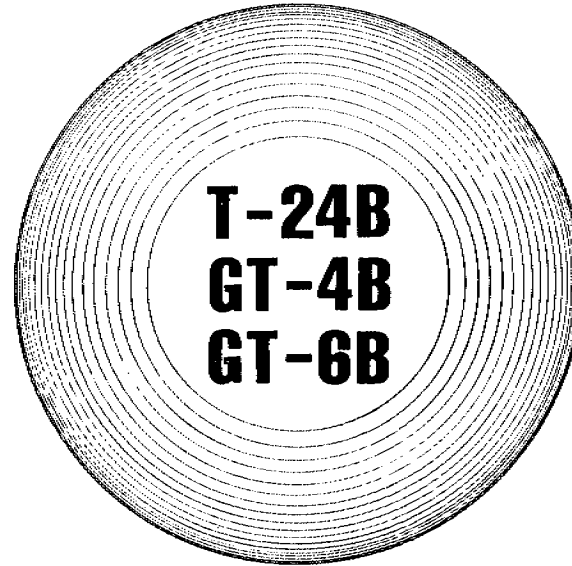


PENTAX / GEOTEC

TRANSIT



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PENTAX

OPERATING INSTRUCTION BOOK

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2. Looking through the optical plummet, by turning foot screws, coincide intersection of O.P. cross line with intersection of cross line drawn on white paper.
3. Turn the alidade through 180° and look through optical plummet and check whether intersection of O.P. cross line and intersection of cross line which is drawn on white paper coincide. If they do not coincide, adjustment is necessary.

Adjustment

1. Draw straight line between two points: the one point sighted by intersection of O.P. cross line and the other point of intersection of cross line drawn on white paper and adjust three adjustment screws so as that O.P. sights the center point. (See Fig. 19.)
2. By turning the alidade through every 90° , repeat adjustment until the intersection of O.P. cross line and the intersection of cross line on the white paper always coincide. In these adjustment and inspection, the instrument need not to be horizontal.

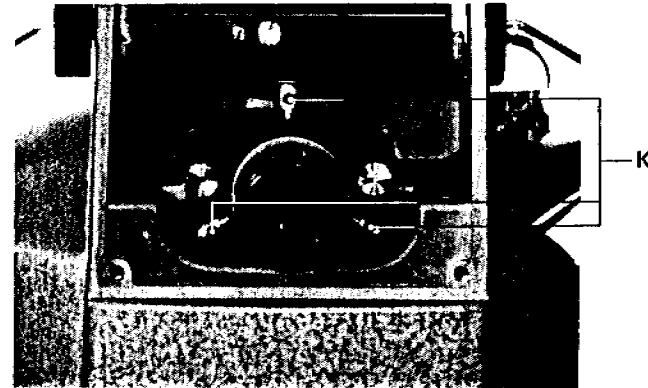


Fig. 19 K Adjustment Screws

7-6 Index Error

These inspection and adjustment are made after the inspection and adjustment of telescope level. Check that the bubbles in the plate level and in the telescope level are positioned in the center and take a reading of vertical circle. At this time, if the reading of vertical circle is 0, no adjustment is necessary. If it is not 0, removing standard cover at the side of vertical circle, loosen clamp nut with adjustment pin and by rotating vernier adjustment screw with adjustment pin, set the reading of vertical circle to 0 and tighten clamp nut.

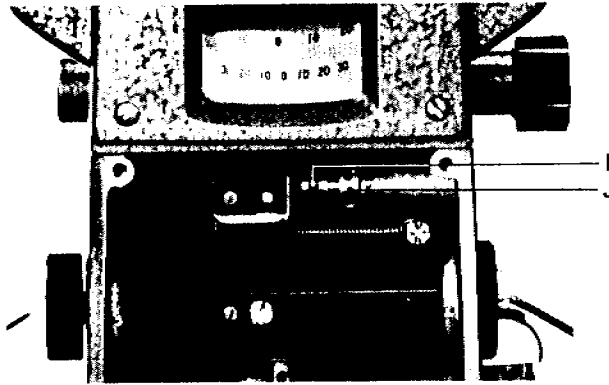


Fig. 18 I Adjustment Screw J Clamp Nut

7-7 Optical Plummet (O.P.)

The line of sight of O.P. should coincide with the prolongation line of the center of vertical axis. So do inspect and confirm whether the optical plummet is adjusted correctly or not.

Inspection

1. Attach the instrument to the tripod and set it. Place on a ground a sheet of white paper on which a cross line is drawn below instrument.

1. Technical Data

Telescope	erect image
Magnification	28X
Clear objective aperture	1.6in 40mm
Field of view at 1,000ft/m.	.24ft / 24m
Shortest focusing distance	5.3ft 1.6m
Multiplication constant	100
Additive constant	0

Bubble sensitivities per 2mm run

Telescope level	40"
Plate level	90"
Circular level	.10'

Horizontal circle	360°
Graduation diameter (T-24B)	4.7in 120mm
Graduation diameter (GT-4B and GT-6B)	4.3in 110mm
Vernier reading	20"

Vertical circle

Graduation diameter (T-24B)	2.8in 70mm
Graduation diameter (GT-4B and GT-6B)	2.8in 70mm
Vernier reading	1'

Compass Built in bar type

Weight

Instrument of T-24B	9.9lbs	4.5kg
Instrument of GT-4B	10.8lbs	4.9kg
Instrument of GT-6B	10.8lbs	4.9kg

Plastic carrying case. 4.4lbs 2.0kg

2. Description
2-1 T-24B

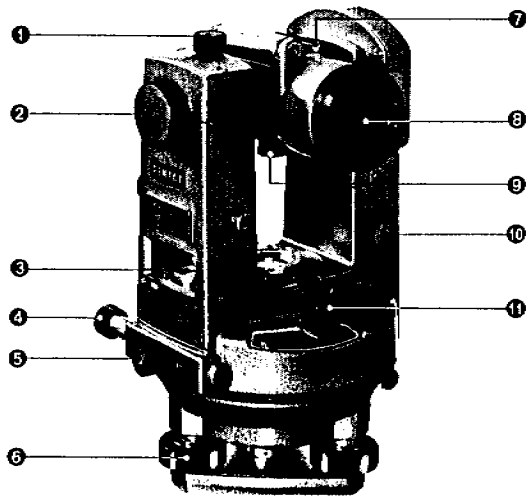


Fig. 1

A

- | | |
|--------------------------------|--|
| ① Telescope clamp screw | ⑦ Optical sight |
| ② Focussing knob | ⑧ Objective lens |
| ③ Circular bubble | ⑨ Reticle illumination knob |
| ④ Horizontal upper drive screw | ⑩ Compass clamp knob |
| ⑤ Horizontal upper clamp screw | ⑪ Horizontal circle reading eyepiece (B) |
| ⑥ Foot screw | |

Adjustment

1. Point the telescope to the target board in the longer distance. Adjust the reading by rotating the telescope drive screw so as to be the same reading to the target board in the shorter distance.
2. Rotate the bubble adjustment nut (Fig. 17) with the adjusting pin to center the bubble in the telescope level.
3. Repeat from inspection 4 and check that the adjustment is correct.

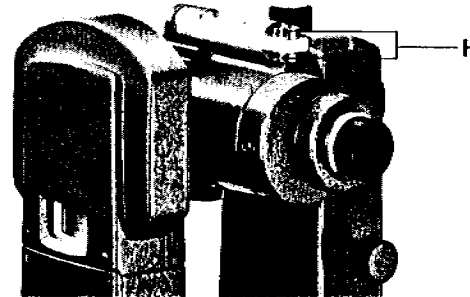


Fig. 17 H Adjustment Nuts

7-5 Telescope Level

Inspection

1. Prepare two same plates and set up the instrument in the center of two walls having a distance of 30 – 50 meters and level it.
2. Center the bubble in the telescope level with telescope drive screw to set both walls on the line of sight alternately. Set a target board on each wall so that reading on it appears at the same level. (Fig. 16A)
3. Move the instrument to a position 2 meters distance from a wall and level it. (Fig. 16B)
4. Center the bubble in telescope level with telescope drive screw and take a reading on each target. If the readings are the same, no adjustment is necessary. If they do not coincide, adjustment is necessary.

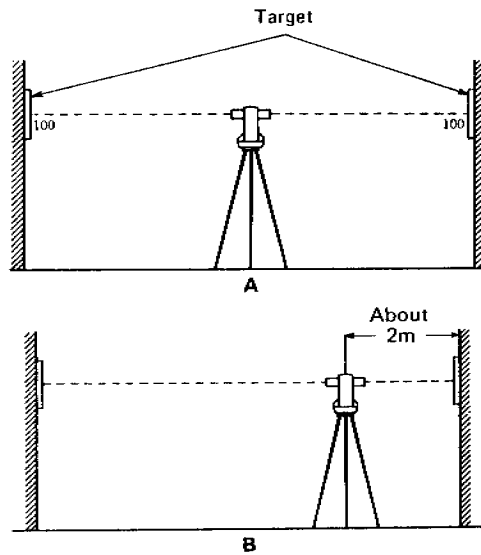
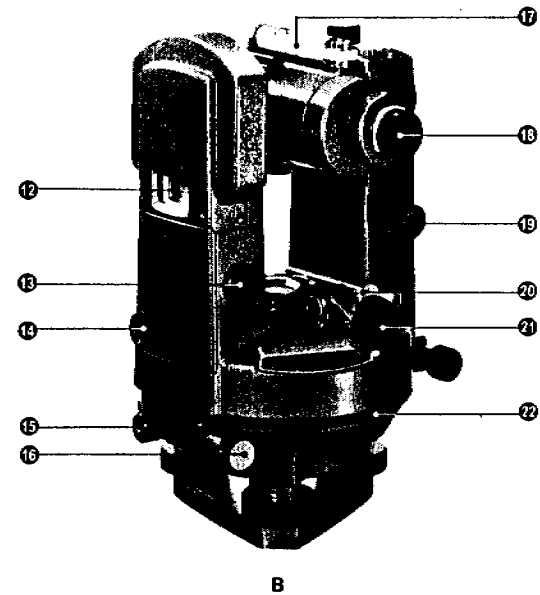


Fig. 16



- | | |
|---------------------------------|---|
| 12 Vertical circle | 18 Telescope eyepiece |
| 13 Compass index line | 19 Telescope drive screw |
| 14 Optical plummet | 20 Plate level |
| 15 Horizontal lower clamp screw | 21 Horizontal circle reading eyepiece (A) |
| 16 Horizontal lower drive screw | 22 Circle rotation ring |
| 17 Telescope level | |

7-3 Circular Bubble

After finishing adjustment of plate level in section 7-2, the circular bubble should now be in the center of its setting circle. If the bubble is not in the center, turn the adjustment screws with screw driver or adjusting pin until the bubble shifts in the center. (See Fig. 13.)

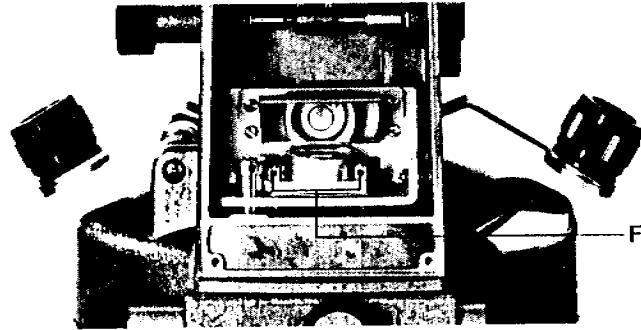
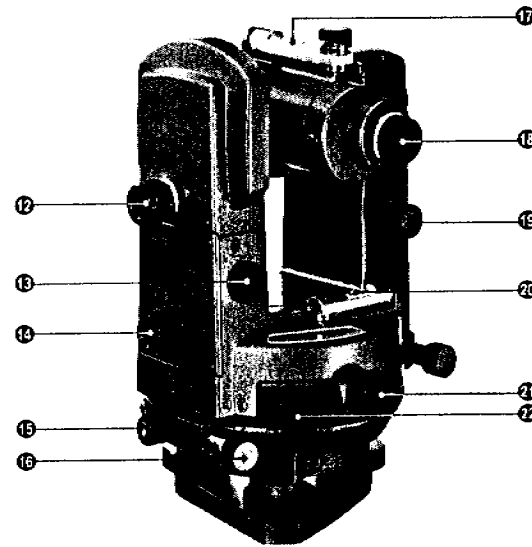


Fig. 13 F Adjustment Screws

7-4 Horizontal Collimation Error

The error of horizontal line of sight is eliminated in all cases by obtaining the average observation of telescope in normal and reversed position. Besides particular cases, the adjustment should be avoided by yourself. If necessary, the adjustment is made as follows.

1. Make the point which is 30m — 50m away from the instrument and is the same height with that of instrument. With telescope in normal position, vertical line of cross hairs sights the point and call it point A.
2. Slacken telescope clamp screw (1) and reverse telescope and sight the point B on the opposite side of point A under the same conditions of point A.
3. Loosen horizontal upper clamp screw (5) with telescope reversed and turn the alidade clockwise and sight point A again.
4. Loosen telescope clamp screw and return telescope to normal position. Make a point which is sighted similar distance with point B and call it point C.
5. If point B and point C coincide, no adjustment is necessary.



B

- | | |
|-------------------------------------|---|
| 12 Vertical circle reading eyepiece | 18 Telescope eyepiece |
| 13 Compass index line | 19 Telescope drive screw |
| 14 Optical plummet | 20 Plate level |
| 15 Horizontal lower clamp screw | 21 Horizontal circle reading eyepiece (A) |
| 16 Horizontal lower drive screw | 22 Circle rotation ring |
| 17 Telescope level | |

3. Preparation for Measuring

3-1 Setting up the Instrument and the Tripod

Adjust the length of tripod legs so as to be comfortably high for measuring. Set the tripod by eye over the ground point and tread metal shoe firmly into ground. If necessary, use plummet bob. Set the instrument on the tripod plate and fix it with center screw. Looking through optical plummet eyepiece (14), rotate foot screw (6) and tilt the instrument so as to coincide the cross of optical plummet eyepiece with ground point. By extending or retracting each leg of tripod, position the circular bubble in the center of setting circle. At this time, the cross of optical plummet is on the ground point.

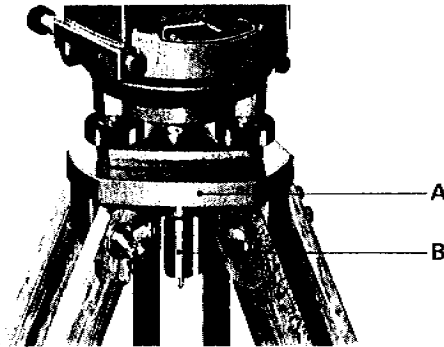


Fig. 3 A Tripod Plate B Center Screw

3-2 Leveling up by Plate Level

At first, memorize that the bubble of plate level moves to the shift direction of left thumb when turning the foot screws. If the sun shines too strongly, the instrument should be protected from direct ray by sunshade and so forth. Procedures of leveling up by plate level is follows.

1. Loosen horizontal upper clamp screw (5) or horizontal lower clamp screw (15) and rotate the alidade (upper part of instrument) so that plate level (20) is parallel to the line joining any two foot

6-3 Eyepiece Sunglass

This is used for the sun or bright object observation and is fitted on telescope eyepiece (18).

The color of sunglass is dark green and light green. Two different coloured sunglasses available.

7. Testing and Adjusting

7-1 Tripod

There should be no looseness between the various components of the tripod in particular between wooden parts and metal parts. If necessary, tighten screw of each part by driver or wrench.

7-2 Plate Level

Level up the instrument as described in section 3-2 in advance. If the bubble will not remain centered for all positions of alidade, adjust as follows.

1. After leveling up instrument as described in section 3-2 and turn the alidade through 180° . See the position of the bubble.
2. With adjusting pin, by turning adjustment screw, bring the bubble to a point halfway between moved point. (See Fig. 12.) And by turning foot screw C, bring the bubble to the center.
3. If the bubble does not remain in the center by turning the alidade for all direction, repeat from step 2 until the bubble remains centered for all positions of alidade.

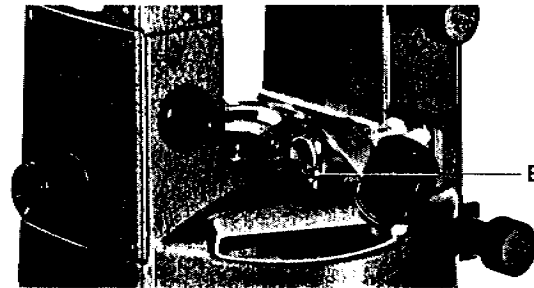


Fig. 12 E Adjustment Nut

6-2 Diagonal Eyepiece

It is used for zenith and observing in confined spaces and so on. It is fitted on telescope eyepiece (18). When fitting diagonal eyepiece, turn rotation ring of telescope eyepiece counterclockwise and remove the eyepiece. Turn the rotation ring of diagonal eyepiece clockwise to fit on.

The direction of diagonal eyepiece can be turned through 360° . When look through telescope with diagonal eyepiece fitted on, such phenomenon rarely happens that reticle cross hairs are visible moved up and down or right and left. But this phenomenon is not related to the precision of instrument. If necessary, it can be adjusted by three adjusting screws.

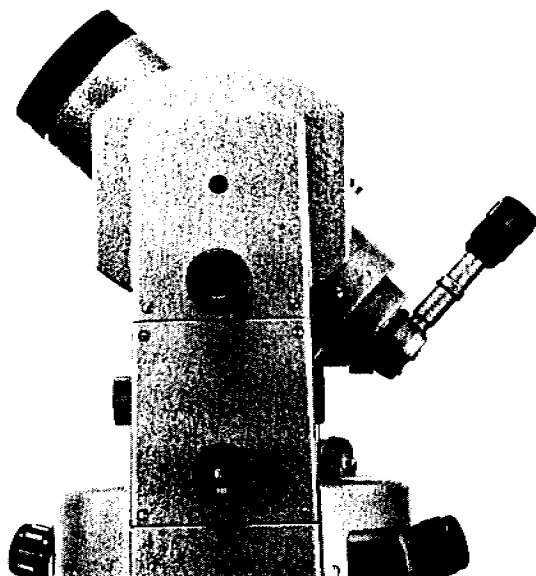


Fig. 11 Diagonal Eyepiece

screws (6), A and B. Center bubble by turning A and B foot screws toward equal and opposite direction.

2. Turn the alidade through 90° in a clockwise and center the bubble by remaining foot screw C.

Furthermore, turn the alidade in the same direction through every 90° . Repeat step 1 and step 2. As a result, the bubble should be always centered for all direction of the alidade.

3. If the bubble cannot be positioned in the center, the adjustment of plate level is required. (See p. 18 Chapter 7-2.)

* After leveling up by plate level, shift the instrument on the tripod plate and reset centering if necessary. At this time, take care not to rotate tribrach on tripod plate. If rotate it, the bubble positioned in the center would shift.

* Shifting device is incorporated in GT-6B. Therefore, GT-6B can be moved easily without shifting the bubbles.

3-3 Centering under Roof Point

Method 1

The instrument can be centered under plumb bob suspended from a roof or ceiling by lining up the plumb bob with the center of reticle illumination knob (9). The instrument is fitted on the tripod placed under the tip of plumb bob already suspended from roof or ceiling point. Level up the instrument by method of Chapter 3-2, and with telescope reversed, set it horizontal and set vertical circle to 0° correctly.

The instrument is now shifted over tripod plate (do not turn foot plate) so as that the center of reticle illumination knob exactly coincide the tip of the plumb bob.

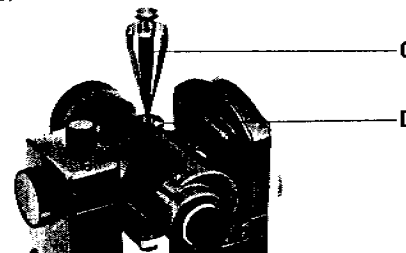


Fig. 4 C Plumb Bob D Reticle Illumination Knob

Method 2

From roof point or ceiling point, a plumb bob is suspended, move the roof point and ceiling point to the ground and set ground point there. Set the instrument on the ground point moved from roof or ceiling point by method of Chapter 3-1 and Chapter 3-2 and under the above mentioned steps centering of instrument to the ceiling point has been achieved.

4. Measuring

4-1 Focussing and Sighting

4-1-1 Reticle Cross Hairs

Take off objective cap on telescope and fit sunshade on it if required. Point telescope to bright direction, Turn telescope eyepiece (18) in a counterclockwise direction and pull out the eyepiece ring. Looking through telescope, rotate the eyepiece ring in a clockwise direction until cross hairs line is sharp and black. Try to be relaxed when you look through the eyepiece. Because you try to concentrate too hard while looking at cross hairs, you will become susceptible to parallax. This will also produce a strain on your eyes.

4-1-2 Target Image Focusing

Slacken horizontal lower clamp screw (15) and telescope clamp screw (1). Point telescope to target by optical sight (7). Tighten all clamp screw (1). Point telescope to target by optical sight (7). Tighten all clamp screws. Look through telescope eyepiece and turn focussing knob (2) until target is seen. By turning horizontal lower drive screw (16) and telescope drive screw (19), set cross hairs to target. Turn focussing knob until target is seen sharp or free from parallax. (even if your eyes move right and left, cross line does not slip out target.) The focussing marks comprise an infinity (∞) and three triangular marks. The tip of each triangle (Δ) shows the distance direction. Smaller triangle indicates greater distance. The smaller mark indicates about 4m (13.3ft). The middle mark indicates about 7cm (6.7ft). The biggest triangular mark indicates about 1.6m (5.3ft).

4-1-3 Sighting

Turn horizontal lower drive screw (16) and telescope drive screw (19) or turn horizontal upper the drive screw (4) and telescope drive screw (19) until telescope sights the target correctly. It depends on kinds of

6. Optional Accessories

6-1 Electric Illumination

This is used for the dark places such as night and underground work. Electric illumination consists of lamp house and battery box in one set. Lamp house holds connection cable for connecting with battery box. The brightness of cross hairs can be adjusted by reticle illumination knob (9).

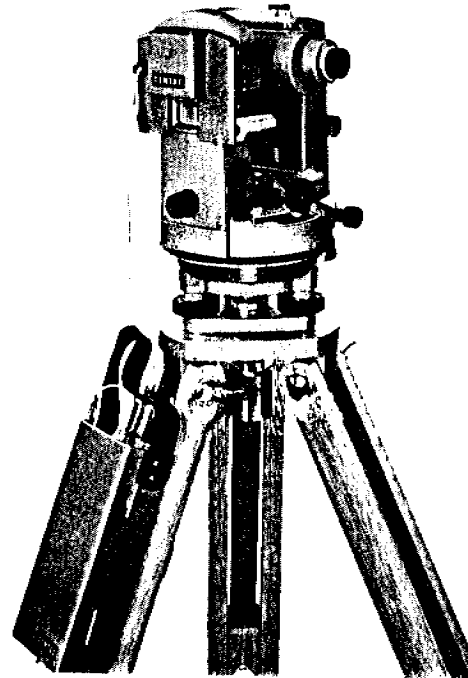


Fig. 10 Electric Illumination

5. Care and Maintenance

Before removing the instrument from tripod, remove all accessories. Fit cap on objective lens and loosen each clamp screw. Align two or three small round yellow packing marks. Make telescope horizontal and tighten all clamp screws. Wipe off dust and stain clearly with soft cloth (if possible, bleaching better). If the instrument gets wet and moisture, get rid of it with soft cloth. Until the instrument gets dry completely, do not put it into the container. Please avoid to put the instrument into container with wet and moisture condition. Leave accessories in a fixed place of container exactly and take care for them not to shift in a container. When closing the lid of container and have difficulty to close it, the way of packing is different. At this time, re-leave the instrument in container seeing picture.

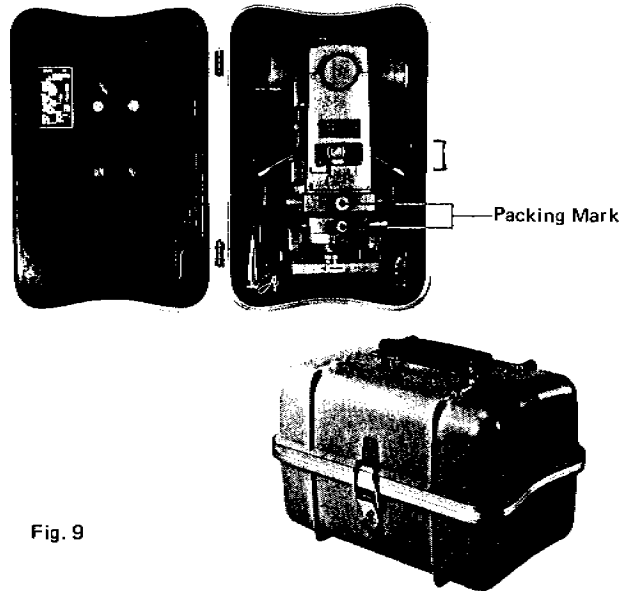


Fig. 9

target whether single vertical hair splits or double hairs put into the target.

The last turn of a drive screw should be clockwise. At the time of measuring in a dark place, set illumination device on instrument (15) and adjust reticle illumination knob until cross hairs are illuminated.

4-2 Circle Reading

4-2-1 Horizontal Circle

First, read off the circle graduation in 20' unit on the regular scale indicated by the 0 line on the vernier scale. (In Fig. 5, 72° plus two 20' graduation, i.e. 72°40'.)

Secondly, read off the reading on the vernier scale which is most closely aligned with the regular scale. (In Fig. 5, 7' plus two 20'' graduation, i.e. 7'40''.)

Add the reading of the two scales together to obtain the final reading. (In Fig. 5, 72°40' + 7'40'' = 72°47'40''.)

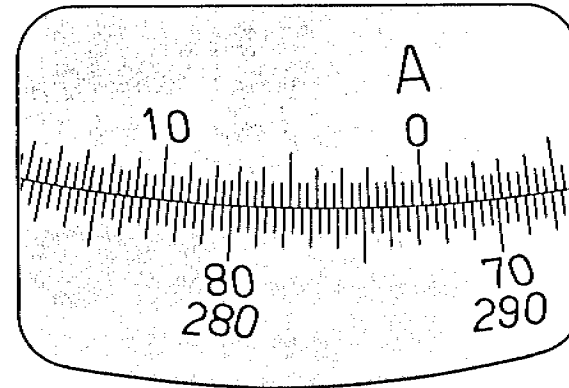


Fig. 5 Horizontal Circle 72°47'40''

* When angle measurement of very high precision is required, read off both A and B verniers and take the average as the final value.

4-2-2 Vertical Circle

Firstly, read off the circle graduation in 30' unit on the regular scale indicated by the 0 line on the vernier scale. (In Fig. 6A, 16°30'; in Fig. 6B, 12°30'.)

Secondly, read along the regular scale (in the direction of higher numbers) and read off the reading on the vernier scale which is most closely aligned with regular scale. (In Fig. 6A, 23'; in Fig. 6B, 17'.)

Add the reading of the two together to obtain the final reading. (In Fig. 6A, 16°53'; in Fig. 6B, 12°47'.)

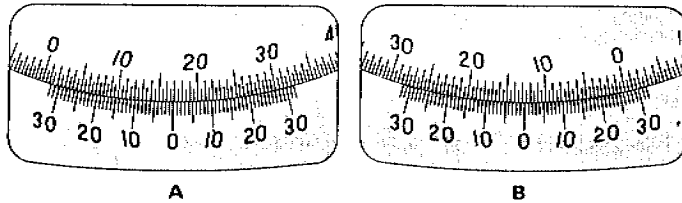


Fig. 6 Vertical Circle

* The vertical graduated circle is a 0 - 90° - 0 - 90° - 0 compass scale. When the line of sight of the telescope is horizontal, the reading is 0.

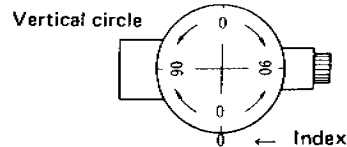


Fig. 7 Vertical Circle

4-3 Setting Horizontal Circle to Required Value

When setting horizontal circle to 0° or to required angle, the following steps are made.

1. Loosen each clamp screw and by turning circle rotation ring (20), position the circle graduation of required angle to the position which can be read by circle reading eyepiece (22).

(In case of GT-4B and GT-6B, position the circle number of required angle engraved on horizontal circle rotation ring close to horizontal circle lense.)

2. Tighten horizontal upper clamp screw and turn horizontal upper drive screw. Set the vernier graduation reading to required reading.

4-4 Stadia Surveying

Using stadia line having in cross hairs, distance measurement can be done from the center of the instrument to the staff. When line of sight is horizontal, 100 multiple of ℓ : staff interval put into by stadia line is horizontal distance.

When line of sight is inclined, the calculation is made as follows.

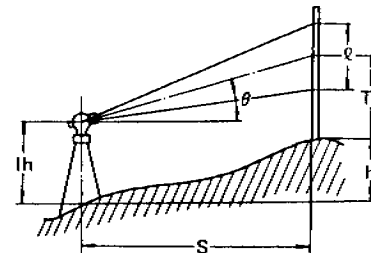


Fig. 8

$$S = 100 \ell \cos 2 \theta \text{ (Should be } lh = Th \text{)}$$

S = Horizontal distance

ℓ = Reading difference of top and bottom stadia line readings

θ = Vertical angle

lh = Instrument height

Th = Reading of line of sight

