

[54] **MULTIPLE GUN ROTATABLE TELEVISION
PROJECTOR HEAD FOR 360 DEGREE
DISPLAY**

3,542,948 11/1970 Wolff..... 178/6

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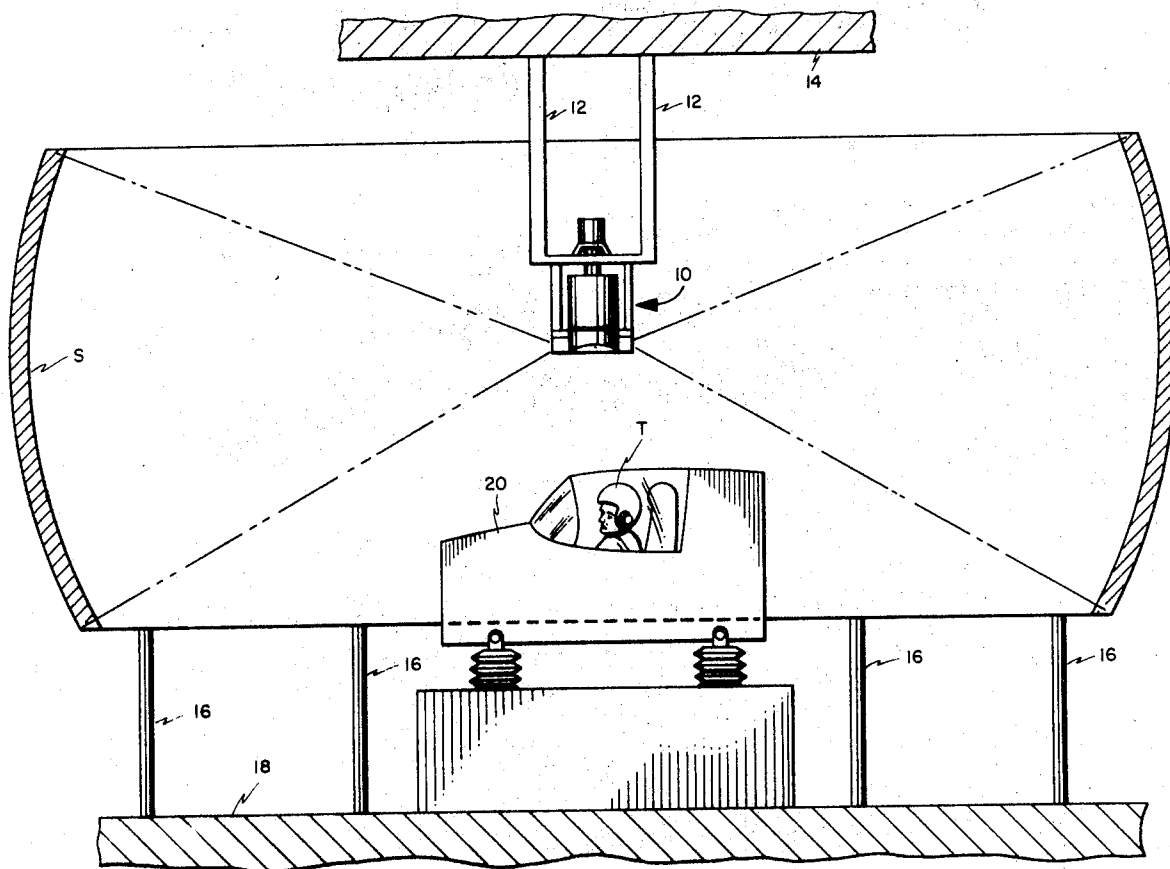
[57] **ABSTRACT**

[52] U.S. Cl..... **178/7.5 D**, 178/DIG. 35, 178/6.8,
178/7.7
[51] Int. Cl. **H04n 3/28**
[58] Field of Search..... 178/7.5 R, 7.5 D,
178/7.7, 6.8, 6, DIG. 35, 7.88

A rotating television projection tube includes multiple projection guns within a single envelope and thereby provides multiple projection beams. Each beam repeatedly produces a single stroke scan line which, when projected vertically on a 360° projection screen, and when moved horizontally by rotating the tube causes a continuous television raster to be generated through 360°.

[56] **References Cited**
UNITED STATES PATENTS
3,432,219 3/1969 Shenker et al..... 178/7.88

7 Claims, 2 Drawing Figures



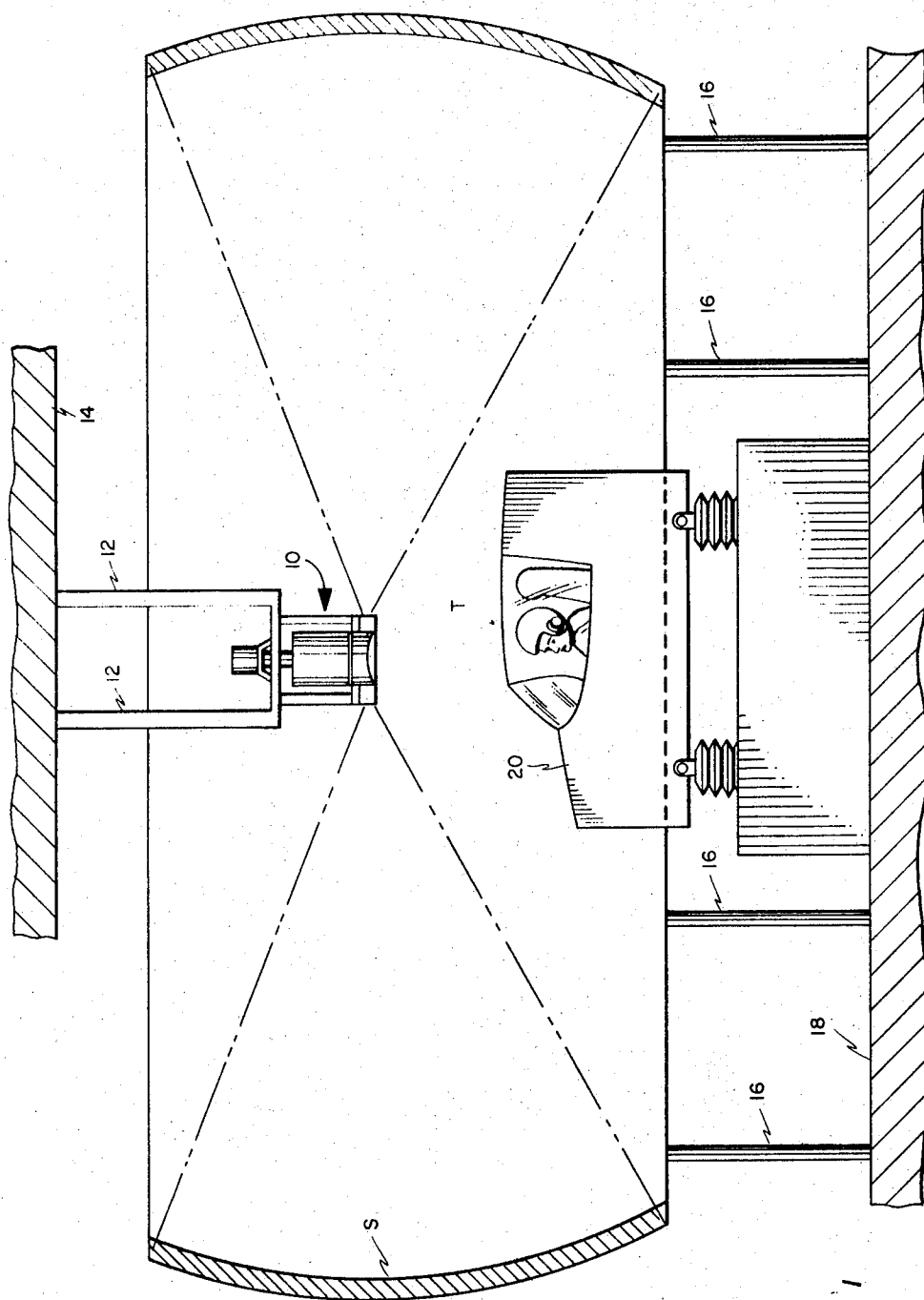


FIG. 1

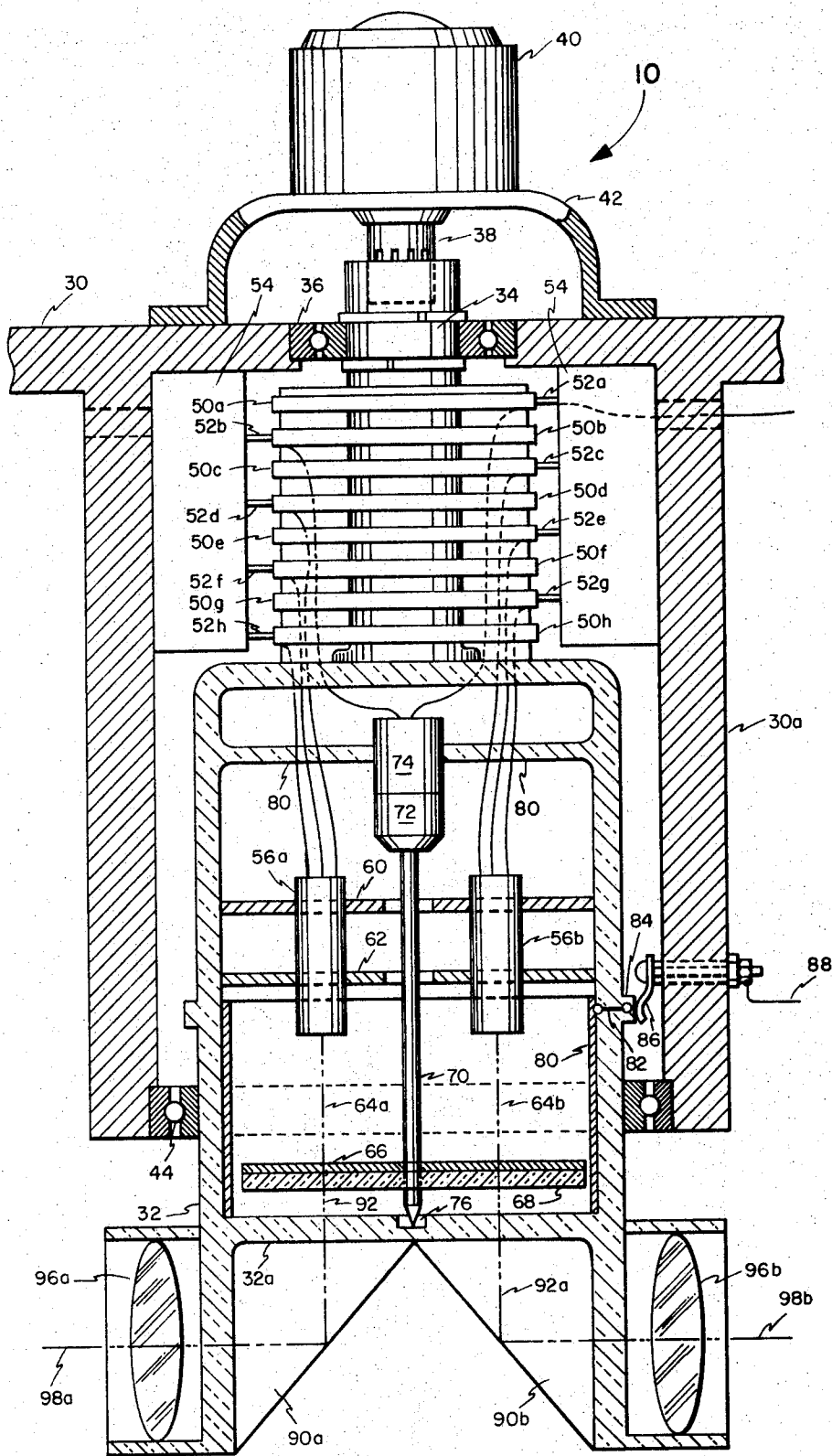


FIG. 2

MULTIPLE GUN ROTATABLE TELEVISION PROJECTOR HEAD FOR 360 DEGREE DISPLAY

BACKGROUND OF THE INVENTION

This invention relates to 360° television displays and more particularly to an improved multiple beam, rotatable projection head therefor. In the field of projection television a problem that has presented various difficulties in solution is that of providing adequate picture brightness for 360° displays. A standard means uses a plurality of fixed projectors with the edges of their rasters matched as closely as possible on the screen. Difficulties in obtaining registry between the rasters has prevented this from being a satisfactory technique. Another technique is to mount several projectors on a common shaft and by single stroke vertical line scanning and by rotating the projector assembly a satisfactory 360° continuous raster is produced. This system, exemplified by U. S. Pat. No. 3,542,948, has the problem of considerable rotating mass. Still another technique is to utilize multiple fixed projectors operating in the single stroke vertical scan mode and mediate the beams with a specially contoured optical reflector. This arrangement, disclosed in my copending U.S. Pat. application Ser. No. 245,415, filed Apr. 19, 1972, requires the fabrication of a highly complex optical element.

SUMMARY OF THE INVENTION

With the foregoing in mind, it is a principal object of this invention to provide improved projection head for use in 360° television projection of a high brightness continuous raster display.

Another object of this invention is to provide such a projection head which contains, within a common envelope, a plurality of cathode ray tube electron guns located around a common vertical axis, and aimed downwardly so that when operated their single stroke scans illuminate a phosphor coated faceplate.

Still another object is to provide, as part of the projection head, an internal rotatable faceplate on which a suitable phosphor is applied, rotation of the faceplate serving to avoid damage to the phosphor by repeated single stroke scanning.

Yet another object is to construct the common envelope of suitable materials so that said envelope may be evacuated, sealed, and mounted in a bearing assembly such that the envelope may be freely rotated by a drive motor while light produced by the illuminated phosphor passes through an optically clear faceplate portion for projection.

Another object is to provide prisms or mirrors below the said envelope faceplate such that the light beams from the illuminated phosphor are reflected outward radially from the tube assembly, with the beams from the prisms being mediated by suitable optical lens means affixed to the rotating tube assembly.

The invention may be further said to reside in certain arrangements of optical, electrical, electronic and mechanical parts whereby the foregoing objects and advantages are achieved, as well as others which will become apparent from the following description of a presently preferred embodiment when read in conjunction with the accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a view, partly in section and partly in elevation,

illustrating a 360° panoramic display television system including a rotating gun projection head embodying the invention; and

FIG. 2 is an enlarged view, partly in vertical section, of the projection head of FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENT

In the form of the invention illustrated in the drawings and described hereinafter, there is provided a rotating electron gun television projection head generally indicated at 10. The projection head 10, later described in more detail with reference to FIG. 2, is conveniently supported by brackets 12 from the ceiling 14 of a structure in which it is to be used, and is located on the central axis of a spherically curved projection screen S. The screen S is supported by legs 16 on a floor 18. The screen may be used to display T.V. images projected by the head 10 for any purpose such as to provide visual cues to a pilot trainee T in a cockpit simulator 20. The projection head 10 about to be described provides a continuous 360° raster on the screen S drawn by repetitive, vertically moving scanning beam action.

Referring now to FIG. 2, the projection head 10 comprises a stationary frame 30 having a depending cylindrical skirt portion 30a. Rotatably mounted in the skirt portion 30a is a generally cylindrical, evacuated envelope 32 conveniently formed of glass and having a transparent faceplate 32a recessed into the lower end thereof. The envelope 32 has a shaft 34 extending axially from the upper portion thereof and carried in a suitable low friction bearing means 36 in the frame 30. The shaft 34 is drivingly engaged by the shaft 38 of an electrical motor 40 which is mounted by a bracket 42 on the frame 30. The envelope 32 is further supported for rotation within the frame 30 by anti-friction bearing means 44 received in the lower edge of the frame skirt portion 30a.

The shaft 34 carries a slip ring assembly 50 including a plurality of slip rings 50a - 50h which cooperate with brushes 52a - 52h extending inwardly from insulative brush carrier means 54. The brushes and slip rings serve to provide electrical connections to various components within the rotating envelope 32.

A plurality of electron beam forming guns are supported within the envelope, two of which are shown at 56a and 56b, by insulating support members 60 and 62. The electron guns 56a and 56b, and others if more than two are used, are aligned with their principal axes parallel to and equidistant from the central axis of the cylindrical envelope 32. These electron guns, which are themselves of conventional construction incorporating electrostatic deflection means, direct their electron beams 64 to impinge on a phosphor coating or layer 66 on a rotatable transparent disc 68.

The plate 68 is supported for rotation about the central axis of the envelope 32 by a shaft 70 extending from reduction gearing 72 driven by an electric motor 74. The shaft 70 has its end remote from the motor and gearing journaled in bearing means 76 carried by the faceplate 32a, while the motor and gearing are supported within the envelope by suitable spider means 80. The purpose of the rotating disc 68 is to prevent "burning" of the phosphor coating 66 because of the repeated single line sweep characteristic of operation of the projection head.

In order to provide the necessary high voltage field for operation of the electron guns, the inner surface of the envelope has a portion coated with a conductive metallic layer 80 which is adapted to be suitably charged as an anode. Thus, the layer 80 is connected by a conductor 82 to a slip ring 84 on the surface of the envelope 32. The slip ring 84 cooperates with a brush 86 mounted in a suitably insulated manner on the frame skirt 30a and supplied with high voltage power via a conductor 88.

Mounted adjacent the underside of the faceplate 32a of the envelope 32 are a plurality of beam reflectors in the form of prisms, two of which are shown at 90a and 90b. While only two such prisms are shown, the number will correspond to the number of electron guns embodied in the projection head 10.

The prisms 90a, 90b are arranged to produce redirection of light energy 92 emanating from the phosphor coating 66 when activated by the electron beams 64. This redirection of the light energy 92 directs it through projection lens means 96a and 96b which form, from the light energy, scanning beams 98a and 98b which are focused at the screen S.

In operation of the system the electron beams 64a, 64b are caused to trace single line scans on the phosphor coating 66 such that the scanning beams 98a, 98b draw substantially vertical traces on the screen S. The motor 40 drives the envelope 32 at such a rate that a predetermined number of such vertical line traces are drawn by the beams 98a, 98b on the screen S during each revolution of the envelope, thereby creating a 360°, continuous raster on the screen. The timing of the deflections of the beams 64a, 64b is preferably such that the beams 98a, 98b draw interlaced fields. The electron beams 64a, 64b, and hence the screen scanning beams 98a, 98b are modulated by television video signals derived from television camera means operating on the same principles as the projection head 10. That is, a rotating television camera head having a plurality of individual cameras corresponding to the individual electron guns 56a, 56b may be used to provide the desired television video signals either directly in real time, or for later playback from recordings.

While only two electron guns and a corresponding number of reflection means and projection lens means are shown for clarity, a greater number of such elements, say six of each, would be advantageous in achieving a high degree of image brightness in the display generated.

Obviously many other modifications and variations of the present invention are possible in the light of the above teachings. It is therefore to be understood that within the scope of the appended claims the invention may be practiced otherwise than as specifically described.

What is claimed is:

1. A television projection head for providing 360° panoramic projection on a surrounding projection screen, said head comprising:
 - frame means;
 - an envelope mounted for rotation with respect to said

- frame means about a vertical axis;
 - drive means for rotating said envelope;
 - a plurality of electron guns disposed within said envelope in equispaced relation about said axis and with their principal axis parallel thereto;
 - phosphor coated screen means disposed in the path of electron beams from said guns;
 - a plurality of reflecting means, each disposed to reflect radially outwardly light emitted by said phosphor coated screen means when scanned by the electron beam from a respective one of said guns; and
 - a plurality of projection lens means, each associated with one of said reflecting means, for focusing said reflected light upon a screen whereby radial single line scans of said phosphor coated screen means by each of said guns will produce a raster of substantially vertical line scans on said projection screen as said head is rotated by said drive means.
2. A television projection head as defined in claim 1 and further comprising:
 - means for moving said phosphor coated screen means at a predetermined rate which will prevent damage to said phosphor coated screen means by repetitive single line sweeps by said electron beams.
 3. A television projection head as defined in claim 2, and wherein:
 - said envelope is substantially cylindrical in shape, said axis being the central axis thereof; and
 - said phosphor coated screen means comprises a transparent disc lying in a plane normal to said axis of said envelope and having an electron beam excitable phosphor coating facing said electron guns.
 4. A television projection head as defined in claim 3, and wherein:
 - said means for moving said phosphor coated screen means comprises a shaft extending coaxial with the axis of said envelope and supporting said disc; and
 - bearing means for supporting said shaft for rotation of said disc about said axis.
 5. A television projection head as defined in claim 4, and wherein:
 - said means for moving said phosphor coated screen means further comprises electric motor means supported by said envelope and coupled to said shaft.
 6. A television projection head as defined in claim 5, and further comprising:
 - slip ring means mounted on said envelope for rotation therewith;
 - brush means mounted on said frame means for cooperation with said slip rings; and
 - conductor means connecting said slip ring means to said electron guns and to said electric motor means for moving said phosphor coated screen means.
 7. A television projection head as defined in claim 6, and wherein:
 - said drive means for rotating said envelope comprises an electric motor mounted on said frame and coupled to said envelope.

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