

The invention relates to a periscope-like sighting device, having a main mirror which is mounted in a mirror head pivotably round a first axis and which, together with the mirror head, is mounted rotatably round a second axis, and having an optical system, formed from several elements, in a housing.

The aim of the invention is to arrange the individual optical elements in a housing in a sighting device of the above type, so as to achieve as large as possible an area of observation.

According to the invention this aim is achieved in that an optical system comprising a first deflection prism, an objective lens, a first beam splitter, a second beam splitter and a second deflection prism, as well as the main mirror associated with the first deflection prism, and the mirror head are arranged in the housing to slope backwards from bottom to top in relation to a vertical rear wall of the housing in the direction of incident visible and/or invisible radiations.

According to a further feature of the invention the sighting device is provided with a laser range finder known per se for measuring the target. Here the actual laser transmitter is arranged on the rear of the sighting device housing, a further deflection mirror is associated with the main mirror, and also the actual laser-receiver is associated with the first beam splitter of the optical system.

Further features of the invention can be seen from the following description in conjunction with the drawings and the claims.

The invention will be described in more detail below by means of an embodiment example with reference to the drawings. These show:

Fig. 1 a schematic sectional side view of a sighting device with the arrangement of the optical elements and of a laser range finder,

Fig. 2 the sighting device of Fig. 1 shown in section,

Fig. 3 a schematic view shown on an enlarged scale of the optical elements arranged as a structural unit on a carrier member,

Fig. 4 a section along the line IV-IV in Fig. 3 with an adjustment device arranged on the carrier member,

Fig. 5 a section along the line V-V in Fig. 3 through the carrier member,

Fig. 6 a mirror head for the main mirror of the sighting device of Fig. 1, shown in elevation,

Fig. 7 the mirror head of Fig. 6 shown in side view, and

Fig. 8 a diagram to explain the co-ordinates which can be reached by the rotary- and pivoting movement of the main mirror mounted in the sighting device housing.

In Figures 1 and 2, 100 designates a periscope-like sighting device which substantially comprises a housing 30, an optical system 20 formed from several elements and also an integrated laser-range finder 25 formed from several elements.

Fig. 1 shows the schematically represented sighting device 100 in section according to the line I-I shown in Fig. 2, and in it can be seen the housing 30, the optical system 20 and the partially represented laser-range finder 25. The housing 30 substantially formed from side walls 32, 32', a rear wall 31 as well as an upper floor 33' and a lower floor 33, has, on the side opposite the rear wall 31, a front wall 34 which slopes backwards from bottom to top. An opening 34' constructed as a window is provided in the front wall 34, and is closed by means of a glass cover plate 35 which is secured by means which are not shown.

As shown in Fig. 1 and 2 and seen in the direction of optical radiation A1, A2, A3, A4 and A5, the optical system 20 formed from the individual elements comprises a main mirror 10 mounted pivotably in a mirror head 40, a first deflection prism 12 provided with an aperture diaphragm 11, an objective lens 13, a first beam splitter 14

for reflecting-out the laser radiation, a second beam splitter 15 and a second deflection prism 16 for deflecting the optical radiation, as well as an eyepiece 19 for viewing by an observer 1.

The sighting device 100 is arranged on a carrier (not shown) for example a weapon, and can be directed onto an object together with the weapon according to its height and its lateral displacement. The mirror head 40 arranged in the sighting device 100 on the one hand, and the main mirror 10 on the other hand, can be rotated or pivoted relatively to the movement of the weapon. Here, as can be seen in Fig. 2, the main mirror 10 is pivotable round a first axis X in the direction of arrow X' and is rotatable together with the mirror head 40 round a second axis Y in the direction of arrow Y'. The range of rotation in the direction of the arrow Y' of the mirror head 40 amounts to about 27° to the left and to the right respectively. To achieve as great as possible a pivoting movement of the main mirror 10 composed of the angles A and B, the mirror head 40 is slopingly arranged and mounted in the housing 30 at an angle C with respect to the lower floor 33 as seen in the direction of the rear wall 31, as illustrated in Figure 1.

At a slope angle C of the mirror head 40 of about 66° a preferred geometrical arrangement is obtained with an optimum angle of elevation A of about $+80^\circ$ relative to a horizontal plane H and an optimum angle of depression B of about -20° .

As shown in Fig. 1, in order to obtain as great as possible an area of observation via the sighting device housing 30, the eyepiece 19 is also arranged to be inclined at an angle D on the rear wall of the housing 30. The viewing angle designated D is about 25° . With this arrangement the observer 1 can both look into the eyepiece 19 and also monitor the free observation area above the sighting device for any possible necessary regulation, by means of a slight nodding motion of the head.

The elements 12, 13, 14, 15 and 16 of the optical system 20 shown in Fig. 1 and Fig. 2, as well as a deflection mirror 21 associated with the main mirror 10, are arranged in the housing 30 in accordance with the slope angle of the mirror head 40. The optical system 20 is substantially arranged on a carrier member 50 formed as a portion 51 of the rear wall 31, as will be described in detail below.

Fig. 3 schematically shows the carrier member 50 on an enlarged scale, this member having a plate-like portion 51 provided with a surrounding bearing surface 51'', and being constructed on its inside 50' for receiving and securing of the optical elements. The carrier member 50 has on the inside 50' a pocket 55 substantially formed from web members 52, 53, 54 and a front wall 56 as well as a rear wall 57 (Fig. 5), the pocket being constructed to receive the second deflection prism 16, the second beam splitter 15, the first beam splitter 14 and also a first lens 22. The parts 16, 15, 14 and 22 are held in the pocket 55 by means which are not shown. A lens system 23 as well as a laser-receiver 24 (Fig. 2) of the laser range finder 25 are secured on the web 53 and also on a flange 53' by means which are not shown in more detail.

A carrier 60 constructed like a pocket and not shown in greater detail is fastened to a flange 61 on the central web 54 by means which are also not shown, this carrier being designed to receive the first deflection prism 12 and also the objective lens 13 which may be fixed in a specific position on the carrier 60.

A retaining member 65 for the deflection mirror 21 (Fig. 1, 2) is secured to a further web 59 of the carrier member 50 on the one hand, and to an adjustment lever 70 on the other hand, by means which are not shown. The adjustment lever 70 arranged and secured by one end on the retaining member 65 is operatively connected by its other end to a correspondingly associated bearing 75 arranged on the carrier member 50. Two adjustment screws 76, 76' arranged on the bearing 7

act upon a journal 70' of the adjustment lever 70. The retaining member 65 provided with a corresponding expansion slot 66 and carrying the deflection mirror 21 can be adjusted by means of the adjustment lever 70 by corresponding rotation of the adjustment screws 76, 76'.

A precise deflection of the laser beam L2, L3 transmitted by the laser range finder 25 and orientated coaxially to the incident visible radiation onto the reflecting surface of the main mirror 10 is obtained by means of the adjustability of the parts 65, 70 just described.

As shown in Fig. 1 and 2, the laser beam L2 penetrates an aperture 26 correspondingly arranged in the portion 51, is deflected by the deflection mirror 21 as the beam L3 to the main mirror 10 and from there to the object, and is correspondingly reflected from the latter. Hence the invisible laser beam L4 reflected from the object onto the main mirror 10 travels substantially parallel to the incident visible radiation A1.

Fig. 4 shows a section along line IV-IV of Fig. 3 and the portion 51 of the carrier member 50 can be seen, as can a formed and partially shown carrier part 58 for the eyepiece 19, the bearing 75 provided with the adjustment screws 76, 76', a portion of the adjustment lever 70 with the journal 70' and also the retaining member 65 for the deflection mirror 21.

Fig. 5 shows a section along line V-V of Fig. 3 and the first beam splitter 14 arranged in the pocket 55 can be seen, as can the lens 22 arranged in a retaining member 22', the lens body 23 as well as the web 53 formed on the inside 50' of the carrier member 50 with the flange 53' for securing the laser-receiver 24. The parts 14, 22 and 23 shown schematically in Fig. 5 are not shown in section for simplicity of representation.

Furthermore there can be seen the bearing surface 51'' arranged on the inner side 50' as well as the formed walls 56 and 57 of the pocket 55 sloping back at an angle

with respect to the portion 51. On the other side of the portion 51 there are arranged several ribs 51' in parallel spaced relationship to one another, as well as the carrier member 58.

The carrier member 50 previously described by means of Figures 3, 4 and 5, and comprising the parts 55, 58, 60, 65 and 70 as well as the optical elements 12, 13, 14, 15, 16, 22 and 23, is constructed as a structural unit and, as shown in more detail in Fig. 1, is substantially inserted into the housing 30 through an aperture 31' and secured by means which are not shown. The portion 51 of the carrier member 50 forms a part of the rear wall 31.

In Fig. 6 and 7 there is shown the mirror head designated in its entirety with the reference numeral 40 and carrying the main mirror 10 represented in various positions, and this mirror head will be described in detail below:

The mirror head 40 substantially comprises a carrier body 41, a carrier plate 42 for the main mirror 10, a support body 45 as well as a first code disk 80 and a second code disk 80'. A coding device 81, 81' schematically represented in Fig. 7 is associated with each of the code disks 80, 80' for monitoring the respective angular position of the main mirror 10 or of the mirror head 40. As can be seen in Fig. 6, the carrier body 41 has a substantially U-shaped profile cross section with two side parts 43, 43' formed on a base part 44. The support body 45 is constructed as a hollow shaft and has a flange part 45' as well as a shaft body 45'' which is constructed for mounting the base portion 44 provided with a cylindrical aperture which is not shown in detail. On the underside of the support body 45, a housing-like bushing body 46 is secured, by means which are not shown, to receive a first drive mechanism which is not shown. The bushing body 46, the support body 45 as well as the base part 44 of the carrier body 41 are penetrated by a drive shaft 47, not seen and indicated in broken lines, which is operatively connected on one side to the carrier body 41 and on the other side to the

first drive mechanism which is not shown.

The carrier plate 42 arranged between the two side parts 43, 43' of the carrier body 41 is mounted in the side parts 43, 43' on both sides with formed shaft journals 48, 48'. On one side the shaft journal 48 is operatively connected to a second drive mechanism which is not shown in detail, and this second drive mechanism (not shown) is arranged in a housing-like bushing body 49 secured to the side part 43. On the other side the carrier plate 42 is provided with a formed flange 42' on which the second code disk 80' is secured by means which are not shown. In addition in the side part 43' there is arranged a bushing body 79, in which the shaft journal 48' (not shown) is mounted.

The mirror head 40 previously described by means of Fig. 6 and 7 is, as shown in Fig. 1 and 2, arranged in the region of a reinforced floor part 38 provided with an aperture 36 and secured to the flange part 45' on the inner side of the floor part by means which are not shown. The aperture 36 is closed by a plate 37 after the mirror head 40 has been mounted.

The two drive mechanisms (not shown in detail or designated) arranged in the bushing bodies 46, 49 are so-called torque generators (torquers), by means of which the mirror head 40 on the one hand can be rotated together with the main mirror 10 about the second axis Y in the direction of the arrow Y' and on the other hand the main mirror 10 mounted in the carrier body 41 can be pivoted about the first axis X in the direction of the arrow X'. The pivoting movement of the main mirror 10 in the direction of the arrow X' corresponds to an elevational adjustment, and the rotary movement of the mirror head 40 with the main mirror 10 in the direction of the arrow Y' corresponds substantially to an azimuthal adjustment.

Fig. 8 diagrammatically shows in cross-hatching the area of observation R achieved from the centre of the field of vision M, on the one hand by the rotary movement about the

second axis Y and on the other hand by the pivoting movement about the first axis X.

For the purpose of tracking a moving target or for locating a target the mirror head 40 with the main mirror 10, as schematically shown in Fig. 8, can be laterally rotated by movement in the horizontal plane H to a first position H' as well as to a second position H'', and, with partial subsequent control of the corresponding lateral angle, can be pivoted by the elevational or depressional adjustment into the positions E, E' or E'', or D, D' or D'' respectively. The elevational or depressional adjustment must be correspondingly co-ordinated with the lateral rotary adjustment.

Experiments have shown that, proceeding from the horizontal plane H, with an elevational angle A of approximately $+80^\circ$ and a depressional angle B of approximately -20° , as well as a lateral angle S or S' respectively of about 15° each, the substantially rectangular area of observation R schematically represented in Fig. 8 can be analysed while maintaining ergonomically optimum viewing conditions.

The initially mentioned laser range finder 25 provided for the sighting device 100 has a laser transmitter portion which is not shown in detail and not referenced, as well as a laser receiver portion spatially separated from the transmitter portion. The laser receiver portion comprising the parts 22, 23 and 24 is substantially integrated in the optical system 20 arranged on the carrier member 50 and is arranged in the sighting device housing 30.



Claims

1. Periscope-like sighting device (100) having a main mirror (10) which is mounted in a mirror head (40) pivotably round a first axis (X) and which, together with the mirror head, is mounted rotatably round a second axis (Y), and having an optical system (20), formed from several elements, in a housing (30), characterised in that the optical system (20) comprising a first deflection prism (12), an objective lens (13), a first beam splitter (14), a second beam splitter (15) and a second deflection prism (16), and also the main mirror (10) associated with the first deflection prism (12), and the mirror head (40), are arranged in the housing (30) to slope backwards from bottom to top in relation to a vertical rear wall (31) of the housing in the direction of incident visible and/or invisible radiations (A1 and L4).
2. Sighting device according to claim 1, characterised in that the optical system (20) formed from the individual elements (12, 13, 14, 15, 16) is arranged on a carrier body (50) and can be installed in the housing (30) as a structural unit.
3. Sighting device according to claim 1, characterised in that a retaining member (58), constructed for receiving an ocular (19), is arranged on the rear side of the housing (30) and is inclined steeply with respect to the vertical rear wall (31) of the housing at an angle (D) of approximately 25° .
4. Sighting device according to claim 2 and 3, characterised in that the retaining member (58) for the ocular (19) is arranged on the carrier body (50) and forms a structural unit with this.
5. Sighting device according to claim 1, characterised in that the mirror head (40) comprising the main mirror (10), a first and a second code disc



(80, 80') and integrated drive mechanisms for the rotating- and pivoting movement, is constructed as a structural unit and is arranged to be steeply inclined in the housing (30) and fixed to the floor (33).

6. Sighting device according to claim 1 or 5, characterised in that the mirror head (40) is substantially U-shaped and in the two vertical side parts (43, 43') has a carrier plate (42), for the main mirror (10), which is pivotably mounted round the first axis (X).

7. Sighting device according to claim 2, characterised in that on the rear side of the housing (30) there is secured, as a separate component, a laser range finder (25) known per se, the receiver portion of which is integrated in the optical system (20) and is arranged together with the carrier body (50) in the housing (30).

8. Sighting device according to claim 7, characterised in that a first lens (22), a lens system (23) and a laser-receiver (24) of the laser-receiver portion, and a deflection mirror (21) associated with the main mirror (10), for the laser radiation emitted onto the object, are arranged and retained on the carrier body (50).