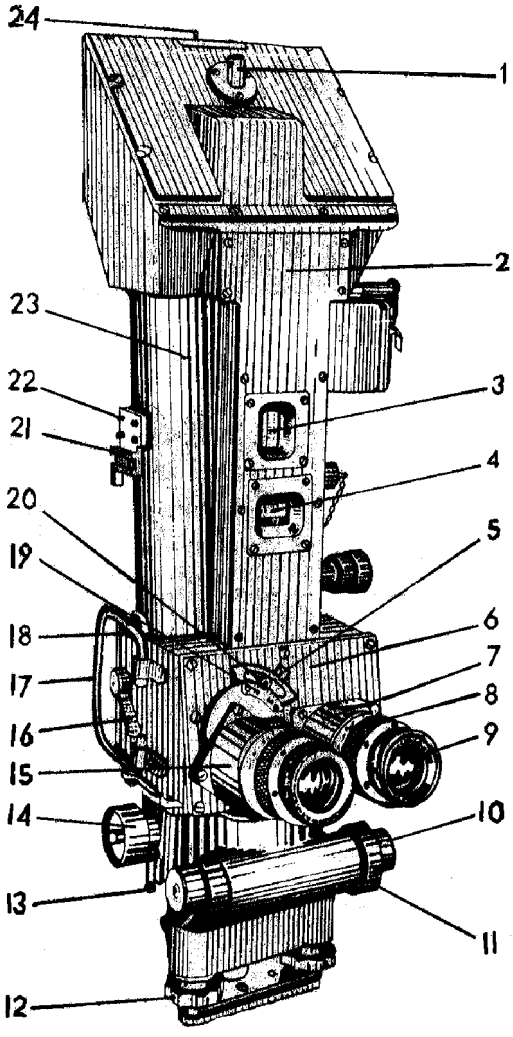
Reading 32-43.5

Fig. 5 **Examples of readings**

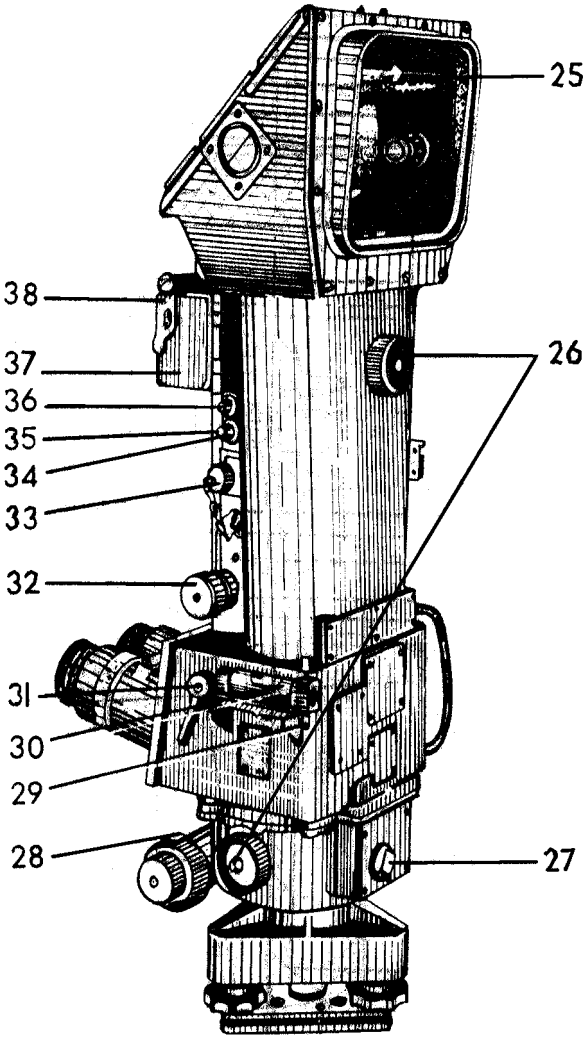


Code	Name	Qty	Note
A1	Container K-316	1	
GB1	NLTs-0,9-1 storage battery	3	
HL1…HL6	Light emitting diode ZL341B	6	
	Resistors S2-33-N		
R1	S2-33 - N-0.125 - 300 Ohm±5% A-D-V	1	
R2, R3	S2-33 - N-0.125 - 130 Ohm±5% A-D-V	2	
R4	S2-33 - N-0.125 - 300 Ohm±5% A-D-V	1	
SA1, SA2	Tumbler MT-1	2	
XP1	Plug 2RMG14B4SH1E2	1	
XS1	Socket 2RM14KPN4G1V1	1	

Fig. 6 **Article 1N11. Electric circuit**

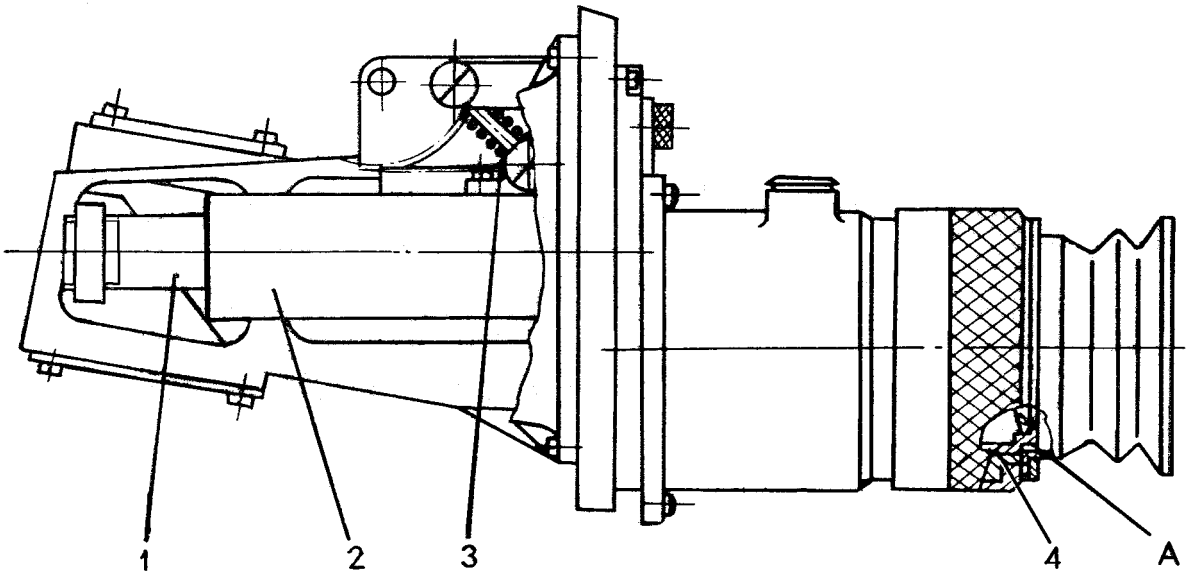


1 – holder; 2 – cap; 3 – scale; 4 – scale; 5 – clamp; 6 – board; 7 – ocular;
8 – scale; 9 – eye-shade; 10 – handwheel; 11 – handwheel; 12 – handwheel;
13 – screw; 14 – handwheel; 15 – ocular; 16 – handle; 17 – handle; 18 – latch;
19 – scale; 20 – index; 21 – holder; 22 – screw; 23 – case



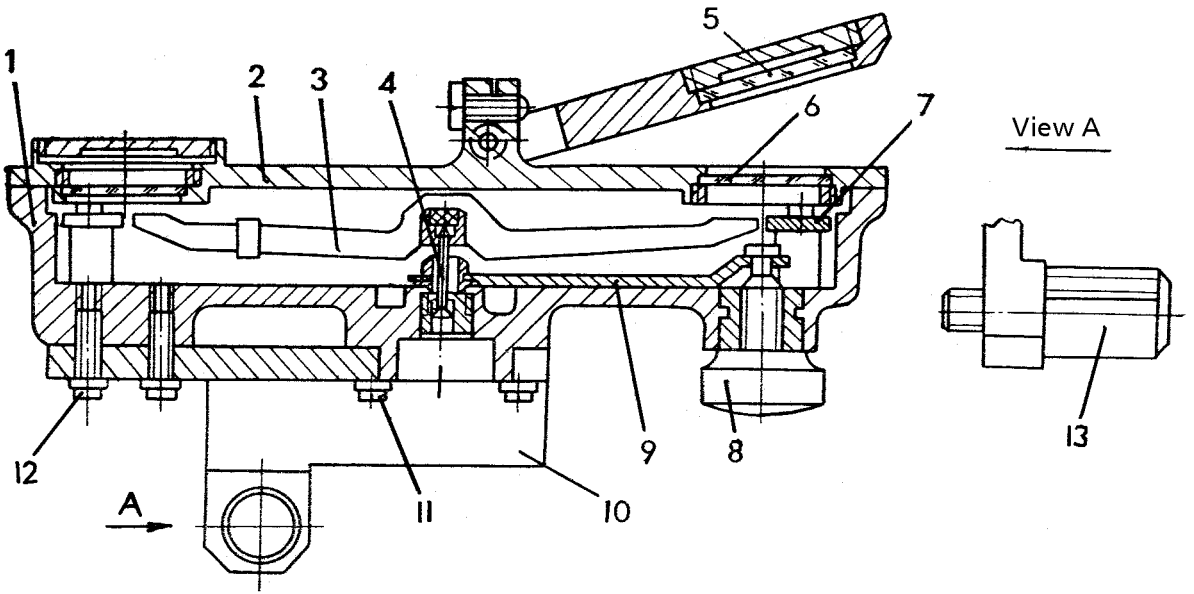
24 – screw; 25 – protective glass; 26 – moisture eliminator; 27 – mirror;
28 – stop; 29 – pin-screw; 30 – level; 31 – handle; 32 – handwheel; 33 – cap;
34 – cap; 35 – tumbler LIMB and RETICULE; 36 – tumbler ILLUMINATOR;
37 – cap; 38 – latch

Fig. 7 **Binocular with limb and bottom**



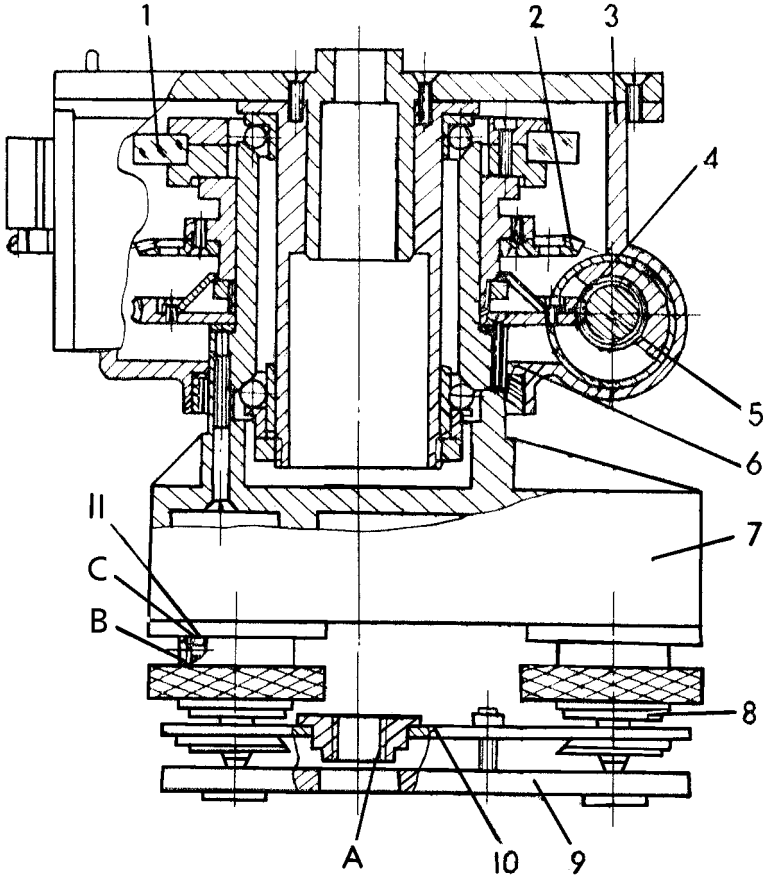
1 – bush; 2 – holder; 3 – block; 4 – holder

Fig. 8 **Board**



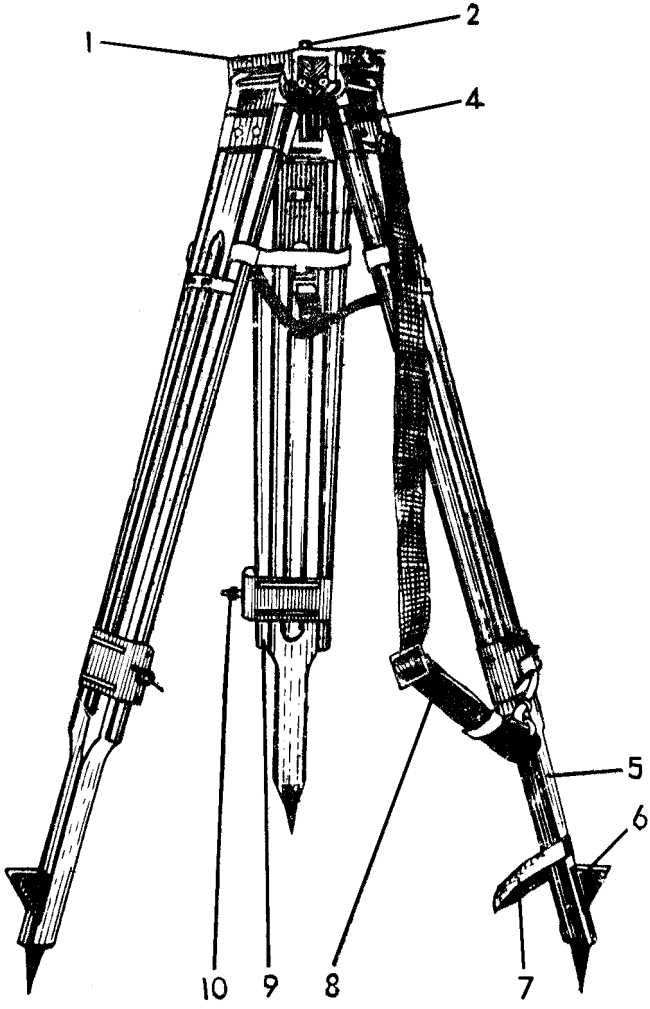
1 – case; 2 – cap; 3 – needle; 4 – steeple; 5 – mirror; 6 – protective glass; 7 – index; 8 – handwheel; 9 – arrester; 10 – holder; 11 – screw; 12 – screw; 13 – screw

Fig. 9 **Aiming circle**



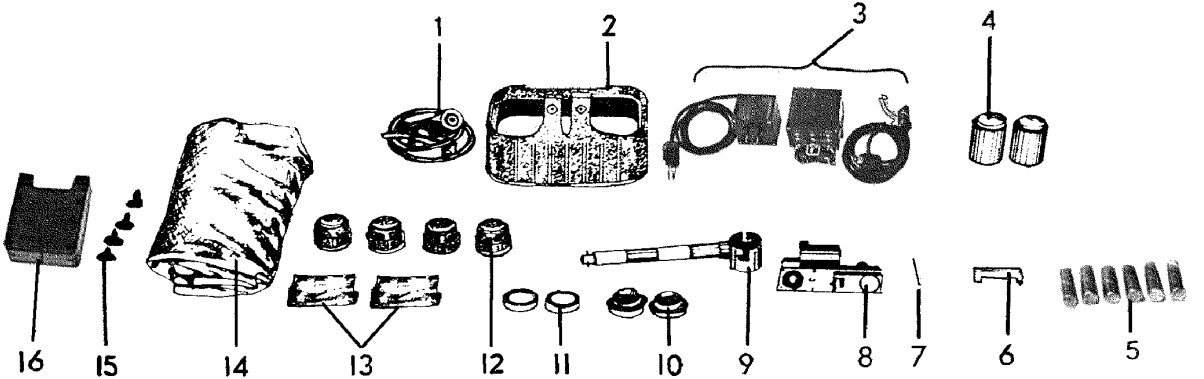
1 – limb; 2 – tooth-wheel; 3 – case; 4 – worm-wheel; 5 – worm; 6 – cage; 7 – case; 8 – screw; 9 – base; 10 – plate; 11 – screw-nut

Fig. 10 **Limb with bottom**



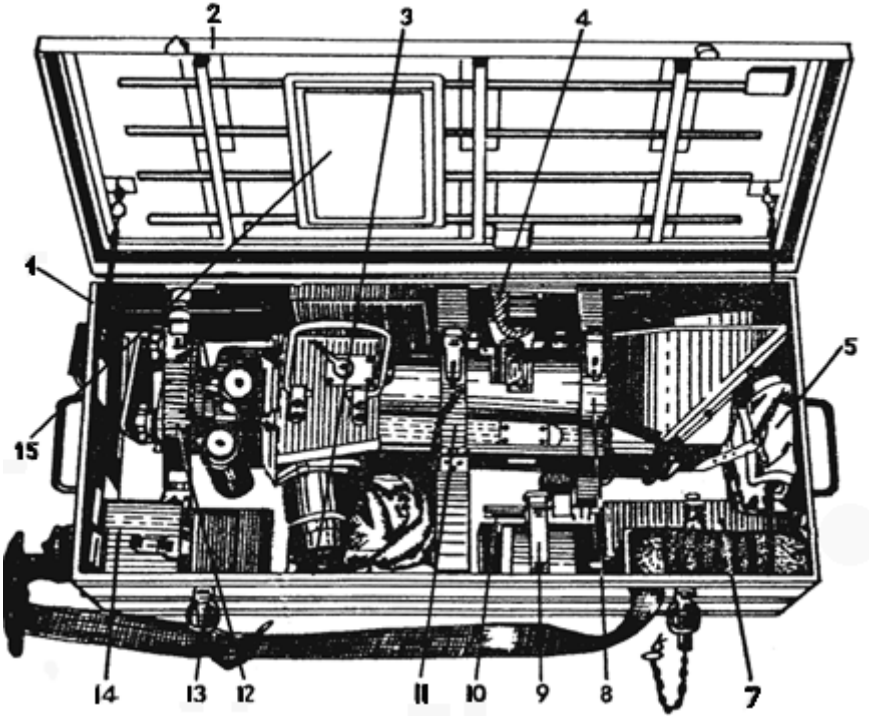
1 – base; 2 – pin; 4 – handle; 5 – rod;
6 – support; 7 – strap; 8 – strap; 9 – rod; 10 – thumbscrew

Fig. 11 **Tripod**



1 – illuminator; 2 – visor; 3 – charge unit; 4 – container K-316; 5 – NLTs-0,9-1 storage battery; 6 – key spanner; 7 – key spanner; 8 – aiming circle; 9 – support; 10 – light filter; 11 – light filter; 12 – cup; 13 – napkin; 14 – soft cover; 15 – cap; 16 – battery tester YK-316

Fig. 12 **Single STA kit**



1 – pack; 2 – cap; 3 – spring; 4 – pocket; 5 – bag;
7 – box; 8 – clamp; 9 – strap; 10 – partition; 11 – clamp;
12 – clamp; 13 – lock; 14 – box; 15 – list of enclosure

Fig. 13 **Article 1N11 in the pack**