# PATENT SPECIFICATION

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Specification Accepted: May 28, 1940.

COMPLETE SPECIFICATION

## Improvements in View-finders for Photographic Apparatus

We, VALSTS ELEKTROTECHNISKA FABRIKA, a State Company of Latvia, incorporated under the laws of Latvia, of Brivibas gatve, 19, Riga, Latvia, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

The invention relates to a view-finder for photographic apparatus which is provided with an ocular and an objective, a frame-shaped element between the ocular and the objective, and a so-called semi-transparent mirror (i.e. one which reflects light and also permits the passage of light therethrough), hereinafter referred to as a semi-transparent mirror, behind the objective, the arrangement being such that the frame-shaped element is illuminated and an image of it indicates to the observer, the picture boundary.

According to the invention a view-finder as above, has the semi-transparent mirror arranged as a separate element immediately behind the objective and surrounded by a frame-shaped window forming part of the front window of the view-finder, for illumination of the frame-shaped element.

View-finders in which the view-field is surrounded by a light-border are already known. However, in such known view-finders, additional windows, or additional optical systems, or an entirely open construction were usually employed to let in the light necessary for producing the illuminated border. When additional windows or optical systems are used to produce the light-border, the dimensions of the view-finder are unduly large and the construction is rather complicated. when an entirely open construction is used, the view-finder cannot be mounted within the body of the photographic apparatus.

These disadvantages are avoided by the view-finder according to the invention, the dimensions of which, in the lateral direction, are especially small and which can be used in all such cases in which the view-finders of the direct vision, or ordinary type have been used hitherto.

The view-finder according to the present invention has also the advantage that the light intensity of the light-border always corresponds to the light intensity of the view. This is not the case in such known view-finders in which the light for producing the illuminated border enters in a lateral direction.

The frame-shaped element may consist of a non-transparent mirror or of a frame of total-reflecting prisms. Preferably the frame-shaped element is located so that the image of it reflected by the semi-transparent mirror is in the focal plane of the ocular. This has the advantage that the light-border and the view are very bright and clear when seen through the ocular, and at the same time the position of the view-field within the light-border is independent of the position of the eye before the ocular, that is, if the eye is moved out of the optical axis, the view-field is not displaced in relation to the light-border, and if the eye is moved in the direction of the optical axis, the size of the view-field within the light-border is not altered.

Examples of view-finders in accordance with the invention are illustrated by the accompanying drawings, in which:—

Figure 1 is a longitudinal section of one embodiment or example.

Figure 2 is a view of the inner side of the objective shown in Figure 1.

Figure 3 is a view of the front side of a semi-transparent mirror located behind the objective as shown in Figure 1.

Figure 4 is a cross-section taken on the line IV—IV in Figure 1.

Figure 5 is a cross-section taken on the line V—V in Figure 1.

Figure 6 is a longitudinal section of a second embodiment or example.

Figure 7 is a cross-section taken on the line VII—VII in Figure 6.

Figure 8 is a cross-section taken on the line VIII—VIII in Figure 6.

[Price 1/-]

Figure 9 is a longitudinal section of a third embodiment or example.

Figure 10 illustrates, on a larger scale, the reflection of the rays for producing the illuminated border in Figure 6.

Like reference numerals indicate corresponding parts throughout the several views.

In the embodiment shown in Figures 1—5, the casing 1 of the view-finder consists of a straight tube of rectangular cross-section (Figures 4 and 5). This casing carries the four optical elements of the view-finder, viz. the ocular 2, which consists of a plano-convex lens and is mounted at one end of the casing, the objective 3, which consists of a plano-concave lens and is mounted at the other end of the casing, the non-transparent frame-shaped plane mirror 4, which is located between the ocular and the objective, and the semi-transparent mirror 5, which is of plane form and is arranged in contact with the inner side of the objective. The frame-shaped mirror 4 is in such a position that its image reflected by the semi-transparent mirror 5 is in the focal plane of the ocular. The optical axis has the reference numeral 6.

The objective comprises a transparent rectangular body 3 having a front plane face and a concave surface 7 preferably parabolic, which is surrounded by a plane frame-shaped portion 8, preferably having a matt surface. Thus, the circumference of the concave surface 7 is spaced from the circumference of the objective 3. In view-finders having rectangular objectives, provisions are to be made for the purpose of obtaining such a concave surface 7 which substantially has a rectangular circumference and which does not intrude upon the surface of the frame-portion 8. For this purpose the diameter of the circle forming the line of intersection between the concave surface and the inner plane surface of the objective 3 may be substantially of the same length as the shorter side of said rctangular objective 3 (Figure 2), and the frame portion 8 forming the illuminating window may be provided with recesses 9 in the inner side of the objective, in the middle portions of the longer sides thereof. These recesses interrupt the concave surface 7 in those portions where the concave surface would otherwise protrude into the frame-portion 8. Said recesses 9 preferably are cylindrical (Figures 1 and 2).

The frame-shaped mirror 4 has its reflecting surface 10 facing the semi-transparent mirror 5. The semi-transparent mirror 5 consists of a rectangular glass plate of the same size as the body 3. The reflecting surface 11 of the semi-transparent mirror 5, for instance a semi-transparent layer of silver, is rectangular and is provided on that side of the plate 5 which faces the objective. The reflecting surface 11 does not extend over the entire area of the plate 5 but is surrounded by a transparent frame-surface 12 (Figure 3). The frame-surface 12 has substantially the same extent as the matt frame-surface 8 of the objective but is preferably a trifle smaller than the latter. That portion of the inner wall of the casing 1, which extends between the two mirrors 4 and 5 is preferably made reflecting.

The frame-portion 8 of the objective 3 and the frame-portion 12 of the semi-transparent mirror 5 which portions are in contact with each other, form together the window for illuminating the frame-shaped mirror 4. Light beams in the direction from the object thus enter the view-finder through this illuminating window, are directed on to the reflecting surface 10 of the frame-shaped mirror 4— in part after reflection by the reflecting inner wall of the casing—and are reflected by the mirror 4 on to the mirror 5; then by the reflecting surface 11 they are reflected on to the ocular 2. Thus, through the ocular an illuminated frame-shaped surface or light-border is seen round the view of the object, which light-border corresponds to the frame-shaped mirror.

In Figure 1, the passage of the rays is illustrated. The lines A—A and B—B indicate the course of two rays which start from a point at the circumference of the object. The object is supposed to be at infinity and, thus, these rays are parallel to each other. In passing through the objective and the semi-transparent mirror 5 the rays are deflected on account of refraction. Then they pass through the edge-portions of the ocular 2 in which they are refracted once more in such manner that after their passage through the ocular they are again parallel. The portions of the lines A—A and B—B which extend to the right of the reflecting surface 11 in Figure 1, also indicate the course of the rays coming from the frame-shaped mirror 4, after they are reflected by the surface 11. The rays entering through the illuminating window, are indicated by dotted lines in Figure 1. The reference character C indicates a point of reflection on the reflecting inner wall of the casing.

The objective produces a virtual image of the object which image is non-reversed in the vertical as well as in the lateral direction, and which is seen through the ocular as surrounded by a bright and well-defined light-frame or border. The light-

border is reproduced by a frame-like area of the mirror 5, of the depth shown in the drawing by the section confined by the two lines A—A and B—B. Also the outer boundary portions of the view-field extend over this area, for all the points of the object as well as of the light-border will present on this place a certain blur zone because the mirror 5 is not located in the focal plane of the ocular.

The distance between the ocular and the reflecting surface 11 and the distance between this surface and the frame-shaped mirror 4 are of such dimensions that the mirror 11 reflects an image of the frame-shaped mirror 4 in the focal plane of the ocular. Thus, the light-border produced by the mirror 4, as well as the object are seen clearly and definitely through the ocular. Moreover, the position of the light-border in relation to the view will always remain constant, independently of the position of the eye in relation to the ocular.

In the embodiment described, the frame-shaped reflecting element consists of a mirror. However, it is also possible to use a frame of total-reflecting prisms as the reflecting element. Such an embodiment is shown in Figures 6, 7, 8 and 10.

In this embodiment the body 3 forming the objective is provided with a central recess 20 of rectangular shape. This recess has a concave preferably parabolic bottom-surface 7 and is of such depth that the recess is surrounded by a rectangular wall 21. The inner end-surface of the wall 21 (to the right in Figure 6) may be a matt surface. In said recess a rectangular semi-transparent mirror 5 is mounted, which, thus, is embraced by the wall 21. The semi-transparent reflecting surface of the mirror 5 is provided on the inner side (to the right in Figure 6) and may be concave. The reflecting frame consisting of total reflecting prisms is indicated by 22. The total-reflecting sides of the prisms have the reference numerals 22a and 22b. The remaining sides or so-called " base-planes " of the prisms face the semi-transparent mirror 5 and are substantially at right angles to the central axis of the tubular casing. Between the rectangular wall 21 of the objective or front-lens 3 and the frame 22 of prisms a transparent rectangular tube 23 is arranged in contact with the inner wall of the tubular casing. Thus the tubes 1 and 23 are concentric. The left end-surface of the tube 23 (Figure 6) may be a matt surface. The base-planes of the prisms extend nearer the centre of the tube 23 than the wall of said tube. The inner edge of the frame 22 is connected to the inner wall of the tube 23 by means of a portion 24 presenting a refracting slanting surface 22c. The prisms 22, the tube 23 and the portion 24 may be made in one piece. A non-transparent frame 25 having a central opening is arranged to the right of the frame 22 (Figure 6) and serves as a stop or holding member for the frame 22.

The wall 21 and the portions of the objective 3 lying in front of this wall, form the window through which light beams pass, for producing an illuminated frame or border round the view. Two light rays passing through the window and the tube 23 are indicated by dotted lines. One of these rays has a straight course in the tube 23 until it reaches the outer reflecting side 22a of the prisms. The other ray is total-reflected in two points on the walls of the tube 23. Thus, the tube 23 serves as a light-conducting element. The reflection of the two rays is seen more clearly in Figure 10. The two rays are total-reflected by the side 22a of the prism and are directed to a common point on the inner reflecting side 22b of the prism. Also at this point a total-reflection occurs. In the surface 22c the two rays are refracted and pass to the semi-transparent reflecting surface of the mirror 5. They are reflected by the mirror 5 and combined with the rays A—A and B—B coming from the object, and then they are refracted in the ocular, as already described in connection with the embodiment shown in Figures 1—5. The non-transparent frame 25 prevents the rays which may be refracted in the surfaces 22a and 22b, from passing into the ocular 2.

The light-conducting tube 23 presents the advantage that, on account of the total reflection in the tube 23, a greater amount of the light entering through the window is used for the production of the light-border, which, thus, will be of greater intensity. Moreover, the illuminating window itself is not seen through the ocular and, thus, will not disturb the view, because the tube 23 covers the window. Consequently, the tube 23 advantageously may be used also in combination with frame-shaped reflecting elements of other types than prism frames, for instance mirrors.

The arrangement of the mirror 5 in a recess in the objective 3 may be used not only in combination with a reflecting element of prisms, but also in combination with a reflecting mirror 4, as illustrated in Figure 9.

As shown also in this embodiment the reflecting surface of the mirror 5 may be plane and may be arranged on the outer side (i.e. on the left hand side in Figure 9).

No claim is made, in general, in this specification to a view finder having a partly or semi-transparent mirror for forming in the plane of the object to be photographed, or in a conjugate plane, an image of marks indicating the picture boundaries, said marks being formed wholly or partly by mirror surfaces which may be inclined, so that the rays reflected by them and passing through the viewing aperture, pass to said mirror surfaces through that frame-portion of the front member of the finder, which is not covered by the partly transparent mirror.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. A view-finder for photographic apparatus having an ocular or eye-piece and an objective, a frame-shaped element between the ocular and the objective and a so-called semi-transparent mirror behind the objective so that the frame-shaped element is illuminated to indicate to the observer the picture boundary, wherein the semi-transparent mirror is arranged as a separate element immediately behind the objective and is surrounded by a frame-shaped window forming part of the front window of the view-finder for illumination of the aforesaid frame-shaped element.

2. A view-finder according to claim 1, wherein the objective comprises a transparent body having a plane front surface and a rear parabolic surface, the circumference of which is spaced from the circumference of said body, and wherein the semi-transparent mirror comprises a plane transparent plate which is arranged behind and in contact with the objective and has a reflecting surface substantially of the same extent as the concave surface of the objective.

3. A view-finder according to claims 1 and 2, and in which the objective and the two mirrors are of rectangular shape, wherein the diameter of the circle forming the line of intersection between the concave surface and the rear plane of the objective is substantially of the same length as the shorter side of the rectangular objective, and the frame-shaped rear surface of the objective which corresponds to the illuminating window, has recesses in the middle of the longer sides intersecting the concave surface.

4. A view-finder according to claim 2 or 3, wherein the bounding frame-shaped surface at the rear of the objective, which surface corresponds to the illuminating window, is matted.

5. A view-finder according to any of the preceding claims, wherein the optical elements are arranged in a tubular casing, the ocular being at one end of the casing and the objective at the other end of the casing.

6. A view-finder according to claim 5, wherein that portion of the inner wall of the casing which extends between the semi-transparent mirror and the frame-shaped element, is reflecting.

7. A view-finder according to claim 1, wherein the frame-shaped element comprises a frame of total reflecting prisms, the base planes of which face the semi-transparent mirror.

8. A view-finder according to claim 1 or 7, wherein a transparent tube is arranged between the frame-shaped window and the frame-shaped element, which tube serves as a light-conducting element.

9. A view-finder according to claims 7 and 8, wherein the base planes of the prisms extend nearer the centre than the cross-section of the transparent tube, and the inner edge of the prism-frame is connected with the inner wall of the transparent tube by a refracting surface.

10. A view-finder according to claims 7 to 9, wherein the transparent tube and the prism-frame are made in one piece.

11. A view-finder according to any of the preceding claims 1 to 10, wherein the objective consists of a transparent body presenting a plane front-surface and having a central rear recess which has a rectangular outline and a concave parabolic bottom surface and is of such depth that it is bordered by a rectangular surround which encloses a transparent plate having a semi-transparent reflecting surface.

12. A view-finder according to claim 11, wherein the contact surface between the transparent tube and the rectangular wall is matted.

13. A view-finder according to any of the preceding claims 7 to 12, wherein a non-transparent frame is arranged behind the prism-frame.

14. A view-finder according to claim 11, wherein the semi-transparent reflecting surface of the transparent plate is provided on the front thereof and is plane.

15. A view-finder constructed substantially as hereinbefore described and illustrated by Figures 1 to 5, Figures 6 to 8 and 10 or Figure 9 of the accompanying drawings.

Dated this 5th day of January, 1939.

MATHYS & SQUIRE,
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52, Chancery Lane, London, W.C.2.

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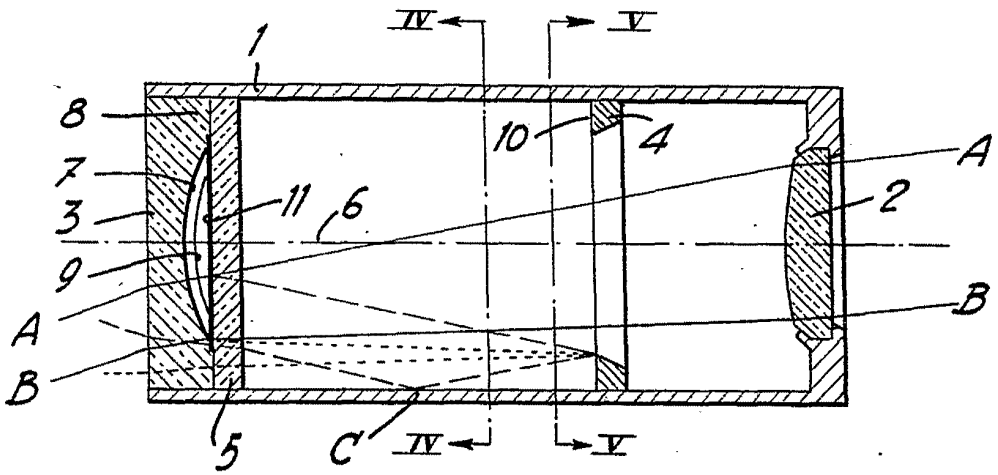
FIG. 1.




A —
B —

FIG. 2.

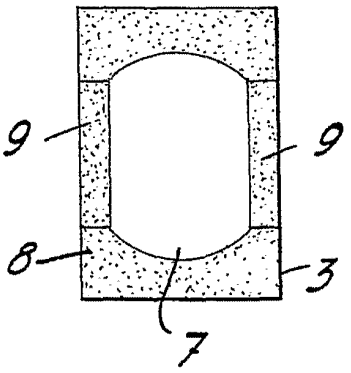
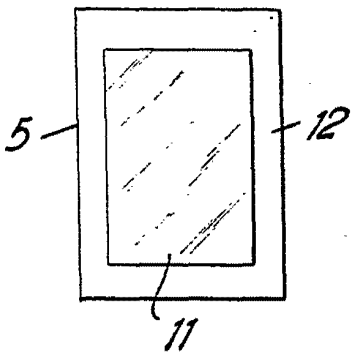



FIG. 3.




A —
B —

FIG. 4.

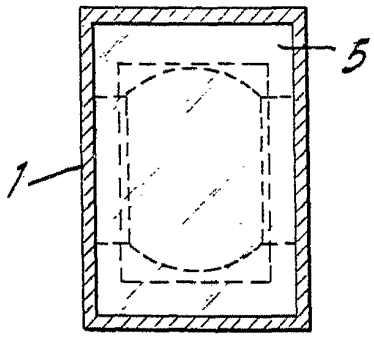
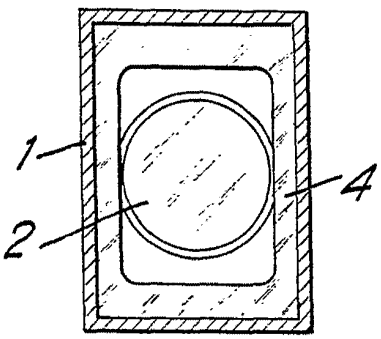



FIG. 5.



A

B

Fig. 9.

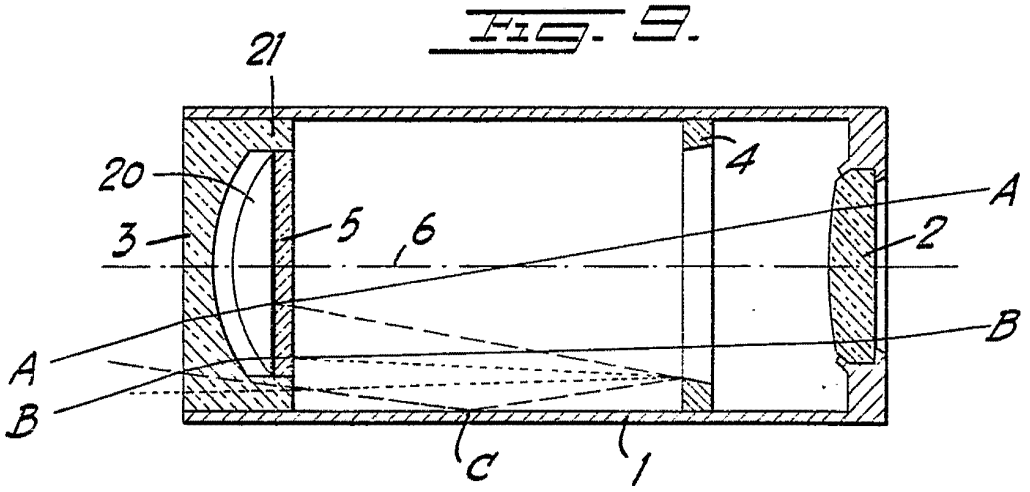



Fig. 6.

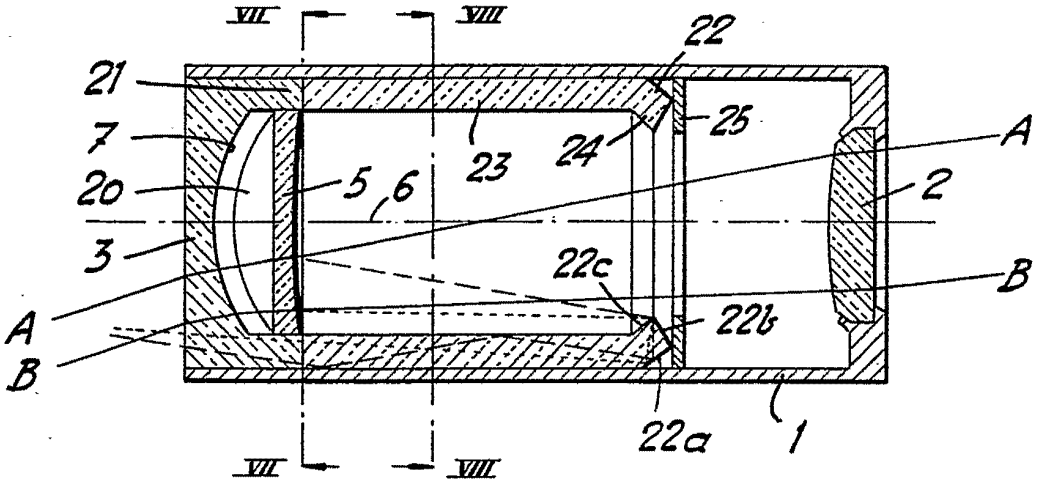



Fig. 7.

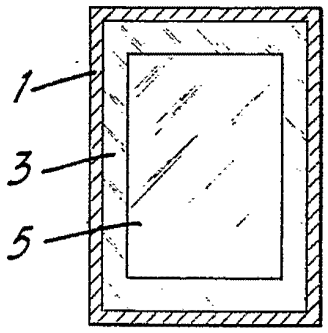



Fig. 8.

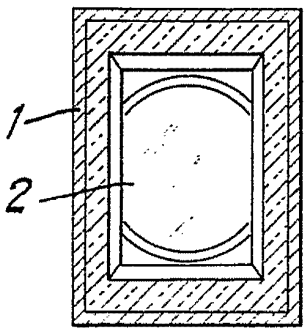



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Fig. 1.

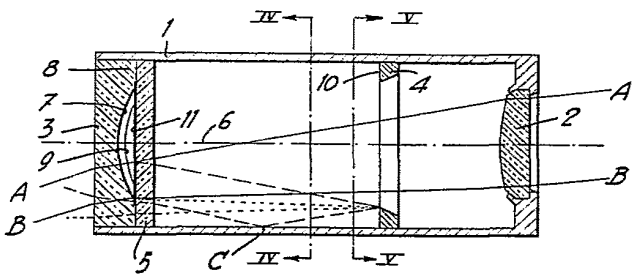


Fig. 2.

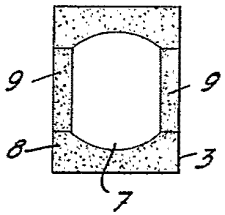


Fig. 3.

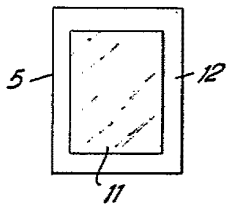


Fig. 4.

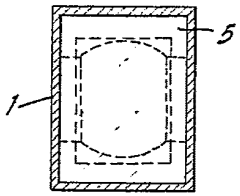


Fig. 5.

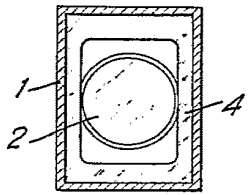


Fig. 9.

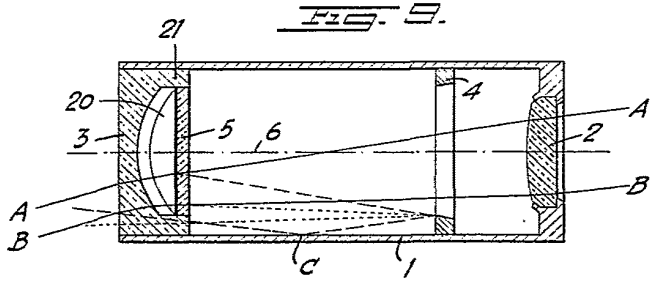


Fig. 6.

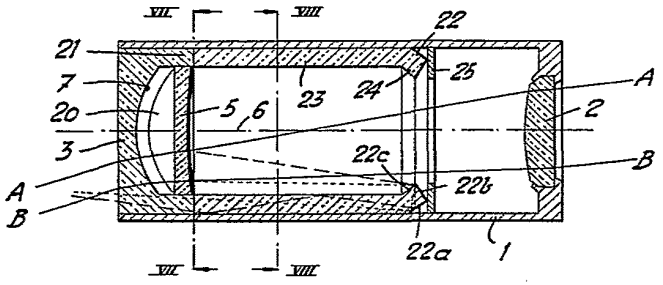


Fig. 7.

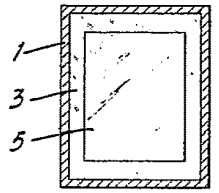


Fig. 8.

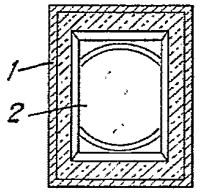


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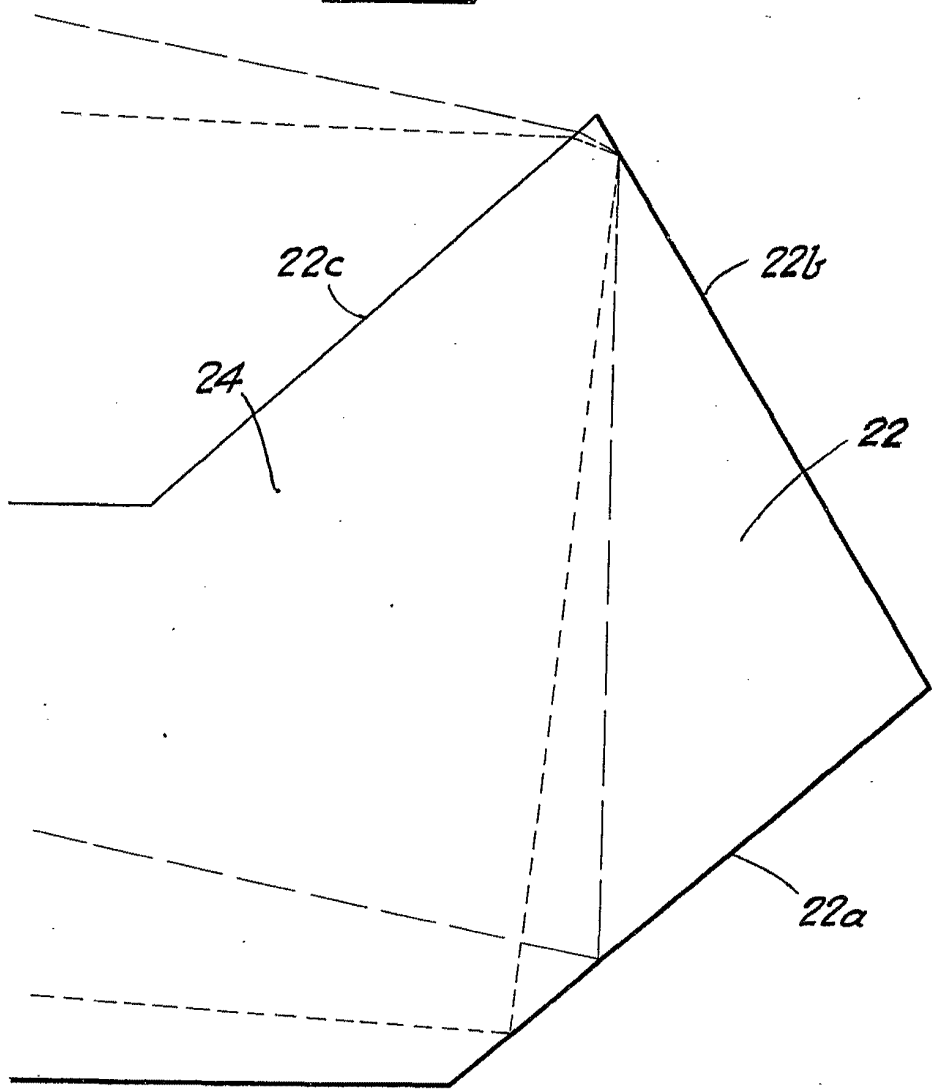
Fig. 10.

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