NIGHT VISION AIMING SIGHT WITH TWO EYEPIECES

The field of the invention is that of weapon aiming sights having a light intensifier.

It is of paramount importance for a soldier to maintain very good mobility in all mission situations and particularly when he is moving around in an urban environment. When a soldier is aiming his weapon, he may become a potential target. To obviate this drawback, a video camera is placed on the barrel of the weapon, this camera being, for example of the CCD (charge coupled device) sensor type. This camera is coupled either to a helmet sight positioned on the soldier's helmet, or to an imager positioned for example on his wrist. This device allows the soldier to take a shifted sight of the target and consequently allows him to fire while remaining protected. However, the firing configuration most often used nevertheless remains that in which the solider takes direct aim of the target with the naked eye. The camera must therefore be sufficiently small and shifted away from the line of sight so as not to impede this conventional firing configuration. This configuration is illustrated in figure 4, which shows a perspective view of the weapon/camera system. The line of sight 100 of the camera 1 is shifted away from the line of sight 200 of the soldier so as to provide him with a correct sight without being impeded by the camera.

For carrying out night missions, it is conventional to fit a night vision sight on the weapon. This sight generally comprises at least one objective, a light intensifier device and an eyepiece. The objective forms an image of the external scenery on the entrance window of the intensifier device. This comprises three main parts: a first photosensitive surface, which converts the optical image into an electronic image; an electron amplifier, which amplifies the electronic image; and a

second surface that converts the electronic image into an amplified light image. Thus, the image of the external scenery is amplified, then collimated to infinity by the eyepiece before finally being observed by the soldier. In this case, the image provided by the camera is of course lost, the light levels being too low to allow a correct image with current sensors. Thus the security provided by the camera during daytime missions is lost. It should be recalled that the soldier may be pinpointed at night by combatants that have either light intensifier binoculars or thermal cameras.

The night vision sight according to the invention allows the soldier to have the same safety when firing at night as during the daytime, the principle being to supply, simultaneously, the soldier and the camera with the same intensified image, which may thus be looked at directly or via a helmet sight or a display. For night-time missions, this sight easily fits onto the weapon without any modifications to the camera already in place. Thus, the soldier does not have to carry out complex mechanical manipulations in a combat situation.

More precisely, the subject of the invention is an aiming sight for a weapon, comprising an objective and an image intensifier, these being placed in a mechanical assembly having an interface for fastening on to said weapon, said objective forming the image of the external scenery on the entrance window of the image intensifier, said weapon including a sight camera whose optical axis is parallel to the axis of its barrel, said sight being characterized in that it comprises at least:

- a first optical channel giving, from the intensified image coming from the image intensifier, a first collimated image; and
- a second optical channel giving, from the intensified image coming from the image intensifier, a

second image which is also collimated, the optical axis of which is parallel to the optical axis of the first optical channel,

these channels being arranged in such a way that, when the sight is mounted on the weapon via its fastening interface, the first image is sent to the objective of the camera and the second image is sent to the eye of the soldier carrying the weapon.

Advantageously, the first optical channel comprises at least one image transfer optic for the intensified image coming from the image intensifier, a semireflecting plate, a first relay optic, a first eyepiece, the final image from the first eyepiece being substantially collimated and the exit pupil of said first optical channel being substantially coincident with the entrance pupil of the objective of the camera when the sight is mounted on the weapon. Furthermore, the second optical channel comprises at least the image transfer optic for the intensified image coming from the image intensifier, the semireflecting plate, a second relay optic, and a second eyepiece, the final image from the second eyepiece being substantially collimated and the exit pupil of said second optical channel being sufficiently far from the body of the sight, from the camera and from the weapon in such a way that the soldier can position his eye in said pupil with no great trouble.

Advantageously, the sight also includes a third optical channel comprising a microdisplay composed of at least one display and of a second image transfer objective forming an intermediate image of the image from display, said intermediate image being sent by reflection and by transmission by the semireflecting plate on the one hand, into the first optical channel and, on the other hand, into the second optical channel superimposed on the intensified image from the image intensifier.

The invention will be more clearly understood and further advantages will become apparent upon reading the description that follows, given by way of nonlimiting example and with the help of the appended figures in which:

- figure 1 shows a schematic view of the night vision aiming sight according to the invention;
- figure 2 shows said aiming sight of figure 1 mounted on the weapon;
- figure 3 shows a sectional view of one possible embodiment of the sight according to the invention;
- figures 4 and 5 show two perspective views of a weapon with and without the aiming sight according to the invention;
- figure 6 shows a schematic view of a variant of the aiming sight, having a third optical channel possessing a microdisplay; and
- figure 7 shows a sectional view of one possible embodiment of the variant of the sight shown diagrammatically in figure 6.

Figure 1 shows a schematic view of the night vision aiming sight 2 according to the invention. The path of the light rays coming from an object point located at infinity on the optical axis of the sight is indicated by dotted lines, thus making it possible to follow the various focusing and collimating operations carried out on the light rays through the various optics of the aiming sight.

The latter comprises an objective 22 that forms an image of the external scenery on the entrance window 231 of an image intensifier device 23. This gives, on its exit window 232, an inverted intensified image. Two optical channels placed behind the intensifier 23 each give a collimated image. These two optical channels have a common part formed from an image transfer optic 24 and a semireflecting plate 25.

The transfer optic 24 provides a first image of the intensified image coming from the intensifier 23. In figure 1, the semireflecting plate 25 reflects part of said image into a first optical channel and transmits the other part into the second optical channel. The semireflecting plate is a plate having plane parallel faces. Its treatment is adapted according to the optical channel that it is desired to privilege. Of course, the optical channels could be reversed.

The specific part 17 of the first optical channel essentially comprises a first relay optic 171, a plane mirror 173 and an eyepiece 172. The first relay optic focuses the image coming from the optic 24 onto the focus of the eyepiece 172, which gives a final image at infinity. The plane mirror 173 folds the optical beams so that the optical axis 100 of the eyepiece is parallel to the line of sight 200 of the second optical channel.

Conventionally, the optical magnification of the first optical channel is equal to the ratio of the focal length of the objective 22 to the focal length of the eyepiece 172 divided by the magnification of the transfer optic 24/relay optic 171 combination.

The specific part 26 of the second optical channel essentially comprises a second relay optic 261 and an eyepiece 262. The second relay optic focuses the image coming from the optic 24 on to the focus of the eyepiece 262, which gives a final image at infinity. The pupil of the second optical channel is placed in such a way that its image through the various optical elements 24, 261 and 262 is sufficiently far from the optic 262 so that the soldier's eye 4 can be positioned in this pupil with no great trouble. The eyepiece may be provided with a dioptric adjustment so as to optimize the sight comfort for the soldier.

Conventionally, the optical magnification of the second optical channel is equal to the ratio of the focal length of the objective 22 to the focal length of the eyepiece 262 divided by the magnification of the transfer optic 24/ relay optic 261 combination.

The various faces of the lenses are antireflection treated so as to optimize the light transmission and to reduce spurious images due to multiple reflections.

It should be noted that the optical configuration of the second optical channel makes it possible to obtain an image perceived by the soldier in the same direction as the direct image of the external scenery when a simple light intensifier is used, that is to say no image inverter, which is not the case when, for example, night vision goggles are used, in which case the intensifier must necessarily include an image inverter. This configuration simplifies the realization of the sight and reduces its cost.

The combination of the various optical components is placed in a mechanical assembly 21 which holds them together and protects them, the sight 2 having to be used in a military environment under extreme temperature and environmental conditions (humidity, rain, etc.). This mechanical assembly has a fastening interface (not shown in the diagram). This fastening interface allows the aiming sight to be fastened onto a weapon 31 and has no special features specific to the sight according to the invention.

Figure 2 shows a diagram of the aiming sight mounted on a weapon 31. Mounted on the weapon 31 is a camera 1 comprising an objective 11 and a sensor 12, which may in particular be a CCD sensor. When the sight is mounted on the weapon, the first optical channel is placed in front of the objective of the camera, the

optical axis 100 of the first optical channel being coincident with the optical axis of said objective. The exit pupil of the first optical channel is substantially coincident with the entrance pupil of the objective 11 of the camera 1 so that the optical transmission of the image is optimal without stopping-down of the optical field.

Figure 3 shows a sectional view of one possible embodiment of the sight according to the invention. The mechanical assembly 21 comprises a main body 212 that supports the light intensifier 23, the image transfer optic 24 and the semireflecting plate 25.

Mounted on this main body are:

- a second body 211, which supports the objective 22. In figure 3, this objective comprises four groups of lenses, giving a total of seven lenses;
- a third body 213 that supports the second relay optic 261 and the eyepiece 262. This third body may include a translational adjustment allowing dioptric adjustment of the eyepiece 262. In figure 3, the second relay optic comprises three convergent lenses and the eyepiece comprises three optical groups giving a total of four lenses; and
- a fourth body 214 that supports the optical unit 171, 172 and 173 of the first channel. The first relay optic comprises three lenses and the eyepiece 172 comprises four lenses.

This modular design makes it possible to modify one of the components, for example to change the objective 22 or to modify the fastening interface depending on the weapon chosen, without having to re-do the entire optomechanical design of the aiming sight.

In this example, the objective 11 placed in front of the sensor of the camera is an objective comprising six lenses.

Figure 4 is a perspective view of the weapon supporting its display camera 1 without the night vision aiming sight. The line of sight 100 of this camera is parallel to the line of sight of the weapon. The camera is small and displaced from the line of sight so as not to impede the soldier's direct view. This configuration allows the weapon to be used in the daytime. Figure 5 is a perspective view of the weapon of figure 4 which this time includes the sight 2 (in solid lines in the figure). The sight is placed in such a way that the first optical channel is positioned in front of the objective of the camera. The exit pupil of the second optical channel is sufficiently far from the body of the sight, from the camera and from the weapon in such a way that the soldier can position his eye in said pupil with no great trouble.

Figure 6 shows a variant of the aiming sight according to the invention. The object of this variant is to add, in the free channel of the semireflecting plate 25, an image coming from a display 282. Thus, a combination 28 consisting of a display 282 and a second image transfer optic 281, which forms an intermediate image of the display 2, is added above the semireflecting plate 25. After reflection on the semireflecting plate 25, this intermediate image 25 is superimposed on the intensified image, coming from the image intensifier 24. Consequently, the soldier sees in the eyepiece 262 the information coming from the display superimposed on the intensified image of the external scenery. This information also reaches the camera by transmission through the semireflecting plate. The spectral emission bands of the display and of the intensifier tube may be different. In this case, the reflection and transmission coefficients of the semireflecting plate may be different depending on the spectral band, so as to give different preference to the first optical channel or to the second optical channel for each of

the two images. The information provided by the display may especially be sight reticles. As a nonlimiting example, the display 282 may be a liquid-crystal display or a micromirror display device.

Figure 7 shows a sectional view of one possible embodiment of the variant of the sight 2 depicted in figure 6. The design of this sight is similar to that shown in figure 3. The main body 212 has simply been modified in its part lying above the semireflecting plate so as to house the mechanical component 215 that supports the objective 281. The display 282 is not shown in this figure. Although the sizes of the exit window of the intensifier 23 and of the display 282 are similar or identical, the first image transfer optic 24 and the second image transfer optic 281 are chosen to be identical so as to simplify the design of the sight, as illustrated in figure 7, in which these two optics have the same optical combination comprising three lenses.

CLAIMS

1. An aiming sight (2) for a weapon (31), comprising an objective (22) and an image intensifier (23), these being placed in a mechanical assembly (21) having an interface for fastening on to said weapon, said objective forming the image of the external scenery on the entrance window (231) of the image intensifier (23), said weapon including a sight camera (1) whose optical axis is parallel to the axis of its barrel (3), said sight being characterized in that it comprises at least:

- a first optical channel (24, 25, 17) giving, from the intensified image coming from the image intensifier (23), a first collimated image; and
- a second optical channel (24, 25, 26) giving, from the intensified image coming from the image intensifier (23), a second image which is also collimated, the optical axis (200) of which is parallel to the optical axis (100) of the first optical channel,

these channels being arranged in such a way that, when the sight (2) is mounted on the weapon (31) via its fastening interface, the first image is sent to the objective of the camera (1) and the second image is sent to the eye (4) of the soldier carrying the weapon.

2. The aiming sight as claimed in claim 1, characterized in that the first optical channel comprises at least one image transfer optic (24) for the intensified image coming from the image intensifier (23), a semireflecting plate (25), a first relay optic (171), a first eyepiece (172), the final image from the first eyepiece (172) being substantially collimated and the exit pupil of said first optical channel being substantially coincident with the entrance pupil of the objective (11) of the camera (1) when the sight is mounted on the weapon.

3. The aiming sight as claimed in claim 1,

characterized in that the second optical channel comprises at least the image transfer optic (24) for the intensified image coming from the image intensifier (23), the semireflecting plate (25), a second relay optic (261), and a second eyepiece (262), the final image from the second eyepiece being substantially collimated and the exit pupil of said second optical channel being sufficiently far from the body of the sight (21), from the camera (1) and from the weapon (31) in such a way that the soldier can position his eye (4) in said pupil with no great trouble.

4. The aiming sight as claimed in either of claims 2 or 3, characterized in that the semireflecting plate is used in reflection in the first optical channel and in transmission in the second optical channel.

5. The aiming sight as claimed in either of claims 2 or 3, characterized in that the semireflecting plate is used in transmission in the first optical channel and in reflection in the second optical channel.

6. The aiming sight as claimed in one of the preceding claims, characterized in that the image intensifier is of the image inversion type.

7. The aiming sight as claimed in one of the preceding claims, characterized in that the sight also includes a third optical channel comprising a microdisplay (28) composed of at least one display (282) and of a third image transfer objective (281) forming an intermediate image of the display (282), said intermediate image being sent by reflection and by transmission by the semireflecting plate on the one hand, into the first optical channel and, on the other hand, into the second optical channel superimposed on the intensified image from the image intensifier (23).