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A PROJECTION SYSTEM



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Field of the Invention

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The invention relates to projection systems for displaying visual information by optical projection onto a viewing screen.

The claimed projection systems are intended for
10 the consumer-oriented and professional applications in cinematography, television, and for displaying the computer information and other types of information.

Prior Art

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The extensively-used and available projection systems comprise a projector and a projection screen. The front-projection systems serve to project images onto a reflecting (front-projection) screen or a white
20 wall, and the rear-projection ones - to project images onto a translucent (rear-projection type) screen.

Advantages of the front-projection systems are as follows: a projection screen has a simple design, small size and weight, and is thin.

5 Disadvantages of the front-projection systems are as follows: a bright external parasitic illumination of a screen results in a visual discomfort of image viewing (the main optical parameters of projection, such as clearness, contrast, colour-rendering and range of
10 half-tone gradation, considerably deteriorate). This circumstance restricts the possibility to use the projection systems in illuminated premises and outdoors. The light flux emitted by a projector must be increased five times, with an increased power consumption
15 of the illumination lamps. To eliminate shading of the projection by viewers, projectors in front of a screen are positioned such that the projection axis is inclined at the angle to 40° with respect to the screen normal, and the trapezoid distortions of the projected images are
20 corrected optically and electronically (with subsequent loss of resolution).

The prototype of the invention, that is the most proximate to the invention in terms of the attained result, is a rear-projection system having a lens-raster

translucent screen. (See: Makartsev V.V., Khesin A. Ya., Steyerberg A.L.. Large-Screen Videosystems, Moscow, "Panas" publishers, 1993, p.p. 70-83, Figs. 22, 23, Terms and definitions p.p. 147-155). On a screen, at the projection
5 side, a Fresnel lens is positioned; and at the viewer side, adjacent are the vertically-arranged lens elements, separated by black vertical strips that provide a high-contrast image in brightly illuminated premises. The Fresnel lens concentrates the projector light flux in a
10 very narrow diffusion angle. Lenticular lenses direct the concentrated projecting light flux into slots between black vertical strips, thus diffusing the flux towards viewers within a wide viewing angle. A dark screen is not sensitive to external illuminations, and a high concentration of
15 light in narrow slots is perceived as a high brightness of an image.

Advantages of the rear-projection systems: in case of external parasitic illumination of the prototype screen, a
20 visually comfortable viewing of the projected images is ensured, and shading of projection by viewers is eliminated (a projector is disposed behind the screen).

Disadvantages of the prototype are as follows: the lens-raster screens considerably reduce brightness and accuracy of colour-rendering from the center to periphery of a screen image when viewing takes place from the aspects
5 near the edge of the viewers' location sector. Complexity of design, an excessive increase in dimensions and mass of the rear-projection system analogues are caused by the necessity to dispose a projection system in light-proof premises or in a housing having projection mirrors, and by
10 means of rigid suspension of a projector, and by the necessity to provide a great projection distance between a projector and screen (comparable with the image diagonal length). In case of a bright parasitic illumination of the viewing screen, contrast of the viewed image decreases
15 significantly, brightness is reduced at edges of the screen image field, accuracy of colour-rendering is reduced.

Said problems associated with the projection systems
20 having the reflecting screens are caused by projection effected onto the maximal screen area seen by viewers, and problems of the translucent screens are connected with the necessity to perform projection at a great angle with

respect to the screen plane in a dark light-insulated relatively small space behind the screen.

Disclosure of the Invention

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The object of the claimed invention is a significant improvement of designs of projection systems - for the purpose to provide the shading-free projection, reduced mass and dimensions of the rear-projection systems, 10 maximal visual comfort of viewing of projection images in the environment of a bright external illumination of a screen, to solve the above-mentioned problems and provide novel technical-operational parameters of projection systems.

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The general technical result to be achieved by embodiment of this invention is a design of a projection system with minimal volume of the projection space, which is to be attained by projection performed at an acute 20 angle with respect to the screen plane, or into end-face of the light-guide screen, with maximal light efficiency.

In case of the front-projection systems, this invention will provide projection without shading of images. In case

of the rear-projection systems, this teaching will
eliminate light-insulation of the post-screen spaces,
which will simplify the design, reduce mass, dimensions
and cost of a system, improve the main parameters and
5 provide novel parameters of a projection system.

An additional technical effect according to claim 2 is
the possibility of simultaneous projection by different
projectors of different images for simultaneous viewing on
10 a common screen of different full-screen images by
different viewers located at different viewing sectors.

An additional technical effect according to claims 3
and 4 is maximal or complete elimination of the projection
15 space by way of projecting the rays onto a light-guide
screen through its transparent end-face and propagating
the rays along the light guide volume to form a screen
image only by local light diffusers of a light guide. This
will exclude shading of projection, provide generation of
20 screen images simultaneously at two sides and will allow
to implement a projection system in the form of
transparent or transparency-controlled plates.

An additional technical effect according to claim 4 is generation of a screen image by projection of rays that correspond to particular image pixels and are characterized by different entry-incidence angles onto the reflecting surfaces inside a screen so that to output said rays by the screen light diffusers in the corresponding coordinates of screen image generation.

An additional technical effect according to claim 5 is an expansion of the viewer-seen screen area having an anti-flare, or opaque black coating, or having a transparent or transparency-controlled screen. At that, the area of the visible screen images is reduced, which substantially improves both the required optical properties of a screen and visual comfort of screen image viewing. In the environment of a bright external illumination: clearness, contrast, accuracy of colour-rendering are optimally increased, the half-tone gradation range is expanded, etc.; power consumption and cost of projection systems are lower. Realization of novel parameters is possible: i.e. simultaneous viewing of a screen image, objects or background behind a transparent or toned projection screen, adjustment of transparency of a screen.

An additional technical effect according to claim 6 is a shading-free projection effected from great distances or shading-free short-focus projection performed by a
5 projector attached to a screen edge and having a steadily-focused lens system.

An additional technical effect according to claim 7 is a constructional simplification of projectors without use
10 of projection lens systems, owing to generation of collimated background illumination of the slide-, or micro-mirror arrays having a predetermined spatial distribution of rays on a screen. This will allow to project geometrically correct and clear images onto planar
15 and curvilinear surfaces of screens.

Another technical result of embodiment of the invention according to claim 8 is a possibility of comfortable viewing, without use of stereoscopic
20 spectacles, of stereoscopic images when viewers move freely within the stereoscopic image viewing sector. Further, different viewers will be able to view simultaneously different stereoscopic images from different aspects of viewing of stereoscopic images.

Said technical effect of embodying the invention is to be achieved as follows: a known projection system comprises one or a number of projectors for generation
5 and/or projection of transformed and/or trapezoid image frames, and a viewing screen. Light diffusers of the projection rays are arranged on a screen.

The distinguishing feature is that light diffusers of
10 a front-, or rear-projection screen are implemented as discrete spherical micro-mirrors, and/or micro-lenses, and/or micro-focons, and/or micro-prisms that protrude from the screen surface or formed within the screen body. Light diffusers are disposed on a screen in a discrete or
15 raster pattern and oriented on a screen such that to capture, with maximal light efficiency (by entrance windows of these light diffusers), all projection rays directed at an acute angle with respect to the screen plane, or capture the projection rays directed into the
20 transparent end-face of the light-guide screen plate, with subsequent deflection and diffusion of the projection rays into the screen image viewing sector, with a brightness that is even across the field.

According to claim 2, a projection system comprises two or a number of projectors for simultaneous projection of images onto a common screen. The projectors are disposed at different aspects of projection performed onto
5 said screen, for example, at one side at a different distance with respect to one another, or at opposite sides of a screen. The system is characterized in that, the projectors are oriented towards the common screen for simultaneous projection of different full-screen images at
10 different aspects. The screen light diffusers are implemented as spherical micro-mirrors, and/or micro-lenses, and/or micro-focons and have an optical arrangement for selective capturing of each projection ray beam of each particular projector, and for diffusing the
15 ray beam into a corresponding viewing sector of one full-screen image. This will allow the simultaneous viewing of different full-screen images (formed by different projectors) seen by different viewers located at different viewing sectors.

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In another embodiment of the projection system according to claim 3, a projection system is characterized in that the viewing screen is implemented as a light guide in the form of a planar-parallel plate, or multi-layer or multi-

strip light guide. Light guide's core has a constant refractive index and is provided with end-face transparent entrance windows to input into the light guide the parallel projection rays. On the light guide surface,
5 locally across the screen area, disposed are light diffusers of the point or raster types. The light diffusers are implemented within the light guide body, or on the surface thereof, and are provided with an optical arrangement for selective capturing of the projection rays
10 in the light guide and outputting said rays from the light guide, with diffusion of them in predetermined coordinates of screen image generation. The projector or projectors are provided with an optical system that generates narrow parallel projection rays. The projectors are oriented
15 towards the screen to provide accurate entry of said rays through the light guide end-face(s) into predetermined coordinates of incidence of the rays onto the reflecting internal surfaces of the light guide, so that particular projection rays inside the light guide will propagate to
20 particular light diffusers by multiple inner reflection from the light guide surfaces (between the light diffusers).

According to claim 4, the projection system is characterized in that in the light-guide screen, the light-guide core has a wedge-wise narrowed thickness in the direction of propagation of rays in the light guide from the light guide entrance end-face. The core has a constant refractive index and has a cladding, or is covered by an optical entrance window of a light diffuser having a constant or step-wise varying refractive index that is less than that of the core. For a projection system of any version of implementation of the light-guide screen - a projector has an optical system to generate projection rays of different elements of a projected image, which elements are characterized by different angles and coordinates of input of said rays into the light guide end-face. This will allow propagation of each particular ray in the light guide before said ray is captured and outputted, by a particular light diffuser, from the light guide in a corresponding coordinate of the screen image, with subsequent diffusion of all projection rays by light diffusers into a screen image viewing sector.

According to claim 5, the projection system implemented as provided for in claims 1 - 4, is

characterized in that the visible to viewers exit windows of the screen light diffusers have minimal area that is times less than the viewer-seen screen area about said windows. The screen area about the light diffusers' exit
5 windows has an anti-flare, or opaque black removable mesh. According to another version, the screen area about the light diffusers' exit windows is optically transparent, or covered with a meshwire optical filter, or has a photochrome coating to adjust the transparency degree of
10 the screen by ultraviolet illumination.

According to claim 6, the projection system implemented as provided for in claims 1, 2 and 5, is characterized in that a projector or projectors have the
15 projection telephoto lenses to perform projection at a remote distance from the screen. According to another embodiment, a projector has a short-focus lens system and is positioned at a minimal distance from the screen edge or rigidly attached to the end-face portion of the screen.
20 A predetermined one or several end-faces of the screen have a planar mirror attached thereto and having the reflective area whose size corresponds to that of the projection reflected to the screen by said mirror. The mirror being inclined with respect to axis of the reflected projection

and screen plane (in accordance with position of a projector with respect to the screen) to deflect the projection rays by the mirror at an acute angle to the screen surface. All projectors provide projection of the transformed trapezoid frame, with an increased projection size within the mirror and screen area.

According to claim 7, the projection system with the screens implemented as provided for in claims 1 - 6, is characterized in that a filmstrip projector or a projector having a translucent or micro-mirror array have an optical system of collimated background illumination of slides or projection arrays. The background illumination is performed with a lens condenser or mirror reflector to effect the fan-wise spatial distribution of each projection ray onto a corresponding light diffuser in appropriate screen coordinates, with broadening of ray apertures on the screen to obtain a clear geometrically correct frame of a viewed screen image.

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According to claim 8, the projection system implemented as provided for in claims 1 - 7, is characterized in that the projectors are implemented to produce the stereoscopic projection. The stereoscopic

screen has light diffusers in the form of lens and/or micro-mirror stereoscopic rasters for capturing the projection rays, for the spatial selection of the left and right images of a stereo couple into viewing zones of the left and right images of said couple by the viewer's left and right eyes, respectively. For comfortable viewing, without use of spectacles, of the stereoscopic images from any aspect or when viewers move in the lateral direction: the system is provided with a semi-automatic corrector, manually or automatically-controlled, and a sensor to track coordinates of the viewers' eyes and coupled to the automatic corrector. The screen or the screen raster system and projectors comprise a drive coupled to the correctors to provide (according to a certain embodiment of the correction system design) conjugation of zones of viewing of the left and right frames of stereoscopic images with viewers' corresponding eyes, for example by rotating the screen about its vertical axis or by shifting the lens raster or shifting the stereoscopic projectors along the screen. Thus, the possibility to create a projection stereoscopic system for simultaneous viewing of different stereoscopic images by different viewers from different viewing aspects, with

the viewers' ability to move freely while viewing, is also provided.

Brief Description of Drawings

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Fig. 1 shows a side view of a projection system for projecting and viewing of images from both sides of a screen and having two projectors on the upper end-face of the screen -and reflecting end-face mirrors (on the lower
10 end-face of a screen); Fig. 2 shows the left frontal side of said screen;

Fig. 3 shows a side view of a rear-projection system having a light- guide viewing screen;

Fig. 4 shows a left frontal side of said screen;

15 Fig. 5 (a) and (b) shows optical diagrams of a front- projection screen and rear-projection screen, with versions of light diffusers (in cross-sectional view of the screen).

Fig. 6 shows a plan view of an optical system in
20 cross-section of a viewing screen having a lens stereoscopic raster and a system for automatic correction for optical registration of the stereoscopic viewing zones with the viewers eyes.

Embodiments of the Invention

In the first embodiment of the claimed projection system as shown in Figs. 1 and 2: viewing screen **1** is
5 designed as a planar thin plate; on the upper end-face of the screen -projectors are attached; and on the lower end-face of the screen - attached are planar mirrors **2a** and **2b** to reflect the projection rays of said projectors onto both sides of screen **1** are positioned. On one frontal
10 side **a** and other side **b** of the screen, in the area of observation of the screen images, light diffusers **3a** and **3b** are provided. The light diffusers are designed and oriented to capture the projection rays α_1 and α_2 (reflected by the mirrors onto the screen) and then to
15 deflect and diffuse the rays by light diffusers within angle β_1 and angle β_2 of the screen image observation sectors from sides **a** and **c** of the screen. Screen surfaces **1a** and **1b** around the light diffusers are coated with an anti-flare, or black opaque coating, or are transparent,
20 or coated with a photochrome film (to adjust the screen transparency by the external ultraviolet illumination).

Projection axes of the projectors and mirror are oriented to direct projection rays α_1 at acute angles

towards surface **1a** of the screen, and rays α_2 - towards surface **1b** of said screen.

In another embodiment of the claimed projection system
5 according to Figs. 3 and 4: the viewing screen is implemented of two parallel planar transparent light guides **1c** and **1d**, and have transparent entrance end-faces for inputting the projection rays α_3 and α_4 . Below, before the entrance end-face of light guide **1c** -projector **2c**, and
10 before the end-face of light guide **1d** -projector **2d** are positioned. On frontal sides **c** and **d** of the screen of light guides **1c** and **1d**, in the area of screen image viewing, light diffusers **3c** and **3d** are arranged. These light diffusers are intended to capture rays α_3 and α_4
15 respectively projected by projectors **2c** and **2d**, output the rays from the light guides, deflect and diffuse said rays respectively within angle β_3 and β_4 of the screen image observation sector from sides **c** and **d**. Light diffusers are intended to propagate the projected rays to particular
20 light diffusers with multiple complete internal reflection thereof from the surface of said light guides.

In Fig. 5(a): on projection viewing screen **1**, each light diffuser **4** comprises positive lens **5** and inclined

planar micro-mirror **6**. From the viewer side, the light diffusers have anti-flare black opaque, or photochrome coating **7** about their entrance and exit windows. Micro-lens **5** is intended for capturing and diffusing (by focusing) of the rays within angle β_5 of the screen image observation sector. Micro-mirror **6** is intended to deflect the focused ray and output the same through a small-area transparent exit window of the light diffuser.

In another embodiment according to Fig. 5(b): a light diffuser is provided with micro-prism **6(c)** to deflect the rays into the mirror micro-focon that diffuses the rays into the image observation sector. In another embodiments, on the screen for deflecting and simultaneous diffusing the rays within angle β_6 of the image observation sector, only spherical or parabolic micro-mirrors **6a** are mounted.

In Fig. 6: a stereoscopic projection system comprises viewing screen **1** having light diffusers **41** to form image elements of the left frame of a stereo couple, and light diffusers **4r** to form image elements of the right frame of a stereo couple. From the viewer side, stereoscopic lens raster **8** to perform optical selection

of the stereo couple frame is movably positioned along the direction denoted by arrow **9**. Lens raster **8** is coupled to drive **9** of automatic corrector **10**. The automatic corrector is coupled to sensor **11** to track
5 (using rays γ reflected from a viewer's face) the spatial position of viewer's eyes with respect to the stereoscopic image viewing zones. The automatic corrector is intended to perform the optical conjugation of the viewing zone of rays β_l of the left image with the viewer's left eye **12l**, and
10 that of the viewing zone of rays β_r of the right image, accordingly, with the right eye **12r** of said viewer. Such arrangement provides the continuous, without the need to use spectacles, easy viewing of a stereoscopic effect when a viewer is in front of the screen and moves
15 laterally in respect of the screen.

The Claimed Projection System is operated as Follows.

According to the first embodiment shown in Figs. 1
20 and 2: two projectors **2a and 2b** form two trapezoid and transformed projected images. Using the optical transformation, the projected image is expanded horizontally to the screen width, and is narrowed vertically to the optimal width of an image that is

multiple times smaller in size than the screen height size. Projection rays α_1 and α_2 are directed at a predetermined small angle to the screen surface and narrowed in cross-section within the area of the entrance
5 window of a light diffuser so that to provide a precise and complete capturing of each separate ray by one predetermined light diffuser. Projectors and light diffusers form the full-screen various images viewed by different viewers simultaneously from two sides of the
10 screen, without optical interference.

In Figs. 3 and 4 the second embodiment of the claimed projection system having a viewing screen consisting of two planar-parallel light guides is operated as follows. Below,
15 from the end-face side of screen **1c** and **1d**, projectors **2c** and **2d** form the projected light fluxes of images in the form of narrowly diverging rays α_3 and, respectively, α_4 . Projector **2c**, from below through the end-face of light guide **1c**, projects rays α_3 . These rays are reflected inside
20 the light guide in the form of rays α_3 that diverge to points of certain light diffusers **3c**, then they are outputted, deflected and diffused by said light diffusers within wide angle β_1 of the screen image viewing sector from side **c**. Similarly, projector **2d** forms the screen

images to be viewed from the opposite side **d** of the screen.

Fig. 5(a) shows projection screen **1** having light
5 diffusers **4** in the form of micro-lenses **5** provided with planar inclined micro-mirrors **6** and opaque black coating **7**. Light diffusers are intended for complete capturing of the projection rays α , which rays are focused by a lens **5** and then are deflected by a mirror **6** for diffusing them
10 within angle β_5 of the screen image viewing sector.

Fig. 5(b) illustrates rear-projection screen **1** having different versions of light diffusers and coatings of the screen. The light diffuser in the upper portion of the
15 screen is designed as optical micro-prism **6c** that deflects the projection rays and is conjugated with mirror-spherical or mirror-parabolic focon (opening) **6d**. Below, in the screen height, disposed are light diffusers having spherical or parabolic micro-mirrors **6a** that protrude from
20 the screen surface and serve to deflect and focus simultaneously the projection rays within a minimal area of the light diffusers' exit windows. In the light diffusers (in the middle portion of the screen height) micro-mirrors are conjugated with openings **e** (in the form of a hollow

focon) to carry out the induced ventilation, against dust,
of the exit windows when the screen is automatically
cleaned by the internal air pressure created by a fan that
blows behind the screen. In light diffuser, in the nether
5 portion of the screen height, micro-mirrors 6a are
conjugated with transparent exit windows of the transparent
screen. The screens (in the screen area behind the exit
windows) can be transparent or coated with an anti-flare
black opaque paint or removable black mesh 7a, or have
10 photochrome coating 7a to adjust the screen transparency
using the ultraviolet background illumination. Angle β_6 is
the angle of the sector of diffusion of the projection rays
by micro-mirrors for viewing of the screen images.

15 In the stereoscopic projection system in Fig. 6,
stereoscopic projectors form an automatic stereogramme in
the form of horizontally alternating vertical strips of
the left and right images of a stereo couple. Stereo
raster 8 projects the left image into the left eye
20 viewing zone, and projects the right image into the right
eye viewing zone. Light sensor 11 receives rays γ ,
reflected from the viewer's face, to determine the eyes'
spatial position according to the contrast of an image of
the eyes and face. The sensor forms a control signal that

is supplied to automatic corrector **10**. Using drive **9**, the automatic corrector automatically displaces the stereo raster to the optimal registration of the left eye viewing zones with viewer's left eye **12l**, and that of the
5 right image viewing zone (rays β_r), respectively, with right eye **12r**.

The optimal embodiment of the claimed projection system for use in a dust-laden environment, or under
10 conditions of atmospheric precipitation, can consist of a design, wherein the projection space behind a screen is closed for protection against light, dust, humidity, and where a projector, planar mirror in the screen end-face and the light diffusers' plane can be accommodated. A
15 projector can be disposed at any distance from a screen, and the transformed projection can be directed to the horizontal or vertical entrance window of a screen, or to the end-face mirror of front-, or rear-projection screens (protected against dust and precipitation).

20

Another optimal embodiment of the projection system can be a design adapted for projection into the interior of the glass of spectacles, or onto its surface, for which purpose, on the projection side, a film having

light diffusers is attached to spectacles. In this case, micro-miniature light diffusers on the glass of spectacles can be invisible and adapted not to affect visibility of the external objects viewed through the transparent area of the glass of spectacles around the light diffusers. Using the ultraviolet background illumination of the photochrome layer within thickness of the glass of spectacles, transparency of spectacles for better viewing of the projected images against dark background can be adjusted. To ensure a high luminous efficacy of the projection, the light diffusers in spectacles are designed to have the minimum angle of diffusion of the projection rays only into the eye pupil area, which arrangement will reduce the projection power consumption hundreds times. Thereat, an excellent stereoscopy in a super-wide angle of the field of vision up to 140° , with any range of hue gradation, an enhanced brightness and contrast, a high accuracy of colour-rendering and resolution, which would not be attained using the stereo screens of the known stereo projection systems, are achieved.

The proposed projecting mono- and stereoscopic systems provide the optimal and constructional parameters

that cannot be achieved in the best analogues of the world prior art. The possibility of easy, without use of spectacles, viewing of stereo images, as well as a highly efficient stereoscopic projection in the glass of
5 spectacles conforms with a considerable inventive step.

Industrial Applicability

All claimed projection systems can be produced in series using the known manufacture techniques for producing
10 projectors, stereo projectors, projection optical means and viewing screens having light reflectors or lens rasters. For automatic correction of a stereo projection system, the known systems for automatic correction of displacement of objects that are provided with sensors for tracking the
15 contrast elements of the objects for the purpose to determine the spatial orientation of these objects and for automatic adaptation of a system, can be used. Thus the industrial feasibility of the invention is evident.

CLAIMS

1. A projection system, comprising one or a number of projectors and a viewing screen, on said screen light diffusers for diffusing of projection rays being formed, characterised in that the light diffusers are adapted to capture the projection rays directed from an end-face of the screen across its surface, and subsequently deflect said rays into a sector of observation of an image formed on the screen; and further comprises an optical system that transforms a projected image and registers cross-sections of the projection rays with entrance pupils of the light diffusers formed on the screen so that to provide a depth of sharpness of the projected image over the entire screen surface.

15

2. The projection system as claimed in claim 1, characterised in that the viewing screen is adapted to perform a projection from a screen end-face onto the frontal and/or reverse, from the viewer side, surface of said screen, for which purpose the light diffusers are implemented in the form of protruding from, or recessed in the screen surface - mirrors, lenses, prisms for capturing, deflecting and diffusing the rays projected from a screen end-face.

20

3. The projection system as claimed in claim 1,
characterised in that the viewing screen is provided with a
light guide in the form of a flat-parallel plate, or a
laminate or multi-strip light guide that has a core having
5 a constant refraction index, and end-face entrance windows
for inputting, into the light guide, the parallel
projection rays; on the light-guide surface, locally over
the screen surface, disposed are light diffusers to output
said rays out of the light guide in pre-determined
10 coordinates of formation of a screen image and to diffuse
said rays into a sector of observation of said image, for
which purpose a projector or projectors are provided with
an optical system to form narrow parallel projection rays
and to direct said rays through the light-guide end faces
15 into predetermined coordinates of incidence of the rays on
the light-guide reflecting planes so that to propagate the
rays within the light guide by multiple internal reflection
from its surfaces and to output the rays from the light
guide by the light diffusers on the screen.

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4. The projection system as claimed in claim 3,
characterised in that the screen light guide core narrows,
wedge-wise, from the light guide's entrance end-face in the
direction of propagation of rays in the light guide, the
25 core having a constant refraction index and being coated

with a cladding or an optical entrance window of a light
diffuser having a constant or stepped refraction index
whose value is lower than that of the core; for any version
of embodiment of the light-guide screen, the projector
5 being provided with an optical system for formation of
projection of rays of the projected image's various
elements, which rays are characterised by different angles
of entrance of these rays into the light-guide end-face for
carrying out the selective outputting of these rays out of
10 the light guide by the screen light diffusers within the
appropriate coordinates of formation of a screen image and
for subsequent diffusing of these rays by light diffusers
into a sector of observation of the image.

15 5. The projection system as claimed in any one of claims 1-
4, characterised in that the entrance and exit windows of
the screen light diffusers have a minimal area that is
multiple times smaller than the screen area around said
windows, and the screen area around the exit windows being
20 coated with an anti-flare opaque black layer, or on the
screen between the light diffusers positioned is an opaque
black mesh, or the screen area around the light diffusers
being optically transparent or coated with a photochrome
film to adjust the screen transparency using the
25 ultraviolet background illumination.

6. The projection system as claimed in any one of claims 1-5, characterised in that the projector is equipped with a projection telephoto lens and anamorphic cylindrical lens
5 for a minimal magnification of the projection size, for example a magnification in height, and simultaneous magnification of the projection to the screen width, the projector being positioned at a predetermined distance from the screen, and on the end-face of the screen width
10 positioned is a mirror retrodirective reflector to deflect the projection into the screen end-face, or the projector being disposed near the screen end-faces, and on the opposite end-faces of the screen being positioned the mirror reflectors for multiple reflection of the
15 projection, so that to narrow the cross-section of the projection rays within the area of the light diffusers' entrance windows.

7. The projection system as claimed in any one of claims
20 1-6, characterised in that a transparency projector and the screen are provided with an optical system for transforming the projection images and for narrowing the cross-section of the projection rays without the use of projection lenses and transforming anamorphic lenses, for which purpose an
25 illuminator of transparent projected images, in the

transparency projector, is provided with an optical arrangement to form background illumination of slides by thin rays that diverge fan-wise, cross-section of which rays being broadened within sizes of the area of entrance
5 windows of the light diffusers.

8. The projection system as claimed in any one of claims 1-7, characterised in comprising one or several stereo projectors and a stereo screen having light diffusers and a
10 lenticular raster to carry out the spatial selection of the left and right images of a stereo couple into the zones of vision of the left and right images of a stereo couple by, respectively, the viewer's left and right eyes; and for the purpose of an easy, without the use of spectacles, viewing
15 of stereo images at any aspect or in case when viewers move in a lateral direction; the system being provided with a semi-automatic manually-controlled corrector or an automatic corrector coupled to a sensor for tracking the viewers' eyes coordinates, said semi-automatic or automatic
20 correctors comprising a drive for carrying out various versions of correction of the stereoscopy system, for example by way rotating the stereo screen about its vertical axis, or by displacing the lenticular raster, or displacing the stereo projectors along the screen.

9. A projection system comprising one or a number of projectors to generate and/or project the transformed and/or trapezoid image frames, and a screen, on the screen of which system the projection ray light diffusers are formed, characterized in that the light diffusers of a front-, or rear-projection screen are implemented as discrete spherical micro-mirrors, and/or microlenses, and/or micro-focones, and/or micro-prisms that protrude from the screen surface, or are formed within the screen body, disposed on the screen in a discrete pattern or raster pattern and oriented on the screen such that entrance windows of said light diffusers are enabled to capture all projection rays directed at an acute angle to the screen plane, or capture the projection rays directed onto the transparent end-face of a light guide screen plate, with subsequent deflection and diffusion of the projection rays into a sector of viewing of the screen images, with brightness that is uniform over the field.
10. The projection system according to claim 9, further comprising two or a number of projectors for simultaneous projection of images onto a common screen, which projectors are disposed at different aspects of projection to be performed onto said screen,

characterized in that, for simultaneous viewing of
different full-screen images by different viewers located
in different viewing sectors, the projectors are oriented
towards the screen for simultaneous projections of
5 different full-screen images into different sectors of
separate viewing of these projections, and the screen light
diffusers are implemented as spherical micro-mirrors,
and/or microlenses, and/or micro-focones having an optical
arrangement for selective simultaneous capturing of the
10 projection ray beam of each particular projector, with
diffusion of the ray beam into a corresponding viewing
sector of one full-screen image and diffusion of other
projection beams into other viewing sectors.

15 11. The projection system according to claim 9,
characterized in that the viewing screen is implemented as
a light guide in the form of a planar-parallel plate', or a
multi-layer or multistrip light guide, the light guides
having a core with a constant refractive index and
20 transparent entrance end-faces to input into the light
guide the projection rays and to propagate said rays along
the light guide by multiple complete internal reflection;
on the light guide surface, locally on the screen area,
disposed are the light diffusers for selective capturing,
25 outputting from the light guide and diffusion of separate

projection rays in predetermined coordinates of screen image formation, for which purpose the projector or projectors are provided with an optical system that generates a projection beam consisting of thin parallel
5 rays; the projectors being oriented towards the screen to direct the rays onto the light guide end-faces into predetermined coordinates of incidence of each ray inside the light guide surface, considering passage of each particular ray to a corresponding diffuser.

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12. The projection system according to claim 11, characterized in that the screen light guide core has a wedge-wise narrowed thickness in the direction of propagation of rays in the light guide from the light guide
15 entrance end-face; the core has a constant refractive index and has a cladding or is covered by an optical entrance window of a light diffuser having a constant or step-wise varying refractive index that is less than that of the core; in any version of implementation of the light-guide
20 screen: a projector has an optical system to generate projection rays of different elements of a projected image, which elements are characterized by different angles and coordinates of input of said rays into the light guide end-face to propagate each particular ray in the light
25 guide before said ray is captured by a particular light

diffuser, with subsequent output of the ray from the light guide in a corresponding coordinate of the screen image, with subsequent diffusion of the projection rays by the light diffusers into a screen image viewing sector.

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13. The projection system according to any one of claims 9 - 12, characterized in that the visible to viewers exit windows of the screen light diffusers have minimal area that is less than the viewer-seen screen area about said windows, and for the purpose of absorption of parasitic illumination and spots, the screen area about the light diffusers' exit windows has an anti-flare or opaque black coating, or an opaque black removable mesh, or said area is optically transparent or covered with a meshwire optical filter, or has a photochrome coating to adjust transparency degree of the screen by ultraviolet illumination.

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14. The projection system according to any one of claims 9,10 and 13, characterized in that a projector or a number of projectors having projection telephoto lenses are positioned at a remote distance from the screen, and/or projectors having short-focus lenses are positioned at a minimal distance from the screen and rigidly attached to the end-face portion of the screen; all projectors providing a transformed projection; one or several end-

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faces of the screen each has one planar mirror attached thereto and having the reflective area whose size corresponds to that of the projection reflected to the screen by said mirror, each mirror being inclined with
5 respect to axis of the reflected projection and screen plane to deflect the projection rays by the mirror at an acute angle to the screen surface.

15. The projection system according to any one of claims 9
10 -14 characterized in that a filmstrip projector or a projector having a translucent or micro-mirror array have an optical system of collimated background illumination of slides, projection arrays with fan-wise spatial distribution of said rays onto light diffusers in
15 corresponding screen coordinates, with broadening of ray apertures on the screen to obtain a clear geometrically correct frame of a viewed screen image.

16. The projection system according to any one of claims 9-
20 15, characterized in that the system comprises one or several stereoscopic projectors, and a stereoscopic screen with light diffusers and a lens raster for spatial selection of the left and right images of a stereo couple into viewing zones of the left and right images of said
25 couple by the viewer's left and right eyes, respectively;

and for comfortable viewing, without use of spectacles, the stereoscopic images from any aspect or when viewers move in the lateral direction; the system being provided with a semi-automatic corrector, manually or automatically-
5 controlled, and a sensor to track coordinates of the viewers' eyes and coupled to the automatic corrector; the screen or the screen raster system, or projectors comprise a drive coupled to the correctors to provide a correction system appropriately to a particular version of the design,
10 so that to conjugate the zones of viewing of the left and right frames of stereoscopic images by viewers' corresponding eyes, for example by rotating the stereoscopic screen about its vertical axis, or by shifting the lens raster or shifting the stereoscopic projectors
15 along the screen.