



- [54] **HEAD-MOUNTED PERSONAL VISUAL DISPLAY APPARATUS WITH IMAGE GENERATOR AND HOLDER**
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[21] Appl. No.: **08/686,843**

[22] Filed: **Jul. 12, 1996**

Related U.S. Application Data

- [63] Continuation of application No. PCT/US95/11344, Aug. 31, 1995, which is a continuation-in-part of application No. 08/416,919, Apr. 21, 1995, Pat. No. 5,903,395
- [60] Provisional application No. 60/001,151, Jul. 14, 1995.
- [51] **Int. Cl.⁶** **G02B 27/14**; G09G 5/00
- [52] **U.S. Cl.** **359/630**; 345/8
- [58] **Field of Search** 359/630, 631, 359/633; 345/7, 8; 351/114, 115

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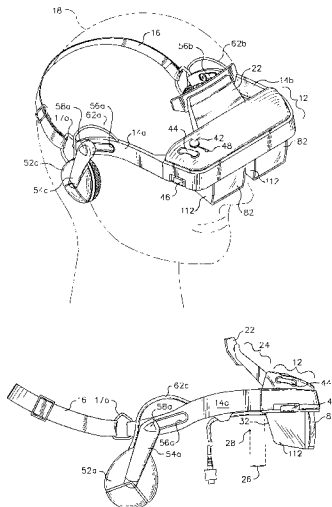
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[57] **ABSTRACT**

A visual display device is provided for delivering a generated image, preferably combinable with environment light, to the eye of a user. The device is lightweight and compact but yields a high quality image. In one embodiment, a shroud protects from stray light and holds optical elements in desired alignment. In one embodiment an image generator is masked by at least two masks to provide for a high quality image without waste. In one embodiment, a removably mounted shield or activatable device and convert the apparatus from a see-through device to an immersion device and back again. In one embodiment, the device can be comfortably mounted to the user's head while still allowing for use of conventional eyeglasses. A tracker for outputting an indication of the orientation, attitude and/or position of a head-mounted display (HMD) may be provided. The tracker can be configured so that it is incorporated in the HMD housing and/or can be easily decoupled from the HMD, so that the HMD can be used without the tracker (e.g. for watching movies). Preferably, decoupling involves unplugging a single electrical connector (such as a cable) and unfastening a mechanical connection (such as a strap). Preferably the tracker provides pass-through of signal to the HMD and, when the tracker is coupled to the HMD, only a single cable or other data link connects the HMD-tracker combination to the host computer. In one embodiment, the tracker uses magnetic sensors. In another embodiment, one or more inertial sensors, such as a rate gyro and/or accelerometers are used.

22 Claims, 32 Drawing Sheets



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