

PERISCOPE

The present invention relates to a periscope according to the preamble of the main claim.

5 A periscope system is made known in DE 36 27 716 A1, which comprises a housing having a region extending into a vehicle with a view in front of a viewing prism, and having a region extending out of a vehicle with a sight in front of a sighting prism, and which comprises a prism core made of a transparent material, and the side of the prism core facing away from the view comprises a display field of a display unit with information
10 that can be adjusted in the view.

The disadvantage of this system is that only a very narrow display field can be shown.

The problem addressed by the invention is that of providing a periscope, wherein further
15 information such as vehicle data, camera images or other information from the vehicle surroundings can be shown directly in the view of the periscope and at the same time the terrain located in front of the vehicle can be observed through the sight.

This problem is solved, in combination with the features of the preamble, according to the
20 invention by the features of the characterizing part of the main claim.

Given that a light-emitting display is disposed behind the viewing prism in a viewing direction, and a medium having a lower refractive index than the material of a reflection surface of the viewing prism adjoins the back side the viewing prism, total reflection at the
25 reflection surface takes places at a first viewing angle region into the view, and light shining in through the sight is visible and the light of the display is visible under a second viewing angle region into the view. The angle between the reflecting boundary surface and the optical viewing axis is selected such that the observer is able, by changing the head position only slightly in the vertical direction, to either see through the reflective
30 surface in a straight line and without reflection, or to look out of the sight of the periscope with total reflection.

If the optical path straight through the reflective surface has been selected, the display is visible in this optical axis; however, if the head position is moved, the sight of the periscope
35 can be seen out.

A particular advantage of this periscope according to the invention is that it functions without mechanically moving components and displays, in the view, either the light beams entering through the sight, in a large area, or shows the information on the display, likewise in a large area, wherein only a slight change in the viewing direction is required.

5 The periscope according to the invention therefore makes it easier for a user or vehicle driver to simultaneously control his vehicle and the state thereof to a very substantial extent since he need not switch permanently between the spatially interspaced vehicle displays and the view of the periscope because all of the data that he requires can be displayed in the periscope.

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Further advantageous embodiments of the subject matter of the invention will become apparent from the dependent claims which follow, and from combinations thereof.

15 According to a particularly preferred embodiment of the subject matter of the invention, the medium adjoining the back side of the viewing prism is composed simply of air, which greatly simplifies the technical embodiment of the periscope.

A further embodiment of the subject matter of the invention is also advantageous, in which an optical wedge is disposed between the display and the viewing prism to compensate for a barrel distortion which occurs through the viewing prism, wherein the air gap must be maintained between the optical wedge and the back side of the viewing prism in order to maintain the principle of total reflection on the optical boundary surface of the viewing prism. The optical wedge makes it possible to reduce, distortions occurring without this in the view entirely or to a substantial extent.

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According to a further advantageous embodiment of the periscope according to the invention, it is equipped with components which prevent the light coming from the display from escaping from the periscope via the sight, wherein no additional mechanically moving components are required to achieve this. In a preferred technical solution, a display is used which emits polarized light, such as an LCD screen, and a polarization filter having a configuration oriented 90° relative to the direction of polarization of the light from the display is used in the beam path between the view and the sight.

35 In a second technical solution, the display is illuminated with a predetermined refresh rate, wherein a so-called shutter is integrated in the beam path between the view and the sight, which prevents light passage with this refresh rate, wherein this frequency is

greater than 20 Hz. This switching back and forth between display illumination and shutter, which is referred to as “chopping”, makes it possible to prevent light from escaping through the sight of the periscope. At the same time, however, the eye of an observer will not perceive the image in the display as flashing because the frequency at which the illumination switches on and off is faster than the perceptual inertia of the eye.

The two embodiments of the invention are described in the following with reference to figures. They show:

- Fig. 1. a spatial view of a periscope with an additional display,
- Fig. 2. a cut view of a periscope comprising a polarization filter and a polarized light-emitting display, and
- Fig. 3. a periscope comprising a shutter built into the beam path.

The periscope is composed mainly of a housing 1 having a region extending into a vehicle with a view 2 in front of a viewing prism 3, and having a region extending out of a vehicle with a sight 4 in front of a sighting prism 5, and of a prism core 6 made of a transparent material such as plastic or glass.

A light-emitting display 7 is disposed behind the viewing prism 3 in the viewing direction, wherein to compensate for a barrel distortion therebetween, an optical wedge 10 is disposed such that an air gap 8 is maintained between optical wedge 10 and the back side of viewing prism 3, and so the air situated therebetween is the medium having the lower refractive index than that of the material of the reflection surface of the viewing prism 3.

It is also feasible to use another liquid, solid, or gaseous material instead of air, provided it has a lower refractive index and physically enables total reflection on the reflection surface of the viewing prism 3, which is provided here by a cover pane 13 disposed on a side of the viewing prism 3 facing away from the view 2.

In a periscope of the type depicted in Fig. 2, display 7 is composed of an LCD screen which emits polarized light which is prevented from escaping from the periscope by a polarization filter situated at an angle of 90° in front of sight 4, wherein polarization filter 11 is designed in this case as a film on sight 4 of the periscope, which is in the form of a cover glass 13.

As shown in Fig. 3, another embodiment of the periscope according to the invention is equipped with a display 7, the display illumination of which has a refresh rate greater than 20 Hz, and a shutter 9 is integrated in the beam path between view 2 and sight 4 in core 5 6 of the periscope, which prevents light from passing at precisely this refresh rate, thereby ensuring that no light coming from the display can escape from the periscope via the sight. The light entry and exit surfaces of core 6 comprising viewing prism 3 and sighting prism 5 are each provided with cover glasses 13, wherein a laser filter 14 is also disposed between cover glass 13 in front of the view 2. The reflection surface of sighting 10 prism 5 is equipped with a deflection mirror 12. The individual glasses are connected by transparent film or adhesive.

Claims

1. A periscope, in particular for an armored vehicle, comprising a housing having a region extending into a vehicle with a view in front of a viewing prism, and having a region extending out of a vehicle with a sight in front of a sighting prism, and of a prism core made of a transparent material, characterized in that a light-emitting display (7) is disposed behind the viewing prism (3) in a viewing direction, and a medium having a lower refractive index than the material of a reflection surface of the viewing prism (3) adjoins the reflection surface of the viewing prism (3), and total reflection at the reflection surface takes place at a first viewing angle region into the view (2), and light shining in through the sight (4) is visible and the light of the display (7) is visible under a second viewing angle region into the view (2).
2. The periscope according to claim 1, characterized in that the medium behind the reflection surface of the viewing prism (3) is air.
3. The periscope according to one of the aforementioned claims, characterized in that, to compensate for a barrel distortion, an optical wedge (10) is disposed between the display (7) and the viewing prism (3), and an air gap (8) is created between the surface of the optical wedge (10) and the reflection surface of the viewing prism (3).
4. The periscope according to one of the aforementioned claims, characterized in that the display (7) emits polarized light, and a polarization filter (11) with light emitted at a 90° angle relative to the polarization direction of the light emitted by the display (7) is disposed in the beam path between the view (2) and the sight (4).
5. The periscope according to one of the aforementioned claims 1 to 3, characterized in that the display illumination has a certain refresh rate, and a shutter (9) is integrated in the beam path between the view (2) and the sight (4), which shifts or releases the beam path such that it is phase-shifted by 180° relative to the refresh rate.
6. The periscope according to claim 5, characterized in that the display illumination of the display (7) is operated at a refresh rate greater than 20 Hz.