Claims

1. Low-beam headlight, comprising:

beamforming optics for generating, on the basis of light, a light/dark distribution comprising a light/dark edge extending obliquely at least in portions with respect to a vertical first transverse direction and a horizontal second transverse direction perpendicular thereto, wherein the beamforming optics comprises a condenser lens array for receiving incident light; and a projection lens array with a multitude of projection lenses for outputting light received by the condenser lens array;

wherein the condenser lens array includes a plurality of condenser lenses arranged in a matrix arrangement with several columns and several lines, wherein condenser lenses of at least a first column are adapted to the obliquely-extending light/dark edge;

wherein, compared to a second projection lens assigned to a second condenser lens of the first column, a first projection lens assigned to a first condenser lens of the first column of the matrix is decentered differently with respect to the assigned condenser lens along the second transverse direction.

2. Low-beam headlight according to claim 1, wherein the condenser lenses of the first column comprises a boundary edge extending obliquely along the first and the second transverse direction at least in portions, adapted to the obliquely-extending light/dark edge.

3. Low-beam headlight according to claim 2, wherein the condenser lenses of the first column comprise a first and an opposite second boundary edge, each extending obliquely along the first and second transversal direction at least in portions and adapted to the obliquely-extending light/dark edge.

4. Low-beam headlight according to claim 3, wherein an oblique portion of the first boundary edge is arranged so as to be displaced with respect to an oblique portion of the second boundary edge along the second transverse direction.

5. Low-beam headlight according to any of the preceding claims, wherein condenser lenses of the first column each comprise a first and an opposite second boundary edge extending along the first and second transverse directions and comprising at least one bend and extending obliquely at least in portions, and adapted to the obliquely-extending light/dark edge in such a way;

wherein, in at least one condenser lens, a bend of the first boundary edge is arranged so as to be offset with respect to a corresponding bend of the second boundary edge along the second transverse direction.

6. Low-beam headlight according to claim 5, wherein the condenser lens is a first condenser lens and the second boundary edge of the first condenser lens specifies a progression of a first boundary edge of a neighboring second condenser lens or the first column;

wherein the second condenser lens comprises a second boundary edge opposite the first boundary edge, comprising at least one bend along the first and second transverse direction and extending obliquely at least in portions, and adapted to the obliquely-extending light/dark edge in such a way;

wherein the bend of the second boundary edge of the second condenser lens is arranged so as to be offset with respect to the bend of the first boundary edge of the second condenser lens along the second transverse direction.

7. Low-beam headlight according to claim 5 or 6, wherein a distance of the bend of the first boundary edge to the bend of the second boundary edge along the second transverse direction is a maximum within a tolerance range, wherein a position of the bend of the first boundary edge and/or the second boundary edge along the second transverse direction depends on a position of the first column in the matrix.

8. Low-beam headlight according to any of claims 5 to 7, wherein a distance magnitude value by which the bend of the first boundary edge is arranged so as to be offset with respect to the corresponding bend of the second boundary edge along the second transverse direction is constant within the first column and is different or individual for different columns of condenser lenses in the condenser lens array adapted to the obliquely-extending light/dark edge.

9. Low-beam headlight according to any of claims 5 to 8, wherein a displacement direction along which the bend of the first boundary edge is arranged so as to be offset with respect to the corresponding bend of the second boundary edge along the second transverse direction alternates within the first column and for neighboring condenser lenses in the first column.

10. Low-beam headlight according to any of claims 5 to 9, wherein a vertex of a projection lens assigned to the condenser lens is decentered individually with respect to a vertex of the projection lens along the second transverse direction.

11. Low-beam headlight according to any of claims 5 to 9, wherein a different decentered arrangement of the first projection lens, compared to the second projection lens, along the second transverse direction, is adapted to a displacement of the boundary edges along the second transverse direction and at least partially compensates for a displacement of the light/dark edge in the light/dark distribution caused by the displacement of the boundary edges.

12. Low-beam headlight according to any of the preceding claims, wherein the first condenser lens of the first column is arranged directly adjacent to the second condenser lens of the first column, and the second condenser lens is arranged between the first condenser lens and a third condenser lens of the first column;

wherein a third projection lens is assigned to the third condenser lens and is decentered with respect to the third condenser lens, compared to the first projection lens with respect to the first condenser lens, so as to be matching along the second transverse direction.

13. Low-beam headlight according to any of the preceding claims, wherein a displacement of projection lens vertices with respect to a condenser lens vertex of a condenser lens respectively assigned to the projection lens is line-dependent and column-independent along the first transverse direction and line-independent and column-dependent along the second transverse direction.

14. Low-beam headlight according to any of the preceding claims, wherein condenser lenses of a plurality of columns of the condenser lens array are adapted to the

obliquely-extending light/dark edge; wherein the plurality of columns forms a centrally arranged area of the condenser lens array.

15. Low-beam headlight according to any of the preceding claims, wherein the condenser lens array comprises a first, a second, and a third condenser lens array area, wherein the second condenser lens array area is arranged between the first and third condenser lens array areas and includes the first column, wherein only part of the condenser lenses images the obliquely-extending light/dark edge in a transition area from the second condenser lens array area, on the one hand, and the first or third condenser lens array area, on the other hand.

16. Low-beam headlight according to any of the preceding claims, wherein at least a subset of the condenser lenses of the condenser lens array is formed as anamorphic lenses.

17. Low-beam headlight according to claim 16, wherein at least a subset of the projection lenses of the projection lens array is formed as anamorphic lenses.

18. Low-beam headlight according to any of the preceding claims, wherein condenser lenses of the condenser lens array are arranged so as to be offset with respect to each other along a light propagation direction perpendicular to the first and second transverse directions, and their position matches with respect to a height profile.

19. Low-beam headlight according to claim 18, wherein the condenser lenses comprise a focal length that is adapted to the offset position arranged in relation to each other on a channel-by-channel basis in order to at least partially compensate for individual defocusing.

20. Low-beam headlight according to any of the preceding claims, wherein projection lenses of the projection lens array are arranged so as to be offset with respect to each other along a light propagation direction perpendicular to the first and second transverse directions, and wherein their position matches with respect to a height profile.

21. Low-beam headlight according to any of the preceding claims, comprising a light source arrangement for generating a light cone consisting of light so as to provide the incident light for the beamforming optics.

22. Low-beam headlight according to claim 21, wherein the light cone comprises an aspect ratio of at least two with respect to the first transverse direction and the second transverse direction.

23. Low-beam headlight according to claim 22 or 23, wherein the light is less divergent along the first transverse direction than along the second transverse direction.

24. Low-beam headlight according to any of the preceding claims, wherein the condenser lens array is arranged so as to sharply image the light source arrangement into the projection lens array in order to provide a Köhler illumination.

25. Low-beam headlight according to any of claims 21 to 24, wherein the light source arrangement comprises a light source that divergently radiates into the first and second transverse directions, and a collimator for collimating divergent light from the light source with a higher degree of collimation in the first transverse direction than in the second transverse direction.

26. Low-beam headlight according to claim 25, wherein the light source arrangement comprises an aspherical lens between the light source and the collimator for pre-collimation.

27. Low-beam headlight according to claim 25 or 26, wherein the collimator comprises a cylinder lens collimator or an acylindrical collimator or a toroidal collimator.

28. Low-beam headlight according to any of the preceding claims, wherein the light source arrangement is configured such that the light of the light cone comprises a divergence that is more than ten times larger in the second transverse direction than in the first transverse direction.

29. Low-beam headlight according to any of the preceding claims, wherein the condenser lens array and the projection lens array are formed as a monolithic tandem array.

30. Low-beam headlight according to any of the preceding claims, wherein the condenser lens array includes condenser lenses, arranged so as to fill the area, in columns of identical column width and lines of individually different line heights.

31. Low-beam headlight according to any of the preceding claims, wherein the condenser lens array includes condenser lenses, arranged so as to fill the area, in columns of identical column width and lines with a line height that individually varies on a column-by-column basis.

32. Low-beam headlight according to any of the preceding claims, wherein at least the first column includes decentered condenser lenses along the first transverse direction.

33. Low-beam headlight according to any of the preceding claims, wherein the projection lens array includes at least one projection lens decentered along the first transverse direction.

34. Low-beam headlight according to any of the preceding claims, wherein the projection lenses are arranged with a greater pitch along the second transverse direction than the condenser lenses of the condenser lens array; and with a same pitch along the first transverse direction.

35. Low-beam headlight, comprising:

a light source arrangement for generating a light cone consisting of light that is less divergent in a first transverse direction than in a second transverse direction perpendicular to the first transverse direction;

beamforming optics for generating, on the basis of light, a light/dark distribution comprising a light/dark edge extending obliquely at least in portions with respect to the first transverse direction and the second transverse direction, wherein the beamforming optics comprises a condenser lens array for receiving incident light; and a projection lens array with a multitude of projection lenses for outputting light received by the condenser lens array;

wherein the condenser lens array includes a plurality of condenser lenses arranged in a matrix arrangement with several columns and several lines, wherein condenser lenses of at least a first column are adapted to the obliquely-extending light/dark edge;

wherein condenser lenses of the first column each comprise a first and an opposite second boundary edge extending along the first and second transverse directions and comprising at least one bend and extending obliquely at least in portions, adapted to the obliquely-extending light/dark edge in such a way; wherein, in at least one condenser lens, a bend of the first boundary edge is arranged so as to be offset with respect to a corresponding bend of the second boundary edge along the second transverse direction.

36. Low-beam headlight according to claim 35, wherein, compared to a second projection lens assigned to a second condenser lens of the first column, a first projection lens assigned to a first condenser lens of the first column of the matrix is decentered differently with respect to the assigned condenser lens along the second transverse direction.

37. Low-beam headlight, comprising:

an anamorphic collimated light source arrangement comprising a light source with a greater divergence along a second transverse direction than along a first transverse direction perpendicular thereto;

a micro-optical beamformer without diaphragms, including a first condenser lens array with condenser lenses arranged in columns of identical width and rows of individually different height so as to fill the area, the condenser lenses being formed at least partially as lens segments decentered along the first transverse direction; and a second projection lens array arranged behind the same along a light propagation direction, including at least partially decentered projection lenses, and comprising a greater pitch along the second transverse direction than the condenser lens array and an equal pitch along the first transverse direction, wherein each condenser lens images the light source into a projection lens assigned thereto, and each projection lens images the assigned condenser lens towards infinity; and thus forms a far-field distribution of the low-beam;

wherein beamforming of the beamformer along the second transverse direction results at least in part from an interaction of a divergence distribution of the collimated light source arrangement along the second transverse direction and the beamforming of the lens arrays along the second transverse direction;

wherein condenser lenses are equipped with a corresponding bend in boundaries opposite along the first transverse direction in a central area of the condenser lens array to generate an elbow-shoulder contour of a light/dark border in the far-field distribution; and the positions of the bends along the second transverse direction are different for at least a subset of the condenser lenses of a condenser lens array column, and the assigned projection lenses include lens segments with different decentered arrangements along the second transverse direction.

38. Motor vehicle with a low-beam headlight according to any of the preceding claims.

39. Beamforming optics for generating, on the basis of incident light, a light/dark distribution comprising a light/dark edge extending obliquely at least in portions with respect to a vertical first transverse direction and a horizontal second transverse direction perpendicular thereto, wherein the beamforming optics includes:

a condenser lens array for receiving the incident light; and a projection lens array with a multitude of projection lenses for outputting light received by the condenser lens array;

wherein the condenser lens array includes a plurality of condenser lenses arranged in a matrix arrangement with several columns and several lines, wherein condenser lenses of at least a first column are adapted to the obliquely-extending light/dark edge;

wherein, compared to a second projection lens assigned to a second condenser lens of the first column, a first projection lens assigned to a first condenser lens of the first column of the matrix is decentered differently with respect to the assigned condenser lens along the second transverse direction.

40. Beamforming optics according to claim 39, configured for a low-beam headlight.

41. Method for manufacturing a low-beam headlight, comprising:

arranging beamforming optics for generating, on the basis of light, a light/dark distribution comprising a light/dark edge extending obliquely at least in portions with respect to a vertical first transverse direction and a horizontal second transverse direction, so that the beamforming optics comprises a condenser lens array for receiving incident light; and a projection lens array with a multitude of projection lenses for outputting light received by the condenser lens array;

so that the condenser lens array includes a plurality of condenser lenses arranged in a matrix arrangement with several columns and several lines, wherein condenser lenses of at least a first column are adapted to the obliquely-extending light/dark edge;

so that, compared to a second projection lens assigned to a second condenser lens of the first column, a first projection lens assigned to a first condenser lens of the first column of the matrix is decentered differently with respect to the assigned condenser lens along the second transverse direction; or

so that condenser lenses of the first column each comprise a first and an opposite second boundary edge extending along the second transverse directions and comprising at least one bend and extending obliquely at least in portions, adapted to the obliquely-extending light/dark edge in such a way; wherein, in at least one condenser lens, a bend of the first boundary edge is arranged so as to be offset with respect to a corresponding bend of the second boundary edge along the second transverse direction.