A cathode-ray tube including a fibre optics faceplate having two slanted front end faces angled from a plane perpendicular to the axes of the optical fibres of the faceplate. The fibre optics faceplate is cut into two pieces along an intermediate plane substantially perpendicular to the axes of the optical fibres.

1 Claim, 9 Drawing Figures
CATHODE-RAY TUBE HAVING PRISM-SHAPED FIBRE OPTICS FACEPLATE

The present invention relates to cathode-ray tubes and more particularly to a cathode-ray tube having a fibre optics faceplate. The specific purpose of the invention is to provide an improved cathode-ray tube with a fibre optics faceplate having an extremely long life-time.

Generally the cathode-ray tube of the present invention includes a prism-shaped fibre optics faceplate, that is, a fibre optics faceplate having two slanted front end faces angled from a plane perpendicular to the axes of optical fibres constituting the faceplate, the prism-shaped faceplate being cut into two pieces along a plane substantially perpendicular to the axes of the optical fibres. A front side piece of the two pieces will be moved or slide relative to the other piece so as to maintain operable the overall cathode-ray tube even if a portion of the phosphor layer of the cathode-ray tube is degraded or defective. The prism-shaped fibre optics faceplate is disclosed in detail in out co-pending application Ser. No. 242,009 filed Apr. 7, 1972, now U.S. Pat. No. 3,732,367.

The specific structure of the present invention will be understood when the detailed description is read in conjunction with the accompanying drawings in which:

FIG. 1 is a side view showing a known cathode-ray tube having a prism-shaped fibre optics faceplate;

FIGS. 2A and 2B are sectional views showing on an enlarged scale the prism-shaped fibre optics faceplate of the cathode-ray tube of FIG. 1;

FIGS. 3A and 3B are sectional views showing a prism-shaped fibre optics faceplate in different forms;

FIG. 4 is a perspective view showing a front-side piece of the fibre optics faceplate shown in FIGS. 3A and 3B;

FIG. 5 is a perspective view showing a pair of support members for supporting the front-side piece shown in FIG. 4;

FIG. 6 is a perspective view showing the support members and the front-side piece and the support members assembled; and

FIG. 7 is a sectional view showing the front and portion of a cathode-ray tube according to the invention, wherein the assembly shown in FIG. 6 is secured to the cathode-ray tube.

With reference to the drawings and more particularly to FIG. 1 thereof, there is illustrated a cathode-ray tube 10 which is in detail disclosed in the co-pending application Ser. No. 242,009. The cathode-ray tube 10 generally includes an evacuated envelope 11, and a prism-shaped fibre optics faceplate 12 attached to the front end of the bulb portion of the envelope 11. The inner or electron gun side surface of the faceplate 12 is coated with a phosphor layer 13.

In FIGS. 2A and 2B, there is illustrated on an enlarged scale the prism-shaped fibre optics faceplate 12 of the cathode-ray tube 10. As shown, the fibre optics faceplate 12 has two slanted front end faces 12A and 12B angled from a plane perpendicular to the axes of the optical fibres in such a manner as to meet edgewise each other at a ridge 12C. The cathode-ray tube 10 is incorporated in an image pick-up and/or recording system such as a facsimile system to permit the cathode-ray tube 10 to serve as a scanning means for scanning a recording medium with a moving light spot or rather a flying-spot.

In the picking up operation, a recording medium 14 carrying patterned information thereon is positioned on and along the end face 12B, and the electron beam, indicated by an arrow 15, generated in the cathode-ray tube is aligned to hit a portion of the phosphor layer 13 corresponding to the end face 12A. The bombardment of the phosphor layer 13 by the electron beam 15 generates a flying-spot moving along the ridge 12C since the electron beam 15 is deflected in that direction. The flying-spot generated in the phosphor layer 13 is delivered through the fibre optics faceplate 12 to the end face 12A. After the flying-spot is refracted and accordingly focussed at the end face 12A, the flying-spot is irradiated onto the recording medium 14 and reflected by the recording medium 14, as indicated by an arrow 16 and picked up by a photo-electric converter 17 positioned in the vicinity of the faceplate 12. Since, in this instance, the electron beam 15 has a constant intensity, the reflected flying-spot has an instantaneous intensity according to the patterned information on the recording medium 14. The recording medium 14 is, on the other hand, continuously fed in synchronism with the scanning rate of the flying-spot by a suitable feeding means (not shown) so that the photo-electric converter 17 produces an electric image signal representing the patterned information on the recording medium 14. The electric image signal is then processed by a suitable electric circuit arrangement (not shown).

In the recording operation of the system employing the cathode-ray tube 10, a photo-sensitive recording medium 14 is positioned on and along the end face 12B, and the electron beam 15 is aligned to impinge another portion of the phosphor layer 13 corresponding to the end face 12B. The electron beam 15 is deflected in the same manner as in the picking up operation but, in this case, the electron beam 15 is intensity-modulated by an image signal carrying thereon one or more pieces of image information so that a flying-spot has an instantaneous intensity proportional to that of the electron beam 15. The flying-spot generated in the phosphor layer 13 is delivered through the faceplate 12 to the end face 12B and irradiated onto the recording medium 14. Since, therefore, the recording medium 14 is continuously fed in synchronism with the scanning rate of the flying-spot by a suitable means (not shown), the pieces of the information are recorded on the recording medium 14.

It is, in this instance, to be noted that the electron beam 15 should be, in the pick-up operation, so aligned that the flying-spot passes through a portion or rather an operative portion of the end face 12A as near to the ridge 12C as possible thereby to suppress the diffusion of the flying-spot during the advancement from the end face 12A to the surface of the recording medium 14 and to produce an image signal having an increased resolution power. The electron beam 15, therefore, repeatedly impinges on only a limited portion of the phosphor layer 13. It is accordingly a problem that the repeated impingement of the electron beam 15 onto the limited portion of the layer 13 causes to shorten the life-time of the particular portion of the layer 13. Further, when the limited portion of the layer
13 is merely partly degraded or defective, the overall cathode-ray tube becomes unavailable. In order to solve the above-stated drawbacks of the known cathode-ray tube with a prism-shaped fibre optics faceplate, an improved cathode-ray tube is provided according to the present invention.

In FIGS. 3A and 3B, there is shown on an enlarged scale a prism-shaped fibre optics faceplate of a cathode-ray tube according to the invention. The fibre optics faceplate, generally designated by 22, is cut into two pieces, that is first and second members 22A and 22B, along an intermediate plane substantially perpendicular to the axes of the optical fibres. The cut surfaces of the members 22A and 22B facing each other should be flat and clear thereby to provide a slideable and hermetically sealed contact between the surfaces.

As long as, in operation, a portion of the phosphorescent layer 13 corresponding to the operative portion of the end face 12A maintains its fluorescence, the first and second members 22A and 22B are flush with each other as shown in FIG. 3A, and the faceplate 22 operates in the same manner as the faceplate 12 shown in FIGS. 2A and 2B. When the portion of the phosphorescent layer 13 is degraded or defective, the first and second members 22A and 22B are slid along the cut surfaces thereof relative to each other until the member 22A and 22B take such relative positions as shown in FIG. 3B, and the electron beam 15 is aligned to impinge another portion of the phosphorescent layer 13 which is still satisfactorily fluorescent and now corresponds to the operative portion of the end face 12A, as shown in FIG. 3B. When, thereafter, the portion of the layer 13 which is hit by the electron beam 15 is again degraded or defective, the members 22A and 22B are further slid relative to each other and the alignment of the electron beam 15 is further changed so as to make the flying-spot to pass thorough the operative portion of the end face 12A.

FIG. 4 perspective illustrates the second member 22B.

FIG. 5 perspective illustrates a pair of support members 30 and 30' which are shown decoupled from each other. The support member 30 has a generally square cross-section and has an inclined guiding surface 31 at the central portion thereof. Two grooves 32 and 33 are formed at the both side end portions thereof. The support member 30' has the same configuration as that of the support member 30. The support members 30 and 30' are to be coupled through a pair of screw bores 34 and 34' by means of screws 36 and 36' so as to support the second member 22B of a cathode-ray tube according to the invention, as shown in FIG. 6. Being apparent from FIG. 6, the slanted end faces of the second member 22B are flush with the inclined guide surfaces 31 and 31' of the support members 30 and 30', respectively. The guide surfaces of the support members 30 and 30' are convenient for smoothly advancing a recording medium to be placed on the faceplate of the cathode-ray tube.

The thus assembled support members 30 and 30' sandwitching the second member 22B are mounted through the grooves 32 and 33 thereof on support rods 37 and 37' by means of suitably means such as screws 38 and 38', so that the second member 22B meets the first member 22A in such a manner as shown in FIG. 3A or 3B. The support rods 37 and 37' are, of course, fixed relative to the cathode-ray tube.

When it is intended to move or slide the second member 22B relative to the first member 22A, the screw 38 and 38' are loosened and the assembled support members 30 and 30' are displaced to position the second member 22B in a new position relative to the first member 22A.

It will be apparent from the above-detailed description that an improved cathode-ray tube with a prism-shaped fibre optics faceplate has been provided.

It will also be understood that the invention is not to be limited to the exact construction shown and described without departing from the scope of the invention, as defined by the appended claims.

What is claimed is:

1. In a cathode-ray tube having a prism-shaped fibre optics faceplate, the improvement wherein said fibre optics faceplate comprises:
   a first fiber-optics member having two end faces substantially perpendicular to the axes of the fibers, one of said faces facing the electron gun of said cathode-ray tube and being coated with a phosphorescent layer;
   a second fiber optics member having one end face substantially perpendicular to the axes of the fibers and having at the other end portion thereof two slanted end faces angled from a plane perpendicular to the axes of the fibers in such a manner as to meet edgewise each other; and means disposed between said first and second fiber optics members and holding said one end face of said second fiber optics member in contact with the other face of said first fiber-optics member and permitting sliding movement therebetween in a direction substantially perpendicular to the axis of the fibers in said members.