A curtain for camera shutters consisting of a thin plastic foil having arranged on at least one side thereof grooves which extend at right angles to the direction of movement of the curtain so as to provide for a high degree of bending resistance perpendicular to the direction of movement of the curtain and a relatively low bending resistance in the plane of movement thereof.
CURTAIN FOR CAMERA SHUTTERS

The present invention relates to cameras provided with focal-plane shutters of certain type in which the curtain consists of a thin plastic foil.

In addition to being light proof, a good curtain must be durable and resistant to wear and the properties thereof should not change to any appreciable extent within the range of temperature experienced when using the camera. The weight of the curtain shall be small, to facilitate acceleration of the curtain from zero to the shutter speed used. In view of the rapid acceleration to which the curtain is subjected, it should not be too resistant to bending when passing over direction changing rollers or the like, neither should it be subjected to uncontrolled folds. Finally, the curtain should move as silently as possible and be simple to manufacture.

Curtains of hitherto known construction only partly fulfill these requirements and are consequently in many instances encumbered with troublesome disadvantages. The properties of curtains made of rubberized silk are changed to a too great extent when the curtain is exposed to the variations in temperature normally experienced and in addition such curtains are not durable enough. Metal curtains, constructed either of jalousies, composed of folded slats, or of corrugated metal strips, are durable and are not affected by variations in temperature. The slats or corrugations counteract the tendency of the curtain to fold or wrinkle, because the curtain obtains a high bending resistance perpendicular to its direction of travel while the bending resistance of the curtain in said direction of travel is relatively low, thereby facilitating passage of the curtain over direction changing rollers and spools. The durability of the curtain is limited, however, by its tendency to fracture as a result of fatigue. Furthermore, metal curtains have a disturbing high sound level and are expensive to manufacture.

Common to the types of curtain known hitherto is that it has not previously been possible to make them sufficiently thin or of sufficiently small mass without at the same time deleteriously impairing remaining desirable and necessary properties. The main reason for the disadvantages presented by known curtains is that hitherto a material has not been available which possesses to a sufficient extent the suitable and desirable properties aforementioned.

The disadvantages inherent in curtains of known construction are practically eliminated in the curtain of the present invention, partly because a new and improved material has been used and partly because the curtain has been given a novel construction. Tests have shown that a dyed, preferably black, plastic of the polyester type or equivalent is a suitable material for focal-plane shutters of curtain type. The material is durable and is only affected to a negligible degree by variations in temperature. Furthermore, the material is strong, flexible, relatively light and has a suitable degree of elasticity.

These properties permit very thin curtains to be made, as thin as 2/100 of a millimeter in the case of normally occurring picture sizes, without jeopardizing the strength, durability and light-proofness of the curtain. On the other hand, however, it is difficult to prevent the occurrence of uncontrolled folds in the curtain if such thin, flat plastic foils are used. In the case of thin metal curtains it is possible to avoid the tendency of uncontrolled folds by corrugating the curtain at right angles to its direction of travel, as described in Swedish Pat. Specification No. 132,202. This process cannot be applied to a thin plastic curtain, however, owing to the differences in the properties of metal and plastic material. For the purpose of rendering the curtain sufficiently resistant to bending perpendicular to its direction of travel, and thereby avoiding the folding tendency of the curtain while substantially retaining its flexibility over the direction changing rollers, the curtain of the present invention is made considerably thicker than what is necessary for reasons of mechanical strength and is provided with grooves which extend substantially perpendicular to its direction of travel. The thickness of the curtain, the depth, width and distribution factor of the grooves are adapted to the pertinent picture size, in order that the curtain obtains optimal properties. The junction between the full thickness of the curtain and the thinner bottom portion of the groove is suitably made smooth, e.g. by chamfering of filleting the material at the junction portion, thereby avoiding concentration of stresses at the discontinuities in section. The groove may either be provided with a flat bottom portion extending parallel with the plane of the curtain or may be given a suitable curvature which causes them to merge gently into the non-reduced portions of the curtain. The grooves can be formed by milling or embossing a plastic foil of uniform thickness or by ejection moulding a curtain blank.

An embodiment of the invention is illustrated in the accompanying drawing, in which FIG. 1 is a plan view of an extended curtain; FIG. 2 is an enlarged side view of the curtain illustrated in FIG. 1; and FIGS. 3 to 7 are enlarged side views of alternate embodiments of the curtain shown in FIG. 1.

The extended curtain illustrated in FIG. 1 consists of a plastic foil, such as polyester foil or the like, and is provided with uniformly spaced grooves 2 (FIG. 2) which extend substantially perpendicular to the path of travel of the curtain, as shown by the double-headed arrow in FIG. 2. The desired resistance to bending at right angles to the path of travel of the curtain is obtained through the non-reduced portions 3, while the reduced portions 4 provide for the desired reduction in resistance to bending in the direction of travel of the curtain, to facilitate passage of the curtain over the direction changing rollers (not shown). The junction 5 between the reduced and non-reduced portions of the curtain is in the form of a chamfer, to prevent stress concentrations at the discontinuities.

Although the curtain may be made in one piece of a single material it may also be reinforced to increase its mechanical strength, wherewith the fibers in the reinforcing material are preferably oriented at right angles to the path of travel of the curtain.

The invention is not restricted to the above described and illustrated embodiment but can be modified without trespassing from the concept of the invention. For example, the cross-sectional shape of the grooves may be different to that illustrated and described, note FIGS. 6 and 7, and the curtain may be provided with...
grooves on both sides thereof, wherewith the grooves on respective sides can either lie opposite one another as shown in FIG. 3 or be offset in relation to each other as shown in FIG. 4. Off-setting or uneven spacing of the grooves in relation to each other as displayed in page 5, line 19, FIG. 5, prevents grooves and unreduced portions of the curtain, when rolling the curtain onto the curtain spool, from being unsuitably positioned in relation to each other at adjacent spool turns, something which can cause uneven operation of the curtain. Grooves which have varying width along their length are also envisaged, whereby, for example, a greater amount of unreduced material is obtained along the center long axis of the curtain and a smaller amount towards the edges thereof.

What we claim is:

1. A curtain for camera shutters arranged to pass in a direction of movement over direction changing rollers, characterized in that said curtain consists of a strip of light-proof plastic foil, said plastic foil is provided on at least one side thereof with spaced parallel grooves extending substantially perpendicularly to the direction of movement of said curtain so that each of said grooves affords locations of reduced material thickness whereby said curtain has a high degree of bending resistance at right angles to the direction of movement of the curtain and a small degree of bending resistance in the direction of movement of said curtain.

2. A curtain according to claim 1 having grooves arranged on both sides thereof, characterized in that each groove on one side of the curtain is positioned opposite a groove on the other side thereof.

3. A curtain according to claim 1, characterized in that the grooves are arranged on both sides of said curtain and the grooves on one side of said curtain are offset in the direction of movement of said curtain in relation to the grooves on the other side of said curtain.

4. A curtain according to claim 1, characterized in that the grooves are unevenly spaced.

5. A curtain according to claim 1, characterized in that the bases of said grooves are of uniform thickness with the unreduced defining surfaces of said curtain extending parallel to the bottom plane defining the base of said grooves, and the base of said grooves is connected to adjacent unreduced portions by a chamfer for preventing stress concentration at the discontinuities.

6. A curtain according to claim 1, characterized in that the grooves have a symmetrical curvilinear profile which provides for varying thickness of the reduced portion of the curtain in the direction of movement thereof.

7. A curtain according to claim 1, characterized in that the plastic material from which the curtain is made is a suitably black, dyed polyester or another polymer or copolymer or other material having substantially equivalent physical properties.

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