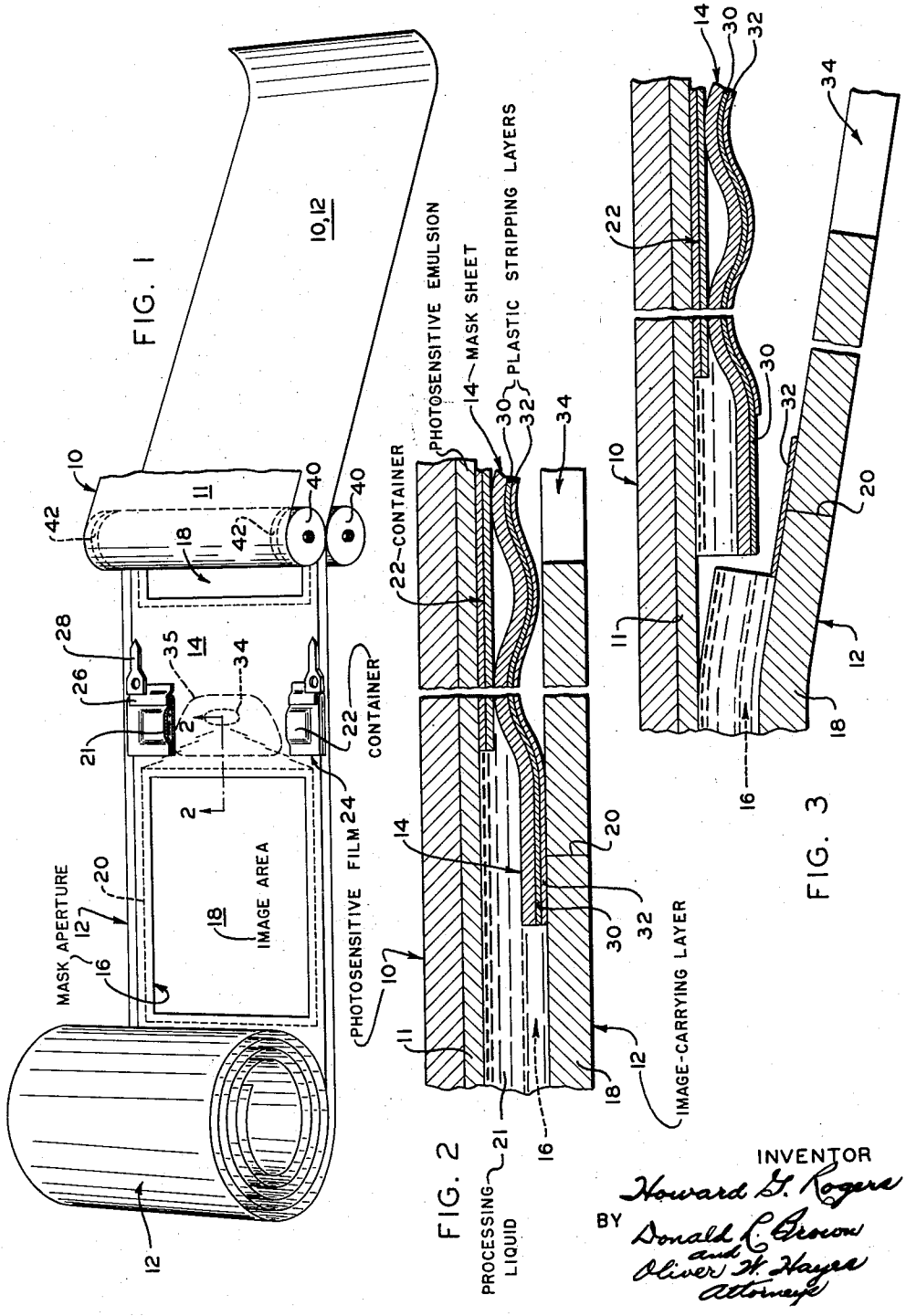
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MASKED PHOTOGRAPHIC PRODUCT FOR RECEIVING A TRANSFER IMAGE

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MASKED PHOTOGRAPHIC PRODUCT FOR RECEIVING A TRANSFER IMAGE

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This invention relates to photography and more particularly to improvements in photographic products of the type adapted for the production of a positive image under the selective control of the development of a negative image in a photosensitive silver halide layer which may be a part of the product. In general, the product of this invention is particularly adapted for, although not limited to, use in a camera of the type shown in U. S. Patent No. 2,455,111 of November 10, 1948, to Carbone and Fairbank, a preferred type of such a camera having a back door through which the positive image is removed.

A principal object of the present invention is to provide means for framing the positive image which is an improvement over the means shown in the copending application of Howard G. Rogers and William J. McCune, Jr., Serial No. 6,058, filed February 3, 1948 (now Patent No. 2,659,673, issued November 17, 1953).

Another object of the invention is to provide such framing means in the form of a mask secured to the surface of an image-carrying layer which can be rolled into a small roll without danger of separating from the surface of the image-carrying layer during formation of the roll or during the unrolling thereof when the positive image is to be formed.

Still another object of the invention is to provide such a framing mask which will not become inadvertently detached from the image-carrying layer during storage of the resultant product under widely varying conditions of temperature and humidity.

Still another object of the invention is to provide such a mask which may be predeterminedly secured to the image-carrying layer by means of two layers of organic-solvent-soluble plastics which define a line of cleavage therebetween.

These and other objects of the invention will in part be obvious and will in part appear hereinafter.

The invention accordingly comprises the product possessing the features, properties and the relation of components, which are exemplified in the following detailed disclosure, and the scope of the application of which will be indicated in the claims.

For a fuller understanding of the nature and objects of the invention, reference should be had to the following detailed description taken in connection with the accompanying drawing wherein:

Figure 1 is a diagrammatic view of one preferred form of the invention during the use thereof, with parts cut away for clarity of illustration;

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Fig. 2 is a diagrammatic, exaggerated, greatly enlarged, fragmentary, sectional view of the product of Fig. 1, taken along the line 2—2 of Fig. 1, but with the elements superposed in processing relationship to the photosensitive layer; and

Fig. 3 is a fragmentary, sectional view similar to Fig. 2 showing the relationship of the elements when the image area is being separated from the image-carrying layer.

In general, the present invention relates to improved framing means for a positive image-carrying layer adapted to be brought into superposed relation with an exposed silver halide photosensitive layer and processed by spreading between the superposed layers a viscous liquid capable of developing a latent negative image in the photosensitive layer and forming a positive image thereof on the surface of the image-carrying layer. In the above-mentioned copending application, the preferred framing means comprises a thin paper mask or frame which has a cut-out portion defining an image area on the surface of the image-carrying layer. This frame is temporarily bonded to the surface of the image-carrying layer, preferably by the use of two layers of plastic between the thin paper mask and the image-carrying layer, these plastic layers being such that they have a greater affinity for their adjacent sheets than they have for each other. When the image area portion of the image-carrying layer is separated from the remainder thereof, the two plastic layers define a ready line of cleavage therebetween. When a mask of the above type becomes inadvertently separated from the borders of the picture area it permits separation of the photosensitive and image-carrying layers at these places and spoils the image along these borders.

If a composite structure, comprising a mask sheet superposed on an image-carrying layer, is formed into a roll by rolling said structure upon itself so that the mask is innermost, the mask is compressed or shortened to a length which is less than its length in a flat condition. When the unit is unrolled, the mask sheet will lengthen out to its unrolled length. This compression or shortening upon rolling a mask sheet which is bonded to an image-carrying layer creates a shearing force tending to disrupt the adhesive bond between the mask sheet and the image-carrying layer. A similar condition occurs when the mask is unrolled. Likewise, buckling ripples which may occur during rolling tend to separate the mask

from the image-carrying layer. The conditions just described present difficulties in maintaining a strippable bond between the masking sheet and the image-carrying layer.

The present invention is particularly concerned with overcoming these just mentioned difficulties. In a preferred form of the invention the mask, after coating with a layer of plastic (preferably a double layer of the type mentioned above), is shortened by an amount which is preferably greater than the maximum elongation to which the mask would be subjected during normal storage or use. The shortening process is preferably accomplished by relatively permanently deforming the mask from its normal plane at a number of closely spaced points. In order to retain the flexibility of the mask, this deformation is preferably accomplished by crimping the mask, this crimping preferably comprising a wave-shaped crimp, the axis of the waves being parallel to the axis of the roll into which the mask is to be formed. This crimping thus gives considerable flexibility to the mask with respect to any bending or buckling force applied around an axis parallel to the roll axis.

The crimped mask is then heat-sealed to the treated surface of the image-carrying layer, this heat-sealing being preferably accomplished under pressure which is applied to a relatively large area of the mask to prevent any substantial elongation of the mask during the heat-sealing. This pressure is preferably quite high so that it mashes the crimped mask down sufficiently so that the mask surface is substantially smooth, there being only slight creases showing in this surface. This heat-sealing under the high pressure also appears to compress the fibers of the mask so that it does not substantially lose its ability to stretch. The troughs or low points of the crimp waves are in contact with the image-carrying layer when the mask is seated thereon prior to applying laminating pressure thereto. Crimp waves of the mask are partially flattened out by the laminating pressure whereby much of the material initially out of contact with the image-carrying layer is pressed into contact therewith. Bonding of the mask sheet to the image-carrying layer is effected at substantially all portions thereof brought into contact with the image-carrying layer and subjected to said laminating pressure.

When such a mask is formed into a roll whose inner diameter is, for example, approximately ¾ of an inch and is then unrolled, the percentage compression during rolling, and the percentage elongation during unrolling, of the mask will be a function of the thickness of the various layers thereof. When the image-carrying layer is .006 inch thick, the mask is .0018 inch thick and the plastic is about .0006 inch thick, the innermost mask of the roll will be subjected to a compression of about .8% in length when the composite sheet is rolled into a ¾ inch roll. When such a roll is stored for a long period of time, particularly under low humidity conditions, the compressed mask assumes the shortened length it has in the roll. When the composite sheet is again unrolled to a flat condition the mask is subjected to an elongation of approximately .8%. When the mask is shortened, by the crimping operation, by approximately 2%, and most of this shortening is left after heat-sealing, there is adequate compressibility and stretch in the mask to permit the mask to be compressed and stretched this .8% during the rolling and unrolling thereof, even though the mask is sealed to the image-carrying layer. Consequently, when the composite sheet is unrolled, there is no tendency for the image-carrying layer to shear the heat-seal bond between the mask and the image-carrying layer, as would be the case if the mask did not stretch. This stretchability of the mask also has the very important advantage of making feasible the use of a bond between the two plastic layers that is weaker than would be possible if the mask were not able to stretch. This is due to the fact that the force necessary to shear the bond between the plastic layers is much greater along the layers than normal thereto. The stretchability of the mask tends to keep this shear force along the bond rather than normal thereto. This weaker bond naturally makes the removal of the image area much simpler and avoids any possibility of tearing the edges of the image area.

Where the mask and image-carrying layer are bent sharply in the same direction as the roll, but around a radius smaller than the initial roll, any buckling which might take place in the mask, due to the shortening thereof, is not transmitted along the mask due to the flexibility of the mask with respect to a bending force applied around an axis parallel to the roll axis. Additionally, the crimping of the mask seems to permit almost any amount of shortening thereof, which might be necessary to accommodate any bending of the image-carrying layer, without causing any buckling of the mask.

Referring now to the various figures, the present invention is shown in the operative relationship the element thereof will assume when used in a processing camera of the type illustrated in the above-mentioned Carbone and Fairbank patent. In the various figures, 10 represents a sheet of photosensitive film, having a silver halide emulsion 11 coated thereon, while 12 is the image-carrying layer. The mask, shown at 14, is indicated in a preferred form as being slightly narrower than the image-carrying layer 12 and as having a number of cutaway portions 16 roughly corresponding to image area portions 18 on the image-carrying layer 12. These image area portions 18 are preferably defined by perforations 20 surrounding each of the image area portions. The mask 14 is shown as preferably covering these perforations 20 so as to prevent the processing liquid from passing through these perforations and also to give a border to the positive image formed on the image area portion 18. A predetermined small quantity of a processing liquid 21 is carried by each of a plurality of containers 22, each of the containers having a liquid-releasing mouth 24 adjacent one edge of the adjacent edge of an image area portion 18. The container 22 is preferably secured to the mask 14, such as by means of a cellulosic tape 26 having a pressure-sensitive adhesive coating. A pair of trap elements 28 is operatively associated with each container for trapping excess liquid spread from its operatively associated container. Each pair of trap elements is positioned adjacent the opposite edge of the image area portion 18 from its operatively associated container so as to trap excess liquid spread from the container, across the image area and towards the trap elements.

Referring now more particularly to Figs. 2 and 3, there are shown greatly enlarged fragmentary sectional views of the mask and image-carrying layer. As seen best in these enlarged views, the mask 14 is secured to the image-carrying layer by means of two layers of plastic 30 and 32. It can also be seen that the right-hand portion of

the mask, in Figs. 2 and 3, adjacent a tear out hole 34, is deeply crimped, while the left-hand portion of the mask shows a completely flattened crimp. The significance of this illustrated embodiment of the invention is discussed hereinafter.

In a preferred method of manufacturing the composite product shown in the drawing, the photosensitive layer is a "fast" silver halide emulsion, the container is formed of metal foil coated with an alkali-inert plastic, and the processing liquid therein is a viscous aqueous alkaline solution of a developer and a silver halide solvent. The image-carrying layer 12 may comprise a sheet of baryta paper treated in accordance with the teachings set forth in the above mentioned copending application. The mask 14 preferably comprises a sheet of sulphate kraft condenser tissue paper approximately .0018 inch thick. The two plastic layers 30 and 32 may comprise, respectively, polyvinyl alcohol and ethyl cellulose. In a preferred form of the invention, the plastic layers 30 and 32 are coated on the mask in accordance with the following nonlimiting example:

EXAMPLE

A mixture is prepared by mixing, by volume, one part methanol, three parts ethyl acetate and four parts of methyl Cellosolve. To 100 cc. of this mixture there are added 5 grams of cellulose acetate flake. The resulting solution is coated on the mask paper by use of a suitable doctor blade and roller to give a dry layer 30 having a thickness of approximately .0002 inch. The ethyl cellulose layer 32 is then similarly applied by use of a solution containing 80 grams of ethyl cellulose, 13 cc. of diethyl phthalate, 320 cc. of toluene and 80 cc. of denatured alcohol. The ethyl cellulose coating is applied over the cellulose acetate to give a dry coating which is preferably .0001 inch thick.

After the double layer coating has dried, the mask is relatively permanently shortened, preferably by crimping the mask. This crimping is preferably accomplished by passing the coated mask between a pair of crimp gears. It has been found that crimp gears having a 96 pitch and a 5/8 inch pitch diameter are quite satisfactory. The gears are made about .0005 inch larger in diameter at the center than at the ends to keep the paper from wandering from side to side. The gears are clamped tightly together, and the paper is wrapped half way around one gear before passing through the bite of the gears to keep the paper from wandering and folding over upon itself. After crimping, the paper has about 28 waves per inch, each about .0035 inch high, the total thickness being about .006 inch. These crimps preferably have the axes of the crimp waves extending perpendicularly to the length of the mask so that these axes will be substantially parallel to the axis of the roll to be formed of the composite mask and image-carrying layer. The crimped mask is then secured to the treated surface of the image-carrying layer by heat-sealing thereto. This heat-sealing is preferably accomplished in a platen press which applies a uniform pressure simultaneously to a relatively large area, such as several square inches, including a large number of crimps. One preferred press applies a pressure of about 100 pounds per square inch over an area of about 20 square inches for about ½ second at a platen surface temperature of approximately 225° F. Due to this large area of application of pressure, the mask cannot expand appreciably while being sealed to the image-carrying layer and it thus remains in its shortened condition. Measurements indicate that the sealing pressure lengthens the mask about .5%, thereby leaving the mask shortened by about 1.5% from its original length. The sealing pressure, however, mashes the crimps substantially flat so that only slight creases remain in the surface of the mask. This mashed crimped mask is shown as being completely flat in the left-hand side of Fig. 2. It is desirable that, at least along the longitudinal edges of the image area portion 18, the mask be substantially flat at its surface so that there will be no inequalities of thickness in the layer of liquid spread between the photosensitive layer and the surface of the image area portion 18.

On the right-hand side of Fig. 2 the mask is shown in its unmashed, crimped form. This portion of the mask adjacent the tear-out hole 34 is preferably left unsecured to the image-carrying layer. This portion is indicated by the dotted line 35 in Figure 1 and serves to assist in removal of the image area portion 18 after the positive has formed on the treated surface thereof. The two sides of Fig. 2 give an excellent comparison between the condition of the mask after crimping but prior to lamination, and the mask after lamination to the image-carrying layer.

When a platen press having a pressure of 100 pounds per square inch is used for sealing the crimped mask to the image-carrying layer, the deviations in the mask surface have been found to be so slight that they have no visible effect upon the thickness of the liquid spread between the photosensitive and image-carrying layers during the processing thereof.

In the use of the above described invention, the photosensitive emulsion 11 of the photosensitive layer 10 is suitably exposed in the camera, the two layers 10, 12, constituting the preferred product of the invention, being preferably connected together at their ends and suitably disposed within the camera so that they may be advanced past a processing means in the camera with the exposed area of the photosensitive layer in coincident superposed relation to the positive image area 18 of the image-carrying layer. In a preferred type of camera the processing means comprises a pair of pressure rolls indicated at 40 in Fig. 1. As the two layers pass between these rolls, the container 22 is positioned therebetween and the liquid 21 is forced from the container mouth 24 by the increased hydraulic pressure created by the rolls 40, one of which preferably has a pair of spacing collars 42 thereon. Continued movement of the two layers causes the released liquid to be spread in a uniform thin layer between the two outer layers 10, 12. The thickness of the layer of liquid spread between emulsion 11 and image area 18 is determined by the thickness of the mask 14 (including coatings 30 and 32) and any collar 42, on the rolls 40, or other spacing means. This layer of spread processing liquid 21 is shown in Fig. 3, it being seen that the thickness of the spread layer of liquid 21 adjacent area 18 is slightly greater than the total thickness of the composite mask 14 due to the presence of collars 42. Liquid spread beyond the end of area 18 is trapped, due to the separation of the pressure rolls, with consequent decrease in hydraulic pressure on the liquid, by the trapping members 28. Motion of the product is then preferably stopped

and the composite lamination is maintained in the dark for about 1 minute. The excess leader portions of the two layers can then be cut off by means of a cutter bar, not shown, at the right-hand end of Fig. 1. A door, provided in the camera, may then be opened and the positive image area 18 can be removed from the lamination by inserting a fingernail through hole 34 and tearing the image-carrying layer along perforations 20. Since the mask 14 is unsecured to the image-carrying layer 12 in the neighborhood of hole 34, the stripping of the image-carrying layer from the mask is facilitated. As can be seen from Fig. 3, that portion of the sealing layer 32 on the image area 18 is stripped away from its adjacent sealing layer 30. The portion of sealing layer 32 adhering to image area 18 thus forms a border for the positive image formed in or under layer 21 of the processing liquid. It should also be noted that the portions of liquid 21 spread between the mask 14 and the photosensitive layer are trapped between the mask and photosensitive layer when image area 18 is removed.

It should be pointed out, in connection with the diagrammatic representation of Fig. 3, that the layer of spread liquid quickly dries out, during and after the processing, to form a film of about .0002 inch thick. Thus, when the time occurs for the image area 18 to be torn out, the film 21 formed by the spread liquid is considerably thinner than shown, although it is usually not completely dry within a minute of spreading. The latter portion of the drying is accomplished by evaporation of the water from the surface thereof exposed as a result of removal of area 18.

It should be emphasized that the present invention has the important characteristic of permitting the use of a relatively weak bond between the two layers of plastic that seal the mask to the image-carrying layer. This permits, among other things, the use of organic-solvent-soluble plastics for forming both of these sealing layers, thereby preventing wrinkles in the mask paper during coating wide sheets thereof and speeding the drying operations. These attributes are of considerable importance where large quantities of these masks must be manufactured.

The table below shows a mask sheet formed of the materials and in the manner described in the example and indicates the degree of stretch of this mask sheet before crimping, the stretchability of the crimped mask sheet, and the stretchability of the crimped mask sheet after it has been heat sealed. The stretchability of the mask sheet after heat sealing was tested with the mask sheet detached from the image-carrying layer.

Table

	Percent of stretch of mask under indicated loads applied to mask sections 1 inch wide.		
	3 lb.	5 lb.	10 lb.
A. Coated mask paper before crimping	0.1	0.2	0.4
B. After crimping	1.9	2.3	2.7
C. Crimped, laminated, and peeled from image-carrying layer	0.5	0.8	1.9

When a mask, having a stretch characteristic like that of C in the table, is subjected to a stress, due to unrolling of a composite product which, for example, has been stored for a long time, any stress tending to separate the mask from the image-carrying layer is dissipated by the stretch of the mask before this stress can become sufficiently high to cause any shearing of the mask seal.

While a preferred type of mask and process of manufacture thereof have been described above, it should be understood that considerable latitude is feasible without departing from the scope of the invention. For example, the mask may be crimped by using embossing rolls rather than crimp gears. Additionally, while it is preferable to form the cutaway portions or apertures 16 in the mask 14 after the coating and crimping operations, this step may be accomplished at an earlier stage of the process of manufacture of the product. Equally, variations in the strippable adhesive bond may be employed, such, for example, as the use of a single layer of plastic, the present invention permitting lower strength bonds than previously considered practicable.

Since certain changes may be made in the above product without departing from the scope of the invention herein involved, it is intended that all matter contained in the above description or shown in the accompanying drawing shall be interpreted as illustrative and not in a limiting sense.

What is claimed is:

1. An elongated composite sheetlike photographic product, rollable into a roll, and providing an image-receptive material employable in a photographic transfer process of the character wherein positive image-forming components formed in a photosensitive layer upon development of a negative latent image therein are transferred to said image-receptive material for providing a positive image, said product comprising an elongated flexible image-receiving sheet as image-receptive material for receiving a plurality of positive images by transfer, an elongated mask sheet of flexible material superposed on said image-receiving sheet, with the surfaces of said mask sheet which are in superposed relation to said image-receiving sheet lying generally parallel to the image-receiving sheet, and said mask sheet being crimped and having a succession of waves extending lengthwise thereof with the respective crests and troughs of said waves extending transversely of said mask sheet and of said image-receiving sheet whereby the crimped mask sheet is extensible lengthwise of itself from said crimped condition to a fully outstretched condition, said mask sheet being provided with a plurality of apertures located at spaced intervals in a direction lengthwise of said mask sheet, each said aperture being adapted to define a picture area on said image-receiving sheet for receiving a positive transfer image and each said aperture being of relatively large area and having a transverse dimension slightly less than the width of the mask sheet so that the portions of the mask sheet which bound said aperture in a direction longitudinally of said mask sheet are relatively narrow and of small width in comparison to the width of the mask sheet itself, the dimensions of each said aperture in a direction parallel to the longitudinal axis of the mask sheet being many times the distance from crest to crest of said crimps, a dry stripping adhesive bond interposed between said mask sheet and said image-receiving sheet in superposed relation and being substantially restricted to the area of contact between the crimps and

the surface of said image-receiving sheet, said mask sheet being secured on said image-receiving sheet in a condition wherein the crimps of the mask sheet are sufficiently flattened to impart to the mask sheet, and in a direction longitudinally thereof, a predetermined length which is less than the length of the mask sheet when fully outstretched.

2. An elongated composite sheetlike photosensitive product as defined in claim 1 wherein each aperture in said mask sheet is of a quadrilateral shape.

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