filters of respective colors of red, green and blue are arranged on the front surfaces of CCDs. The CCD camera **131** picks up an image on the screen **132***c* in a specified cycle of, e.g. 1/60 sec. or in such a time cycle capable of following a displacement of the game player's head at a specified resolving power, and stores the picked images in an image memory **131***a* provided therein while being administering them by addresses. The silhouette image extracting device **133** extracts a human silhouette by executing such a processing to delete a blue image from an image data stored in the image memory **131***a* and including images of the game player and the screen **132***c* behind the game player. This extraction processing can be performed by simply handling a blue area as a data nonexistent area. Further, in a mode where the screen **132***c* has a stripe pattern, a processing to delete such a basic pattern area may be performed.

[**0052**] The position determining device **135** extracts the head from the human silhouette based on the human silhouette obtained by the silhouette image extracting device **133** and the human silhouette characteristic data stored in the human silhouette characteristic data memory **134** using a pattern recognition technique or like technique, calculates the positions of the eyes at the head, e.g. a center position of the head area and determines the position assuming that the calculated position is the position of the game player's eyes. The obtained position information is sent to the game control unit **100** and then used as a viewing point information as in the first embodiment.

[**0053**] Besides the head detectors **30**, **130** of the first and second embodiments, the head detector of the present invention may be embodied as follows.

[**0054**] (1) The CCD camera of the head detector **130** in the second embodiment may be converted into an infrared camera by providing an infrared filter on the front surface of a CCD sensing surface, an infrared light source for irradiating infrared rays in such a range as to cover the screen **132***c* may be provided in proximity to the infrared camera, and a material for absorbing the infrared rays may be applied, for example, to the front surface of the screen **132***c*. With this construction, an image pickup area of the screen **132***c* has a low luminance since no reflected light is returned from the screen **132***c* and, accordingly, the infrared camera can emphasize a difference in brightness between the image pickup area and a reflecting area of the game player. Thus, the human silhouette can be easily extracted. On the other hand, a material for reflecting the infrared rays may be applied, for example, to the front surface of the screen **132***c*. With this construction, the image pickup area of the screen **132***c* has a high luminance since the infrared rays are strongly reflected by the screen **132***c* and accordingly the infrared camera can emphasize a difference in brightness between the image pickup area and a reflecting area of the game player. Thus, the human silhouette can be easily extracted.

[**0055**] Further, a screen on which areas made by the infrared ray reflecting material and those made by the infrared ray absorbing material may be alternately arranged as in a stripe pattern may be used. With such a screen as well, the human silhouette can be easily extracted as in the case of the strip pattern of the second embodiment.

[**0056**] (2) **FIG. 13** is a block diagram showing another embodiment of the head detector. A head detector **230** has an infrared camera **231** as described in (1) and a structural element mountable on the game player's face or head. A goggle or a head fitting element **236** having a specified number of, e.g. three spot infrared ray emitting elements **236***a* for emitting an infrared ray is provided on the front side of the structural element. An image memory **231***a*, an image analyzer **237**, a unique pattern characteristic data memory **238** and a position determining device **239** are provided in a processing unit of the head detector **230**. When an image of the game player is picked up by the infrared camera **231**, image data of three luminous points are stored in the image memory **231***a*, and an image pattern made up of these three points is compared with a data in the unique pattern characteristic data memory **238** by the image analyzer **238** to specify storage positions in the image memory **231***a*, i.e. addresses. The position determining device **239** calculates the position of the game player's eyes based on three pieces of address information in accordance with a preset equation and sends the calculated position to the game control unit **100**. Although the number of the infrared ray emitting members **236***a* is set at 3, the position of the game player's eyes is substantially detectable if at least one infrared ray emitting member **236***a* is provided. Particularly, if two or more infrared ray emitting members **236***a* are provided, there is an advantage of more precisely determining the position of the game player's eyes since the inclination of the head or face can be simultaneously detected.

[**0057**] A specified number of reflectors for reflecting the infrared rays may be provided on the head fitting element **236** instead of the infrared ray emitting members **236***a*, and an infrared ray emitting means having a wide irradiation range at a side of the main game unit **10** may be provided, so that the infrared camera **231** can sense the rays reflected by the reflectors. This arrangement brings about the same effects as above and has an additional effect of making the head fitting element **236** lighter since it needs not be provided with a power source, a driving means, etc. for emitting the infrared rays.

[**0058**] (3) **FIGS. 14A and 14B** show still another embodiment of the head detector, wherein **FIG. 14A** is a block diagram and **FIG. 14B** is a diagram for the explanation of the position determination.

[**0059**] A head detector **330** is provided with a distance measuring sensor **331** including a plurality of ultrasonic transmitting and receiving devices **331***a* transversely arranged at specified intervals above the play area, and a position detector **332**, a peak point detector **333** and a position determining device **334** are provided in a processing unit thereof. Each ultrasonic transmitting and receiving device **331** includes at least a piezoelectric device, an exciting device for exciting the piezoelectric device by a pulse signal to cause it to send an ultrasonic pulse, a receiving device for receiving a reflected wave, and a circuit for switching signal input/output directions. The distance measuring sensor **331** may be a reflection type optical sensor (preferably infrared sensor) provided with a light emitting element and a light detecting element. The respective ultrasonic transmitting and receiving devices **331***a* of the distance measuring sensor **331** are so constructed as to have a width of directivity toward right below, so that the head of the game player in the play area can be detected by any (preferably two or more) of the ultrasonic transmitting and receiving device(s) **331***a*. Alternatively, the ultrasonic trans-