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- (71) **Applicant: TOCCATA GAMING INTERNATIONAL, LLC** [US/US]; 100 S. Birch Street, Suite C, Kimberly, WI 54136 (US).
- (72) **Inventor: STIMAC, Todd, R.;** 4650 Windsor Road, Windsor, WI 53598 (US).
- (74) **Agents: LEONE, Joseph T. et al;** DeWitt Ross & Stevens S.C., 2 East Mifflin Street, Suite 600, Madison, WI 53703-2865 (US).
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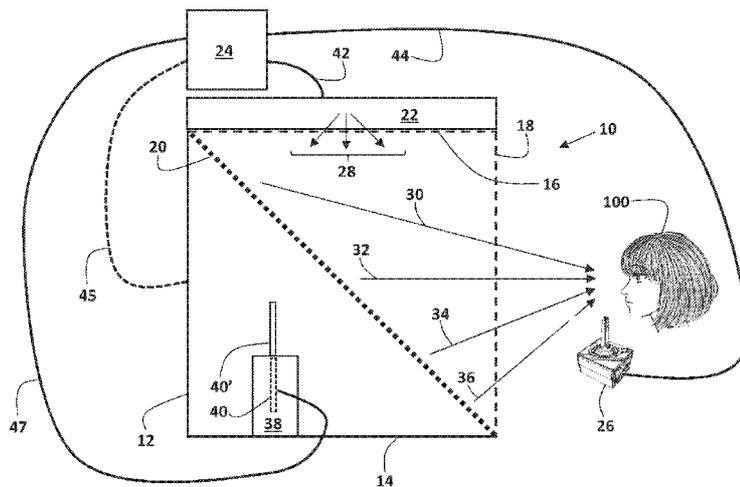


FIG. 1

(57) **Abstract:** A game console having a beam splitter disposed in a housing and a projector that projects images onto the beam splitter that are reflected so that a player can see the images. Real world objects and/or additional projectors are positioned behind the beam splitter relative to the player and transmit images through the beam splitter so that the player can see them. In this fashion, during game play the player simultaneously sees images that are reflected from the beam splitter and images that are transmitted through the beam splitter.

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GAME CONSOLE INCORPORATING
BEAM-SPLITTER DISPLAY AND REAL WORLD OBJECTS

Todd R. Stimac

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CROSS-REFERENCE TO RELATED APPLICATIONS

Priority is hereby claimed to co-pending U.S. patent application Serial No. 15/002,795, filed 21 January 2016, which is incorporated herein by reference.

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FIELD OF THE INVENTION

Disclosed and claimed herein is an interactive video game apparatus in which a virtual field of play is transmitted to the player(s) view via a beam-splitter display that enables the player(s) to view the virtual field of play while simultaneously viewing real objects placed behind the beam-splitter display.

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BACKGROUND OF THE INVENTION

The art of video games and video gaming apparatus has progressed to the point that many games are described as being "virtual reality" (VR), a somewhat amorphous term. For practical purposes, a VR gaming apparatus places the user in a totally synthetic, computer-generated environment. Thus, in a VR gaming environment, the user interacts with (or is "immersed into") a three-dimensional environment which is entirely computer-generated. In their more sophisticated, computationally demanding versions, VR environments can be photorealistic, three-dimensional spaces. However, everything within the VR environment is not real; every object, surface, and image is computer generated. If the environment allows for the players to be "seen" by other players, they appear in the VR environment as avatars of the real players - that is, a computer generated image for each player in the game. When immersed in a VR environment, the user does not directly interact with the real-world environment, nor directly interact with the other players in the game.

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Video games in general utilize an image generator (typically a programmable computer) to create and control the VR environment which is seen by the user, as well as in response to the user's inputs. Conventionally, this is accomplished by projecting or otherwise manifesting a dynamic, digitally generated motion picture (created by the programmable computer) onto a screen, for example via a cathode ray tube, flat panel

display, etc. The image is perceived by the player, who then interacts with the dynamic image via a joy stick or other controller. This, of course, enables the player to alter or otherwise interact with the virtual environment according to the specific rules of the game being played. Conventionally, the display itself is a two-
5 dimensional, flat, opaque surface, and the entire game is played by the player(s) interacting with the virtual images presented on the display. The player(s) do not directly interact, within the game environment, with other players or with real world objects.

10 SUMMARY OF THE INVENTION

A first version of the console comprises a housing having an open or transparent top, an open or transparent front, and a bottom; a projector situated on the top of the housing; a computer operationally connected to the projector and programmed to execute a video game; at least one controller operationally connected
15 to the computer and dimensioned and configured to control play of the video game; a first beam splitter disposed inside the housing and positioned so that images generated by the projector are at least partially reflected from the first beam splitter and exit the front of the housing; and an award indicator disposed inside the housing at a position such that the beam splitter is situated between the award indicator and the front face
20 of the housing, and wherein at least a portion of light reflecting off of or projected from the award indicator is transmitted through the first beam splitter and exits the front of the housing.

A second version of the console comprises a housing having an open or transparent top, an open or transparent front, an open or transparent back, and a
25 bottom; first and second projectors situated on the top of the housing; a computer operationally connected to the first and second projectors and programmed to execute a video game; at least two controllers operationally connected to the computer and dimensioned and configured to control play of the video game; a first beam splitter disposed inside the housing and positioned so that images generated by the first
30 projector are at least partially reflected from the first beam splitter and exit the front of the housing; a second beam splitter disposed inside the housing and positioned so that images generated by the second projector are at least partially reflected from the second beam splitter and exit the back of the housing; and an award indicator disposed inside the housing between the first beam splitter and the second beam

splitter, and wherein at least a portion of light reflecting off of or projected from the award indicator is transmitted through the first beam splitter and exits the front of the housing, and at least a portion of light reflecting off of or projected from the award indicator is transmitted through the second beam splitter and exits the back of the
5 housing.

In another version, the game console comprises a housing having an open or transparent top, an open or transparent front, and a bottom; a projector situated on the top of the housing; a computer operationally connected to the projector and programmed to execute a video game; at least one controller operationally connected
10 to the computer and dimensioned and configured to control play of the video game; a first beam splitter disposed inside the housing and positioned so that images generated by the projector are at least partially reflected from the first beam splitter and exit the front of the housing; a real world object disposed inside the housing at a position such that the beam splitter is situated between the real world object and the front face of the
15 housing, and wherein at least a portion of light reflecting off of or projected from the real world object is transmitted through the first beam splitter and exits the front of the housing; and wherein the projector is dimensioned and configured to project a mask whose image as reflected off the beam splitter is in registration with the real world object when viewed from the front of the housing, and wherein other images
20 projected by the projector are configured to be hidden by the mask when in registration with the mask or are configured to hide the mask when in registration with the mask.

In yet another version, the game console comprises: a housing having an open or transparent top, an open or transparent front, and an open or transparent back; first
25 and second projectors situated on the top of the housing; a computer operationally connected to the first and second projectors and programmed to execute a video game; at least two controllers operationally connected to the computer and dimensioned and configured to control play of the video game; a first beam splitter disposed inside the housing and positioned so that images generated by the first
30 projector are at least partially reflected from the first beam splitter and exit the front of the housing; a second beam splitter disposed inside the housing and positioned so that images generated by the second projector are at least partially reflected from the second beam splitter and exit the back of the housing; a real world object disposed inside the housing between the first beam splitter and the second beam splitter, and

wherein at least a portion of light reflecting off of or projected from the real world object is transmitted through the first beam splitter and exits the front of the housing, and at least a portion of light reflecting off of or projected from the real world object is transmitted through the second beam splitter and exits the back of the housing; and
5 wherein the projector is dimensioned and configured to project a mask whose image as reflected off the beam splitter is in registration with the real world object when viewed from the front and rear of the housing, and wherein other images projected by the projector are configured to be hidden by the mask when in registration with the mask or are configured to hide the mask when in registration with the mask.

10 In short, disclosed and claims herein are the following versions of a game console:

1. A game console comprising:

a housing having an open or transparent top and an open or transparent front;
a projector situated on the top of the housing;

15 a computer operationally connected to the projector and programmed to execute a video game;

at least one controller operationally connected to the computer and dimensioned and configured to control play of the video game;

20 a first beam splitter disposed inside the housing and positioned so that images generated by the projector are at least partially reflected from the first beam splitter and exit the front of the housing;

an award indicator disposed inside the housing at a position such that the beam splitter is situated between the award indicator and the front face of the housing, and wherein at least a portion of light reflecting off of or projected from the award
25 indicator is transmitted through the first beam splitter and exits the front of the housing.

2. The game console of Claim 1, wherein the housing further comprises a back having visible images disposed thereon.

30 3. The game console of Claim 1, wherein the housing further comprises a back, and the back is a second projector operationally connected to the computer.

4. The game console of Claim 3, wherein the first beam splitter is a plate of beam-splitting glass having a transmittance/reflectance (T/R) ratio of from about 20/80 to about 80/20.

5. The game console of Claim 3, wherein the first beam splitter is a plate of beam-splitting glass having a transmittance/reflectance (T/R) ratio of from about 60/40 to about 50/50.

6. The game console of Claim 1, wherein the first beam splitter is a plate
5 of beam-splitting glass having a transmittance/reflectance (T/R) ratio of from about 20/80 to about 80/20.

7. The game console of Claim 1, wherein the first beam splitter is a plate of beam-splitting glass having a transmittance/reflectance (T/R) ratio of from about 60/40 to about 50/50.

8. The game console of Claim 1, wherein the housing further comprises
10 an open or transparent back; and further comprising
a second beam splitter disposed inside the housing and positioned so that images generated by the projector are at least partially reflected from the second beam splitter and exit the back of the housing;

15 an award indicator disposed inside the housing between the first beam splitter and the second beam splitter, and wherein at least a portion of light reflecting off of or projected from the award indicator is transmitted through the first beam splitter and exits the front of the housing, and at least a portion of light reflecting off of or projected from the award indicator is transmitted through the second beam splitter and
20 exits the back of the housing

9. The game console of Claim 8, wherein the first and second beam splitters are plates of beam-splitting glass having a transmittance/reflectance (T/R) ratio of from about 20/80 to about 80/20.

10. The game console of Claim 8, wherein the first and second beam
25 splitters are plates of beam-splitting glass having a transmittance/reflectance (T/R) ratio of from about 60/40 to about 50/50.

11. A game console comprising:
a housing having an open or transparent top, an open or transparent front, and
an open or transparent back;
30 first and second projectors situated on the top of the housing;
a computer operationally connected to the first and second projectors and programmed to execute a video game;
at least two controllers operationally connected to the computer and dimensioned and configured to control play of the video game;

a first beam splitter disposed inside the housing and positioned so that images generated by the first projector are at least partially reflected from the first beam splitter and exit the front of the housing;

5 a second beam splitter disposed inside the housing and positioned so that images generated by the second projector are at least partially reflected from the second beam splitter and exit the back of the housing;

an award indicator disposed inside the housing between the first beam splitter and the second beam splitter, and wherein at least a portion of light reflecting off of or projected from the award indicator is transmitted through the first beam splitter and
10 exits the front of the housing, and at least a portion of light reflecting off of or projected from the award indicator is transmitted through the second beam splitter and exits the back of the housing.

12. The game console of Claim 11, wherein the first and second beam splitters are plates of beam-splitting glass having a transmittance/reflectance (T/R)
15 ratio of from about 20/80 to about 80/20.

13. The game console of Claim 11, wherein the first and second beam splitters are plates of beam-splitting glass having a transmittance/reflectance (T/R) ratio of from about 60/40 to about 50/50.

14. A game console comprising:
20 a housing having an open or transparent top, an open or transparent front, and a bottom;

a projector situated on the top of the housing;

a computer operationally connected to the projector and programmed to execute a video game;

25 at least one controller operationally connected to the computer and dimensioned and configured to control play of the video game;

a first beam splitter disposed inside the housing and positioned so that images generated by the projector are at least partially reflected from the first beam splitter and exit the front of the housing;

30 a real world object disposed inside the housing at a position such that the beam splitter is situated between the real world object and the front face of the housing, and wherein at least a portion of light reflecting off of or projected from the real world object is transmitted through the first beam splitter and exits the front of the housing;

wherein the projector is dimensioned and configured to project a mask whose image as reflected off the beam splitter is in registration with the real world object when viewed from the front of the housing, and wherein other images projected by the projector are configured to be hidden by the mask when in registration with the mask or are configured to hide the mask when in registration with the mask.

15 15. The game console of Claim 14, wherein the housing further comprises a back having visible images disposed thereon.

16. The game console of Claim 14, wherein the housing further comprises a back, and the back is a second projector operationally connected to the computer.

10 17. The game console of Claim 14, wherein the first beam splitter is a plate of beam-splitting glass having a transmittance/reflectance (T/R) ratio of from about 20/80 to about 80/20.

18. A game console comprising:
a housing having an open or transparent top, an open or transparent front, and
15 an open or transparent back;

first and second projectors situated on the top of the housing;

a computer operationally connected to the first and second projectors and programmed to execute a video game;

20 at least two controllers operationally connected to the computer and dimensioned and configured to control play of the video game;

a first beam splitter disposed inside the housing and positioned so that images generated by the first projector are at least partially reflected from the first beam splitter and exit the front of the housing;

25 a second beam splitter disposed inside the housing and positioned so that images generated by the second projector are at least partially reflected from the second beam splitter and exit the back of the housing;

a real world object disposed inside the housing between the first beam splitter and the second beam splitter, and wherein at least a portion of light reflecting off of or projected from the real world object is transmitted through the first beam splitter and
30 exits the front of the housing, and at least a portion of light reflecting off of or projected from the real world object is transmitted through the second beam splitter and exits the back of the housing; and

wherein the projector is dimensioned and configured to project a mask whose image as reflected off the beam splitter is in registration with the real world object

when viewed from the front and rear of the housing, and wherein other images projected by the projector are configured to be hidden by the mask when in registration with the mask or are configured to hide the mask when in registration with the mask.

5 19. The game console of Claim 18, wherein the first and second beam splitters are plates of beam-splitting glass having a transmittance/reflectance (T/R) ratio of from about 20/80 to about 80/20.

 20. The game console of Claim 18, wherein the first and second beam splitters are plates of beam-splitting glass having a transmittance/reflectance (T/R)
10 ratio of from about 60/40 to about 50/50.

 21. A game console comprising:
 a housing having an open or transparent top, an open or transparent front, and
 a bottom;

 a projector situated on the top of the housing;
15 a computer operationally connected to the projector and programmed to execute a video containing images;

 a first beam splitter disposed inside the housing and positioned so that the images generated by the projector are at least partially reflected from the first beam splitter and exit the front of the housing;

20 a real world object disposed inside the housing at a position such that the beam splitter is situated between the real world object and the front face of the housing, and wherein at least a portion of light reflecting off of or projected from the real world object is transmitted through the first beam splitter and exits the front of the housing;

 wherein the projector is dimensioned and configured to project a mask whose
25 image as reflected off the beam splitter is in registration with the real world object when viewed from the front of the housing, and wherein other images projected by the projector are configured to be hidden by the mask when in registration with the mask or are configured to hide the mask when in registration with the mask.

 22. The game console of Claim 21, wherein the housing further comprises
30 a back having visible images disposed thereon.

 23. The game console of Claim 21, wherein the housing further comprises a back, and the back is a second projector operationally connected to the computer.

24. The game console of Claim 21, wherein the first beam splitter is a plate of beam-splitting glass having a transmittance/reflectance (T/R) ratio of from about 20/80 to about 80/20.

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BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a side elevation schematic of a first version of the game console.

Fig. 2 is a front elevation schematic of the game console shown in Fig. 1.

Fig. 3 is a side elevation schematic of a second version of the game console.

Fig 4A and 4B are schematic, bottom side plan views looking directly into projector 22. Fig. 4A is a view in which projected image 32 is programmed to be behind, or hidden by, mask 51'. Fig. 4B is a view in which projected image 32 is programmed to be behind, or hidden by, mask 51' and projected image 34 is programmed to be in front of, or hiding, mask 51'.

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DETAILED DESCRIPTION

The following definitions are used throughout the specification and claims:

"Beam splitter" is used herein to designate a device of any configuration that divides a beam of light or other electromagnetic radiation into two or more separate beams. Beam splitters include prisms and various types of coated glass. Beam splitters, including coated beam-splitting glass that operates in the visual wavelengths is commercially available from a large number of suppliers, such as Edmund Optics (Barrington, New Jersey). Beam-splitting glass is typically characterized by its percentage of reflectance (R) versus transmittance (T), the wavelength ranges for reflectance/transmittance, and whether it polarizes the reflected/transmitted image. Any beam splitter that operates in the visual wavelengths may be used in the present console.

"Computer" as used herein means any electronic device that is specially and permanently programmed to generate digital images (still pictures, animation, motion pictures, alpha-numeric text, etc.), to generate sound, and to execute game code (either via software code, hardware-implemented code, firmware-implemented code, or any combination thereof) or any electronic device that can be programmed to generate the images and sounds and to execute the game code (again via software, hardware, firmware, or any combination thereof) needed to play an interactive video game, including (by way of example and not limitation), a single (or multiple)

processor-based system that may be supported in a stand-alone (desktop, laptop, personal digital assistant, arcade console), networked, mainframe, or client-server architecture, or other computing environment. The system used may include one or more known storage devices (e.g., Random Access Memory (RAM), Read Only
5 Memory (ROM), hard disk drive (HDD), floppy drive, tape drive, compact disk/write-read-ROM, DVD, bubble memory, flash memory, etc.), and may also include one or more memory devices embedded within a processor, or shared with one or more of the other components. The computer may generate images and execute game code to play any interactive video game of any description, with or without accompanying
10 sounds, music, haptic signals, and the like. The computer may be dimensioned and configured as one or more hardware modules, as one or more software modules, or any combination thereof.

"Controller" is defined broadly to mean any device dimensioned and configured for one or more human users to control game play in an interactive video
15 game, including hardwired and wireless controllers, haptic feedback controllers, motion-sensing controllers and the like, whether now known or developed in the future, and of any configuration or input mechanism. Conventional controllers come in many configurations, all of which are included in the definition "controller." For example, a gamepad or joypad controller is held in one or both hands and the
20 thumb(s) and finger(s) are used to provide input. Gamepads can have a number of action buttons combined with one or more omnidirectional control sticks or buttons. Paddle controllers include a wheel and one or more action buttons, for example a "fire" or "shoot" button. Joystick controllers have a handheld stick that can be tilted around either of two axes and (optionally) twisted around a third. Joystick controllers
25 are often used for flight simulators. Joystick controllers are sometimes combined with a throttle quadrant controller (see below) to yield a "hands-on throttle-and-stick" controller in which action buttons or switches are placed on the joystick itself, thus enabling the player to use the joystick and to execute other actions simultaneously, without having to remove their hands from the joystick. For example, in the context
30 of a flight simulation game, the joystick is conventionally used to control the flight of the virtual aircraft, and buttons on the joystick are used to access other functions, such as releasing virtual bombs or firing virtual weapons. Trackball controllers are essentially an upside-down mouse that is manipulated with the palm and fingers of the players hands. A throttle quadrant controller includes a set of one or more levers that

are most often used to simulate throttles or other similar controls in a real vehicle, particularly an aircraft. Throttle quadrants are most popular in conjunction with joysticks or yokes used in flight simulation or submarine simulation. Steering wheel controllers are analogous to the steering wheel of an automobile, and are simply a
5 larger version of a paddle controller designed to emulate the look and feel of a terrestrial vehicle (car, truck, tank, etc.). They are often used in conjunction with foot controllers to emulate the accelerator, brake, and clutch pedals of a manual transmission racing car. Yoke controllers are similar, but are analogous to the yoke used in aircraft and function in the same fashion. Unlike steering wheel controllers,
10 though, yoke controllers have two and sometimes three axes of movement (rotational, up/down/left/right, in/out). Keyboard and mouse combinations are widely used as controllers in games implemented on desktop computers. Touchscreen controllers allow the user to interact with the computer by touching a display screen. Motion sensing controllers interpret a player's physical movements to provide inputs
15 to the gaming system. The Wii-brand controller, for example, uses accelerometers to detect its approximate orientation and acceleration, as well as and an image sensor that enables it to be used a pointing device (such as a virtual firearm). Microsoft's Kinect-brand controller for the Xbox-brand gaming systems uses cameras to track a player's movement. A light gun is a controller that uses a laser or other EM wave to
20 "shoot" virtual targets on the game display. They are often configured to resemble modern or historic firearms or futuristic ray guns, blasters, and the like. Rhythm-type controllers are typically a combination of one or more of the controllers described above, but configured to resemble (and be operated akin to) a musical instrument such as a guitar. See, for example, the controllers described in U.S. Pat. Nos. 6,275,213
25 6,280,327; 6,285,379; 6,424,333; 6,850,221; 6,878,066; 8,537,231 and 8,986,125, all of which are incorporated herein by reference.

The term "operationally linked" or "operationally connected" means that two or more devices connected by a "linkage" are connected in such a fashion that the linked devices operate in the intended fashion. For example, a computer operationally
30 linked to a projector is connected in such a fashion that digital signal stream encoding images generated by the computer is accurately decoded into an image and the image is projected by the projector. In the same fashion, a controller operationally linked to a computer is capable of controlling the play of the game being executed in code on the computer. The term "linkage" is used herein to designate any kind of operational

link that connects the two or more stated devices in an operational fashion. Linkages may be hard wire linkages or wireless linkages of any configuration.

The terms "projector" and "image projector" are used synonymously and are broadly defined to encompass any device dimensioned and configured to project an
5 image visible to the human eye. Included within the definition of "projector" are conventional, cathode ray tube (CRT) projectors, liquid crystal display (LCD) projectors, direct/back-lit and edge-lit light emitting diode (LED) projectors, and plasma displays. These are all conventional devices, well-known, and widely available worldwide from a huge host of manufacturers.

10 Turning now to the figures, the same reference numerals are used throughout the drawings to designate the same or analogous features in each view. Fig. 1 is a side elevation schematic of a first version of the game console. The console includes an enclosure or housing 10. The housing optionally includes a visually transparent front 18, which may be made of a glass or a transparent plastic, for example, a
15 polycarbonate, an acrylic such as poly(methyl methacrylate)), glycol-modified polyethylene terephthalate, and the like. The function of the front 18 is principally to keep dirt, grime and fingerprints off the beam splitter 20 (described below) and to provide structural rigidity to the housing 10. The housing may also optionally include a visually transparent top 16, made from the same materials. The top 16 may be
20 omitted and the projector 22, described below, incorporated directly into the housing 10 as its top surface. As shown in Fig. 1, the back 12 and bottom 14 of the housing may be made from any suitably strong material, such as metal, wood, particle board, etc. The back 12 may be fabricated from transparent materials as well. Left and right sides, not shown in Fig. 1, may be fabricated from the same materials.

25 Disposed within the housing, at substantially a 45° angle, is a beam splitter 20. The beam splitter 20 may be standard plate glass. However, to convey a crisp, clear image to the user, it is preferred that the beam splitter 20 be a sheet of coated, beam-splitting flat glass having a transmittance/reflectance (T/R) ratio of from about 20/80 to about 80/20, without about 60/40 to about 50/50 generally preferred.

30 Disposed on top of the housing 10 is a projector 22, of conventional design. The projector 22 is operationally connected by linkage 42 to a processor or computer 24. The computer 24 encodes the video game being played on the console. The computer 24 contains and executes the programming of the game being played and generates a digital signal train that encodes game images, sounds, scoring, etc., in

conventional fashion. The digital signal train encoding the images is output to the projector 22 via the linkage 42 and the projector converts the signals into projections or projected images designated by arrows 28. The projector 22 is located in such a fashion that the projected images 28 impinge upon the beam splitter 20, and are
5 reflected so that a user/player 100 can see them. The reflected images seen by the user are shown in Fig. 1 by arrows 30, 32, 34, and 36.

Because of the T/R ratio of the beam splitter 20, the player 100, when looking at the beam splitter as shown in Fig. 1, sees both the reflected images 30, 32, 34, and 36, generated by the projector 22, as well as the transmitted image of the back of the
10 enclosure 12. Thus, the back 12, may have disposed upon it graphics, images, etc., which will be viewable by the player 100. Alternatively, the back 12, may be a second projector operationally connected to the computer 24, as shown by dashed linkage 45. If the back 12 is a second projector, the player 100 simultaneously sees the images 30, 32, 34, 34 reflected from the beam splitter 20, and the transmitted
15 images from the back 12 that pass through the beam splitter 20.

Disposed within the housing, on the back side of the beam splitter 20 (*i.e.*, on the other side of the beam splitter relative to the player 100) is at least one award indicator 40'. The award indicator may be a stand-alone unit or may be a retractable unit housed within enclosure 38. As shown in Fig. 1, the award indicator is show in
20 two positions: at 40' when the award indicator is deployed and at 40 when the award indicator is disposed within enclosure 38. The award indicator is a projector (as defined herein) that is operationally connected to computer 24 as shown by linkage 47 and functions to convey substantive aspects of the game itself and/or game information (such as score, bonus prizes earned, etc.). That is, the images presented
25 on award indicator 40' may comprise part of the game play itself, and/or may convey additional information relevant to the progress or outcome of the game. Because of the T/R ratio of the beam splitter 20, the user also see whatever images or alpha-numeric indicia that are projected from the award indicator 40' simultaneously with the reflected images 30, 32, 34, and 36, and any transmitted image from the back 12.

30 In this fashion, the console provides the user 100 an immersive, 3-dimensional game-playing experience. The player's 3-D perception of the game is not contrived or artificial, but actual because of the differing focal points of the images reflected from beam splitter 20, as contrasted to the real world objects (such as enclosure 38) and/or images projected from award indicator 40' and back 12 that are transmitted

through the beam splitter 20 to the user. The interplay between the reflected images and the transmitted images is visually perceived by the player 100 as a highly complex, 3-dimensional moving image. Game play can thus be highly complex, interactive, and saturated with moving images generated by projector 22, back 12, and/or award indicator 40', many of which will be at different focal points.

The player 100 interacts with the game being played via controller 26, which is operationally connected to the computer 24 by linkage 44. In this fashion, the user 100 uses the controller 26 to play the game.

The actual game being played can be any type, style, or format of video game play, either now known or developed in the future. There are a large number of known formats, including: action games (emphasize physical challenges that require eye-hand coordination and motor skill to overcome) platform games (players guide a character through obstacles, jumping on platforms and battling enemies in order to advance), fighting games, shooter games, action-adventure games, survival games, text adventure games, interactive movie games, real-time 3D adventure games, role-playing games, massively multiplayer online role-playing games, construction and management simulation games, vehicle simulation games (*e.g.*, drive, flight, dive, train simulations, racing games, space flight simulations), life simulation games, and wargames. All of these (and others) may be played using the current console.

Fig. 2 is a front elevation schematic of the game console as shown in Fig. 1. The images 30, 32 and 34, generated by the projector 22 and reflected off the beam splitter 20 as illustrated in Fig. 1 are shown in Fig. 2 as fish 30, 32, and 34. The award indicator 40' and its optional enclosure 38 are seen through the beam splitter (rather than reflected from it). That is, the award indicator 40' and its enclosure 38 are behind the beam splitter 20 and light bouncing off these objects (or projected from them in the case of the award indicator 40') is partially transmitted through the beam splitter and seen by the player (who is not shown in Fig. 2). Again, the player simultaneously sees images that are reflected off the beam splitter 20 and images that are transmitted through the beam splitter from objects that are located behind the beam splitter.

Fig. 3 illustrates a variation of the console shown in Fig. 1 in which two beam splitters 20 and 20' are disposed within a housing at about 90° relative to each other and at about 45° relative to a first player 100 (beam splitter 20) and a second player

200 (beam splitter 20'). Because of the T/R ratio of the two beam splitter 20 and 20', the two players can see each other. Two projectors 22 and 22' are provided, in the same fashion as described earlier. These two projectors may be combined into a single, large projector, however, larger projectors tend to be prohibitively expensive.

5 The game play images 28 are projected onto the beam splitters 20 and 20' as described previously. The projected images 28 are reflected off the beam splitters 20 and 20' as previously described, so as to be seen by the players 100 and 200. These images are represented in Fig. 3 by the arrows 30, 32, 34, and 36.

As in the first version, the housing has a bottom 14 and optional transparent front panels 12 and 12' and optional transparent top panel 16. Disposed within the housing, between the beam splitters 20 and 20' is at least one award indicator 40' as described previously. In this version of the console, the award indicator is a two-side projector having projecting surfaces 41a (viewable by player 100) and 41b (viewable by player 200). The award indicator 40' is operationally connected to computer 24 as shown in Figs 1 and 2. (The corresponding linkage 47 is omitted from Fig. 3 for clarity.)

As shown in Fig. 3, each player has a corresponding controller: 26' for player 200 and 26 for player 100. Each controller is operationally connected to the computer 24 by linkages 46 and 44. In the same fashion as described earlier, the computer 24 is operationally connected to the projectors 22 and 22' by linkage 42. In this fashion, the two players see not only the images that are reflected from and transmitted through the beam splitters 20 and 20', they also see each other.

Figs. 4A and 4B illustrate how the images projected from projector 22 can be made to appear to interact with the real world objects that are placed behind the beam splitter 20 relative to user 100 and behind behind beam splitter 20' relative to user 200 (as shown in Fig. 3). Figs. 4A and 4B are bottom plan views looking upward, directly into the projector 22. From this view, the beam splitter is invisible. All that is seen is the direct image projected from the projector, which is again shown as fish 30, 32, and 34. Object 51 represents a real world object, such as the enclosure 38, or any other real world object, that is placed behind the beam splitter 20 or 21' relative to user 100 and/or 200, respectively. The decorative or functional nature of the object is not relevant. Typically, the object would be a decorative element consistent with the theme of the video game being played.

Because the real world object 51 is behind the beam splitter 20 (relative to the player), the images reflected off the beam splitter will always appear to the player to be in front of (*i.e.*, closer to the player) than the real world object. This is because the real world object is behind the beam splitter relative to the player, thus always placing
5 the image reflected off the beam splitter physically closer to the player. However, the images reflected from the beam splitter can be made to appear to behind real world object 51 by projecting a opaque mask 51' from the projector 22. The shape of the mask 51' corresponds to that of the real world object 51, and is projected from the screen in registration with real world object 51. If the real world object 51 is in
10 motion, the mask 51' moves across the projector 22 in registration with the real world object 51. Because the mask 51' is in registration with the real world object 51, it's reflection from the beam splitter 20 it is not seen by the players. Additionally, the color of the mask 51' may correspond to the background color or pattern being projected from projector 22. The color or pattern of the mask 51' may be fixed or
15 animated or otherwise dynamic. Thus, the mask 51' is not perceptible to the players. The other projected images, which are viewable by the players, such as fish 30, 32, and 34, can be programmed either to "go behind" the mask 51' (that is, to be hidden by the mask), or to "go in front of" the mask 51' (that is, so that the image hides the mask). In most animation and rendering programs, the relevant computer command is
20 designated "send to back" or "send backward" and "bring to front" or "bring forward."

Thus, as shown in Fig. 4A, the image 32 is "sent backward" of the mask 51'. Because the mask 51' is in registration with the corresponding real world object 51, it appears to the players 100 and 200 that the image/fish 32 swims behind the real world
25 object 51. That is, when the image 32 is "sent backward" to be behind the mask 51', the parts of the image 32 that are superimposed with the mask 51' are no longer projected, and thus appears to the players to disappear behind real world object 51. In contrast, as shown in Fig. 4B, the image 34 has been "brought forward" to be in front of mask 51'. In this situation, the image 34 appears to be in front of real world object
30 51, while image 32 appears to be behind real world image 51, from the players' perspectives. For the images 30, 32, and 34, the command "send backward" or "bring forward" of the mask 51' may be programmed dynamically (randomly or otherwise) so that the images 30, 32, and 34 will sometimes appear to be behind the real world object 51 and sometimes in front of the real world object 51.

The ability of the two players to see each other adds another layer of complexity to the game play, regardless of whether the game being played is adversarial (for example, a war game that pits player 100 against player 200) or a cooperative (for example, a strategy in which players 100 and 200 are a team). In
5 either instance, the two players are able to communicate with one another verbally and through facial and hand signals.

Numerical ranges as used herein include every number and subset of numbers contained within that range, whether specifically disclosed or not. Further, these numerical ranges are to be construed as providing support for a claim directed to any
10 number or subset of numbers in that range. For example, a disclosure of from 1 to 10 should be construed as supporting a range of from 2 to 8, from 3 to 7, from 1 to 9, from 3.6 to 4.6, from 3.5 to 9.9, and so forth.

All references to singular characteristics or limitations shall include the corresponding plural characteristic or limitation, and vice-versa, unless otherwise
15 specified or clearly implied to the contrary by the context in which the reference is made.

All combinations of method or process steps as used herein can be performed in any order, unless otherwise specified or clearly implied to the contrary by the context in which the referenced combination is made.

20 The game console disclosed herein can comprise, consist of, or consist essentially of the essential elements and limitations described herein, as well as any additional or optional ingredients, components, or limitations described herein or otherwise useful in the field of arcade game consoles.

CLAIMS

What is claimed is:

1. A game console comprising:
 - a housing having an open or transparent top and an open or transparent front;
 - a projector situated on the top of the housing;
 - a computer operationally connected to the projector and programmed to execute a video game;
 - at least one controller operationally connected to the computer and dimensioned and configured to control play of the video game;
 - a first beam splitter disposed inside the housing and positioned so that images generated by the projector are at least partially reflected from the first beam splitter and exit the front of the housing;
 - an award indicator disposed inside the housing at a position such that the beam splitter is situated between the award indicator and the front face of the housing, and wherein at least a portion of light reflecting off of or projected from the award indicator is transmitted through the first beam splitter and exits the front of the housing.
2. The game console of Claim 1, wherein the housing further comprises a back having visible images disposed thereon.
3. The game console of Claim 1, wherein the housing further comprises a back, and the back is a second projector operationally connected to the computer.
4. The game console of Claim 3, wherein the first beam splitter is a plate of beam-splitting glass having a transmittance/reflectance (T/R) ratio of from about 20/80 to about 80/20.
5. The game console of Claim 3, wherein the first beam splitter is a plate of beam-splitting glass having a transmittance/reflectance (T/R) ratio of from about 60/40 to about 50/50.

6. The game console of Claim 1, wherein the first beam splitter is a plate of beam-splitting glass having a transmittance/reflectance (T/R) ratio of from about 20/80 to about 80/20.

7. The game console of Claim 1, wherein the first beam splitter is a plate of beam-splitting glass having a transmittance/reflectance (T/R) ratio of from about 60/40 to about 50/50.

8. The game console of Claim 1, wherein the housing further comprises an open or transparent back; and further comprising
a second beam splitter disposed inside the housing and positioned so that images generated by the projector are at least partially reflected from the second beam splitter and exit the back of the housing;
an award indicator disposed inside the housing between the first beam splitter and the second beam splitter, and wherein at least a portion of light reflecting off of or projected from the award indicator is transmitted through the first beam splitter and exits the front of the housing, and at least a portion of light reflecting off of or projected from the award indicator is transmitted through the second beam splitter and exits the back of the housing

9. The game console of Claim 8, wherein the first and second beam splitters are plates of beam-splitting glass having a transmittance/reflectance (T/R) ratio of from about 20/80 to about 80/20.

10. The game console of Claim 8, wherein the first and second beam splitters are plates of beam-splitting glass having a transmittance/reflectance (T/R) ratio of from about 60/40 to about 50/50.

11. A game console comprising:
a housing having an open or transparent top, an open or transparent front, and an open or transparent back;
first and second projectors situated on the top of the housing;
a computer operationally connected to the first and second projectors and programmed to execute a video game;

at least two controllers operationally connected to the computer and dimensioned and configured to control play of the video game;

a first beam splitter disposed inside the housing and positioned so that images generated by the first projector are at least partially reflected from the first beam splitter and exit the front of the housing;

a second beam splitter disposed inside the housing and positioned so that images generated by the second projector are at least partially reflected from the second beam splitter and exit the back of the housing;

an award indicator disposed inside the housing between the first beam splitter and the second beam splitter, and wherein at least a portion of light reflecting off of or projected from the award indicator is transmitted through the first beam splitter and exits the front of the housing, and at least a portion of light reflecting off of or projected from the award indicator is transmitted through the second beam splitter and exits the back of the housing.

12. The game console of Claim 11, wherein the first and second beam splitters are plates of beam-splitting glass having a transmittance/reflectance (T/R) ratio of from about 20/80 to about 80/20.

13. The game console of Claim 11, wherein the first and second beam splitters are plates of beam-splitting glass having a transmittance/reflectance (T/R) ratio of from about 60/40 to about 50/50.

14. A game console comprising:
a housing having an open or transparent top, an open or transparent front, and a bottom;

a projector situated on the top of the housing;

a computer operationally connected to the projector and programmed to execute a video game;

at least one controller operationally connected to the computer and dimensioned and configured to control play of the video game;

a first beam splitter disposed inside the housing and positioned so that images generated by the projector are at least partially reflected from the first beam splitter and exit the front of the housing;

a real world object disposed inside the housing at a position such that the beam splitter is situated between the real world object and the front face of the housing, and wherein at least a portion of light reflecting off of or projected from the real world object is transmitted through the first beam splitter and exits the front of the housing;

wherein the projector is dimensioned and configured to project a mask whose image as reflected off the beam splitter is in registration with the real world object when viewed from the front of the housing, and wherein other images projected by the projector are configured to be hidden by the mask when in registration with the mask or are configured to hide the mask when in registration with the mask.

15. The game console of Claim 14, wherein the housing further comprises a back having visible images disposed thereon.

16. The game console of Claim 14, wherein the housing further comprises a back, and the back is a second projector operationally connected to the computer.

17. The game console of Claim 14, wherein the first beam splitter is a plate of beam-splitting glass having a transmittance/reflectance (T/R) ratio of from about 20/80 to about 80/20.

18. A game console comprising:

a housing having an open or transparent top, an open or transparent front, and an open or transparent back;

first and second projectors situated on the top of the housing;

a computer operationally connected to the first and second projectors and programmed to execute a video game;

at least two controllers operationally connected to the computer and dimensioned and configured to control play of the video game;

a first beam splitter disposed inside the housing and positioned so that images generated by the first projector are at least partially reflected from the first beam splitter and exit the front of the housing;

a second beam splitter disposed inside the housing and positioned so that images generated by the second projector are at least partially reflected from the second beam splitter and exit the back of the housing;

a real world object disposed inside the housing between the first beam splitter and the second beam splitter, and wherein at least a portion of light reflecting off of or projected from the real world object is transmitted through the first beam splitter and exits the front of the housing, and at least a portion of light reflecting off of or projected from the real world object is transmitted through the second beam splitter and exits the back of the housing; and

wherein the projector is dimensioned and configured to project a mask whose image as reflected off the beam splitter is in registration with the real world object when viewed from the front and rear of the housing, and wherein other images projected by the projector are configured to be hidden by the mask when in registration with the mask or are configured to hide the mask when in registration with the mask.

19. The game console of Claim 18, wherein the first and second beam splitters are plates of beam-splitting glass having a transmittance/reflectance (T/R) ratio of from about 20/80 to about 80/20.

20. The game console of Claim 18, wherein the first and second beam splitters are plates of beam-splitting glass having a transmittance/reflectance (T/R) ratio of from about 60/40 to about 50/50.

21. A game console comprising:

a housing having an open or transparent top, an open or transparent front, and a bottom;

a projector situated on the top of the housing;

a computer operationally connected to the projector and programmed to execute a video containing images;

a first beam splitter disposed inside the housing and positioned so that the images generated by the projector are at least partially reflected from the first beam splitter and exit the front of the housing;

a real world object disposed inside the housing at a position such that the beam splitter is situated between the real world object and the front face of the housing, and wherein at least a portion of light reflecting off of or projected from the real world object is transmitted through the first beam splitter and exits the front of the housing;

wherein the projector is dimensioned and configured to project a mask whose image as reflected off the beam splitter is in registration with the real world object when viewed from the front of the housing, and wherein other images projected by the projector are configured to be hidden by the mask when in registration with the mask or are configured to hide the mask when in registration with the mask.

22. The game console of Claim 21, wherein the housing further comprises a back having visible images disposed thereon.

23. The game console of Claim 21, wherein the housing further comprises a back, and the back is a second projector operationally connected to the computer.

24. The game console of Claim 21, wherein the first beam splitter is a plate of beam-splitting glass having a transmittance/reflectance (T/R) ratio of from about 20/80 to about 80/20.

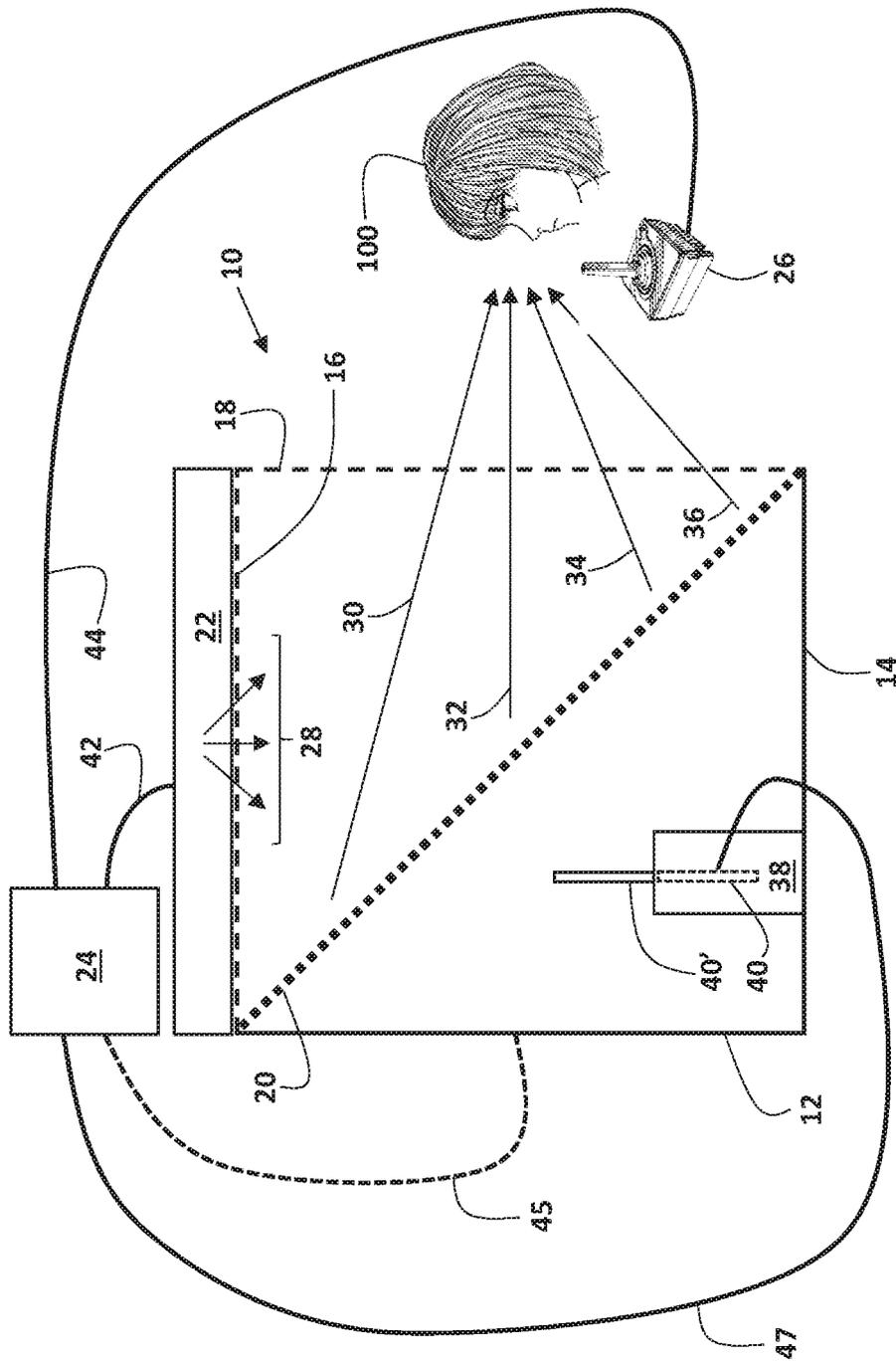


FIG. 1

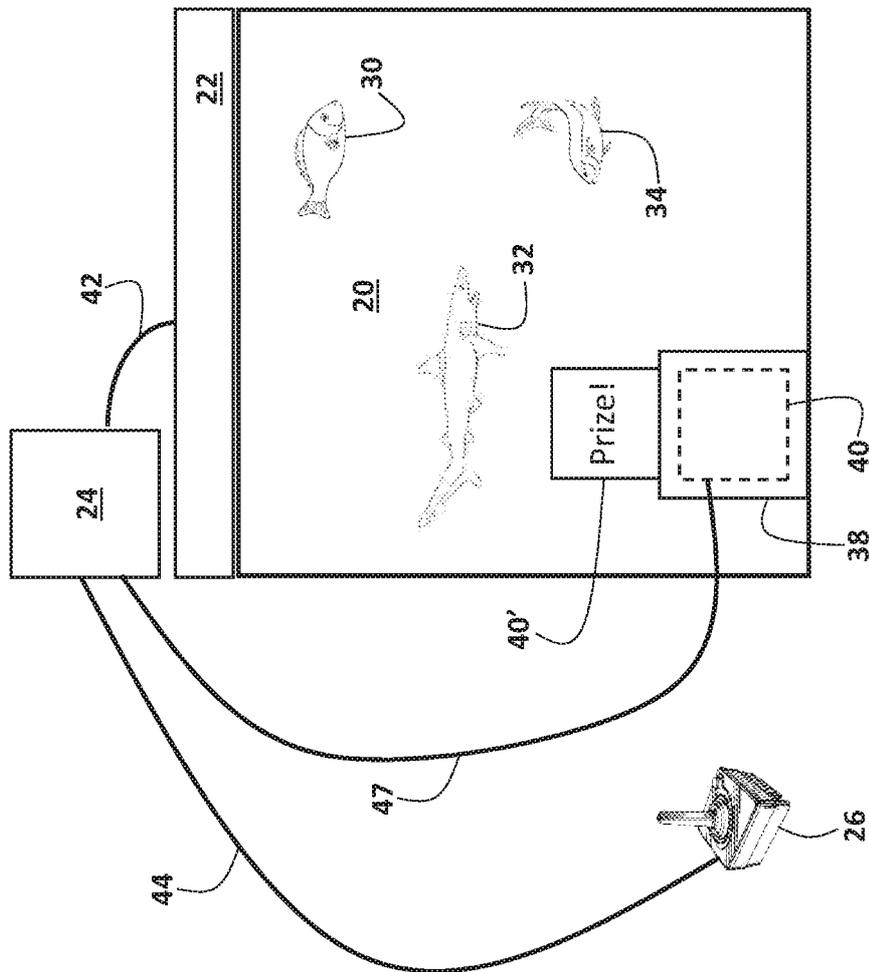


FIG. 2

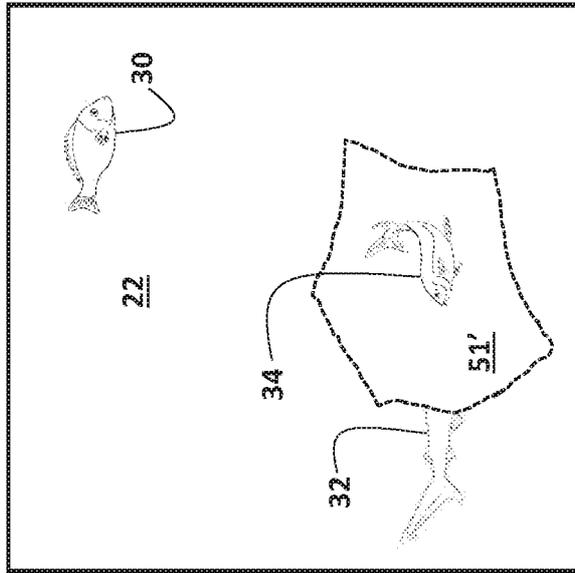


FIG. 4A

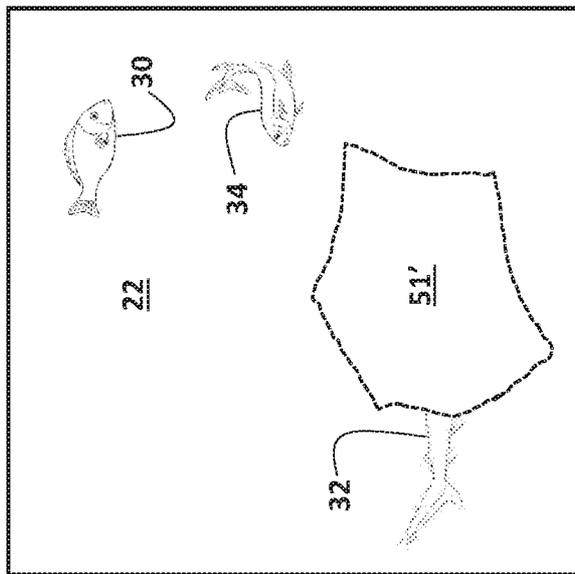


FIG. 4B

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2016/069431

A. CLASSIFICATION OF SUBJECT MATTER
INV. A63F13/25 A63F13/90
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
A63F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal , WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 1 818 087 A1 (SEGA CORP [JP]) 15 August 2007 (2007-08-15) abstract paragraph [0011] - paragraph [0014] paragraph [0015] - paragraph [0018] paragraph [0020] - paragraph [0023] -----	1-13
A	KR 2007 0063928 A (SON CHANG MIN [KR]) 20 June 2007 (2007-06-20) abstract -----	1-13
A	US 5 421 589 A (MONROE MARSHALL M [US]) 6 June 1995 (1995-06-06) abstract column 3, line 1 - column 4, line 5; figure 1a ----- -/- .	1-13

Further documents are listed in the continuation of Box C.

See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

22 March 2017

Date of mailing of the international search report

26/06/2017

Name and mailing address of the ISA/

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040,
Fax: (+31-70) 340-3016

Authorized officer

Garton , Paul

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2016/069431

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	wo 2014/198623 AI (BASF SE [DE]) 18 December 2014 (2014-12-18) abstract page 3, line 9 - page 4, line 44 -----	1-13
A	US 5 122 672 A (MANSOUR TAHIR M [US]) 16 June 1992 (1992-06-16) abstract col umn 1, line 50 - col umn 2, line 37 -----	1-13

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2016/069431

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.

3. As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos. :

4. No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos. :

1-13

Remark on Protest

- The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-13

A games console comprising a projector, beam splitter and an "award indicator" .

2. claims: 14-24

A games console comprising a one or two projectors of particular dimension and configuration, one or two beam splitters and a "real world object" .

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2016/069431

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