June 24, 1941. R. B. WHEELAN ET AL 2,246,561

METHOD AND APPARATUS OF PHOTOGRAPHY

Filed Oct. 4, 1937

Fig. 1.

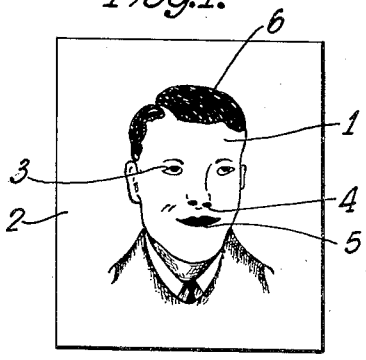


Fig. 2.

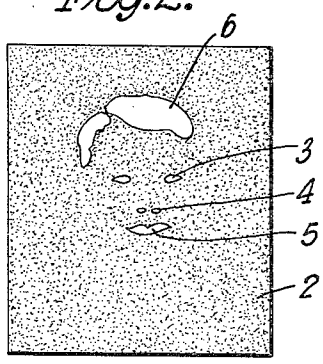


Fig. 3.

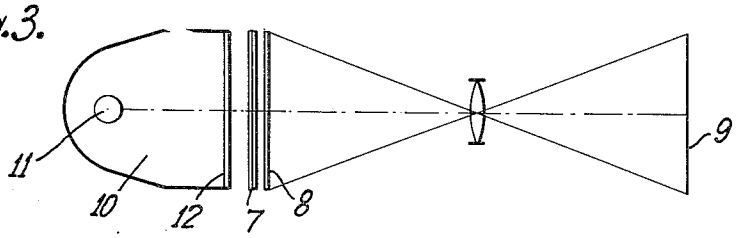


Fig. 4.

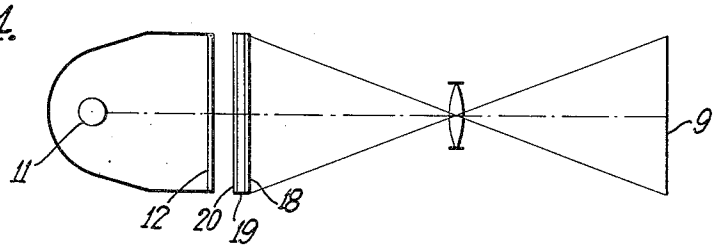


Fig. 5.

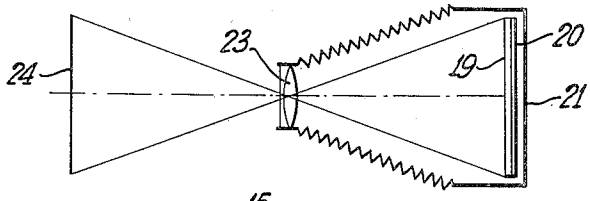
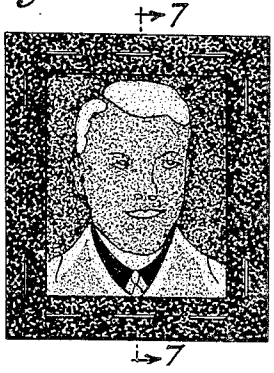


Fig. 6.



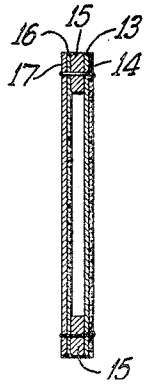
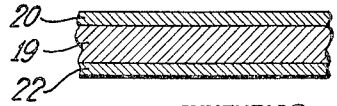


Fig. 7.

Fig. 8.



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METHOD AND APPARATUS OF PHOTOGRAPHY

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Application October 4, 1937, Serial No. 167,110

8 Claims. (Cl. 95—5)

Our invention relates to a method, product and apparatus for finishing photographic products and particularly to the problem of producing finished pictures free from blemishes, film grain marks and retouching strokes, and to a method, product and apparatus for the finishing of pictures without retouching.

Heretofore in the production of prints from negatives it has been the practice to retouch the negative lightly with pencil or to etch dark spots so as to remove marks which might deleteriously affect the finished print. This frequently has been an extended task as where a subject in portrait photography is freckled, or where huge enlargements emphasize the grain marks of the film.

It has heretofore been proposed to overcome these difficulties so as to obviate retouching altogether, or where the negative is roughly retouched, to soften retouching marks, by printing with a diffusion device placed between the negative and the print paper. This expedient has had the undesirable result that, while diffusing and thus softening undesirable blemishes, such as freckles in a portrait or grain marks in huge enlargements of ordinary photographic scenes, it also diffused those portions of the picture in which detail is desirable and necessary.

This invention has for an object the use of a diffusion mask adjacent selected portions of a negative where it is desired to diffuse and thus obviate retouching, or to soften rough retouching marks where used, but to leave undiffused those portions of the view or portrait which are free from blemishes or in which diffusion would impair the detail of the photograph.

Reference is here made to the related invention described and claimed in Patent No. 2,083,215 to Balaban.

The present invention is particularly adaptable to negatives of miniature type which it has heretofore been impracticable to retouch with ordinary methods due to their small size. It is, therefore, an object of the present invention to provide a method and apparatus for the production of enlargements from miniature photographic negatives, which enlargements are free from blemishes such as those heretofore removed by retouching in larger negatives.

This invention is also adaptable to the production of blemish-free enlargements of a size such that as heretofore produced, the grain effect of the film has been apparent and detrimental. It is therefore another object of this invention to provide a method and apparatus capable of obviating grain effect in enlargements without, however, losing detail in selected portions of the view.

The present invention is further adaptable to commercial processes of producing photographic products in which negatives and related diffusion masks are placed in bags, stored and otherwise handled. It is therefore an object of this invention to provide a diffusion mask of improved character which will withstand abuse, handling and storage and it is a further object to provide a method of producing such a mask.

The present invention is also adaptable to wet negative photoprinting in which process the negatives heretofore have been incapable of retouching by ordinary processes. It is, therefore, an object of the invention to provide a method of and apparatus for producing finished blemish-free prints from wet negatives, which at the same time are clear and distinct in selected areas.

It is another object of the invention to provide a method of making a material and a material from which diffusion masks can be made and clarified in selected areas by chemical transformation of the diffusion material into non-diffusing material.

It is also an object of the invention to provide a composite photographic negative and diffusion mask forming material capable of forming such a mask, and capable when formed of being clarified in selected areas by mechanical removal or chemical transformation of the diffusion material into non-diffusing material.

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

The invention accordingly comprises the several steps and the relation of one or more of such steps with respect to each of the others, and the apparatus embodying features of construction, combination of elements and arrangement of parts which are adapted to effect such steps, all as exemplified in the following detailed disclosure. The scope of the invention 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 which is illustrative of the invention, in which:

Fig. 1 is a plan view of a photograph;

Fig. 2 is a plan view of a diffusion mask for the negative used to produce the picture of Fig. 1;

Fig. 3 is a diagrammatic representation in section of a negative with a diffusion mask for it

spaced from the negative in relation to the printing light source and sensitive paper;

Fig. 4 is a diagrammatic representation in section of a modification in which the diffusion mask is combined with the negative film or glass rather than to a separate film or glass, all with reference to the printing light source and sensitive paper;

Fig. 5 is a diagrammatic representation in section of a camera used in exposing the negative used in Fig. 4;

Fig. 6 is a plan view of a composite negative, spacer and diffusion mask arrangement;

Fig. 7 is a sectional view along the line 7—7 of the negative-mask arrangement shown in Fig. 6; and

Fig. 8 is a cross-sectional view of a composite photographic negative-diffusion mask.

In the drawing the same numerals refer to like elements of the apparatus throughout.

Fig. 1 shows a photographic portrait which is illustrative of one type of photographic product to which the present method and apparatus are applicable. Certain areas of a picture, as for instance the facial portion 1, are ordinarily retouched, and in the present invention it is to these areas that the diffusion effect is applied by the present method. Other areas such as background 2 may also be diffused, if desired, particularly if the photograph is of such size that the emulsion "grain" effect is apparent. The eye portions 3, nostrils 4, mouth 5 and sometimes hair 6 are not ordinarily retouched as these details are desirably kept distinct in the picture. The present method of accomplishing the blemish-diffusing effect over selected areas of the picture is carried out by juxtaposing a diffusing mask, such as that shown in Fig. 2, adjacent the photographic negative and between the negative and lens of the enlarging projector, during the print-exposing operation of the photographic process, as shown in Fig. 3, in which the photographic negative is shown at 7, the diffusion mask at 8, and the unexposed photoprint paper at 9. The light source 10 consists of a lamp 11 and translucent glass 12 or condenser so arranged that the photographic negative is evenly illuminated throughout its entire area.

The type of diffusion mask used in my invention is shown generally in Fig. 2 and may consist of a translucent glass or other transparency which has been clarified in selected areas so that the light which passes through these areas is relatively undiffused. The process of preparing the mask may begin with a piece of material which is of uniform diffusion producing character throughout the full area of the photograph, or where it is undesirable to diffuse the background or clothing or any other part, its process may begin with a mask coated only in a selected area such as the facial oval. From this beginning, selected areas on the mask, as for instance, those in registry with the hair, eyes, nostrils and mouth areas 3, 4, 5 and 6, are clarified according to any of the procedures hereinafter set forth so that light may pass directly through the thus exposed transparent area with relatively little diffusion.

In accordance with the present improved method the diffusion mask may be prepared by numerous methods of which the following are illustrative.

Where the diffusion base is of glass, or Celluloid, hard gelatin, cellulose or resinous film, the diffusion mask may be prepared by applying a diffusion coating uniformly over the area and then clarifying the coating as by scraping away with a retouching scribe, or other blunt or sharp instrument, as the occasion demands. Other methods of removing the coating may also be used. For instance, it may be burnished until clear, or dissolved away. Another method is to apply a clarifying solution such as lacquer or Celluloid cement; or in some instances the film may be glazed so as to leave the area unrestricted.

Good results are obtained by spraying on a glass plate, a lacquer solution comprising of two parts clear lacquer, one part thinner and a trace of flat white lacquer (which is just sufficient to cloud the solution). This lacquer solution dries quickly into a hard matte-like translucent coating which is sufficiently tough to resist a reasonable amount of handling, but which can be removed easily in the selected areas, such as areas 3 to 6 of Fig. 2, by scraping with an ordinary retoucher's etching knife. Another masking material capable of giving good results is a solution of naphtha soap and glue.

Diverse translucent coating materials, of which the foregoing are illustrative, may be used in this invention, the criteria of usefulness being translucency when dry coupled with reasonable hardness, and the ability to be removed or rendered transparent by etching, dissolution, absorption, application of heat, burnishing, or by the use of a transparentizer.

The amount and density of the translucent coating may vary between wide limits, but is ordinarily sufficiently thick if it just renders invisible or diffused sharp contrast lines of a distant bright scene. The prepared mask has somewhat the appearance of frosted glass.

The etching or clearing operation is carried out by juxtaposing a prepared light diffusing mask, diffusion side outermost, upon a photographic negative. Ordinarily the image bearing surface is adjacent the clear side of the mask, but as will be pointed out hereinafter this is not essential. The negative and mask are then fastened together, as for instance by cementing or by stapling, as in Figs. 6 and 7, or by otherwise uniting, or merely held in juxtaposition temporarily, and then placed over a light source. The areas of the diffusion film, which are directly over the eyes, nostrils, hair, for instance, of a portrait negative, or any other part of a portrait or other negative, which are to be left undiffused and sharp in the finished print, are then scraped, or otherwise rendered free of diffusion film, or the film is clarified in effect as heretofore specified, so that light can pass undiffusedly and directly through the negative and mask. The scraping operation sometimes results in a ragged edge for the undiffused areas 3, 4, 5 and 6 of Fig. 2. This ragged edge apparently does not interfere and possibly assists the blending of the diffused areas into the undiffused area and is not considered undesirable.

The composite film and mask is then placed in the printing frame, see Fig. 3, so that the diffusion mask 8 is between the negative 7 and the photographic print paper 9.

It is desirable, in some instances, to space the diffusion mask 8 a short distance from the negative 7, either by using a solid glass spacer as suggested in Patent No. 2,083,215 to Balaban, or by using a peripheral spacer as shown in Figs. 6 and 7. The peripheral spacer may, if desired, be on three sides only, or the film may be fastened and spaced at one end only so as to facili-

tate the insertion of a glass to back up the film during removal of the coating and printing of the print. The glass may remain, or be removed and the spacing otherwise provided, as in Fig. 7, during printing.

In Figs. 6 and 7, the diffusion masks may, for example, be base film of relatively hard, clear material, such as Celluloid, cellulose acetate, or regenerated cellulose, having a diffusion coating **14** on one surface. The diffusion coating is removed in the selected areas, as heretofore specified, while juxtaposed over negative **17** which carries image bearing surface **16**. The negative and diffusion mask are spaced in this instance by a peripheral spacer **15** of cardboard or other similar material, and the three elements are fastened together, as for instance, by cementing, or by stapling as shown in Fig. 6. The stapling may be all around the border of the composite, or on one end only if desired. It has been found that the diffusion effect increases as the thickness, quality or density of the diffusion surface material is increased and as the distance between the film and the mask is increased. Thus the diffusion effect of the fixed coating of a given mask, as in Fig. 7, may be increased by increasing the thickness of spacer **15**, and may similarly be decreased by decreasing the thickness of spacer **15**. Similarly, with the spacing fixed, a small amount of diffusion is obtained by using a low quality, low density, or thin coating, whereas a large amount of diffusion may be obtained by using a high quality, high density, or thick coating. The word "quality" in this instance refers to the light diffusing ability of the diffusing substance, thus a water solution of Epsom salts yields a high quality diffuser.

The composite photographic negative-diffusion mask arrangement shown in Fig. 7, is especially adaptable to printing processes in which an incompletely dried negative is used. Heretofore, retouching of such negatives to remove blemishes has been impossible as such work is done on a dry negative. In the present process, blemish diffusion may be accomplished as follows: A wet negative is squeegeed to remove excess water and then stapled to a piece of diffusion mask material with a spacer between, if desired. The mask is then clarified throughout selected areas, such as areas **3** to **6** of Fig. 2, as heretofore specified and the photoprint exposed and immediately developed. Thus improved photoprints, in which blemish defects in selected areas are diffused, can be obtained from a wet negative.

According to another procedure, glass, cellulose acetate, regenerated cellulose, hard gelatin, Celluloid or other film which is sandblasted, or otherwise manually, chemically or mechanically etched or treated so as to produce a light diffusing surface may be used. A diffraction grating, mechanically, or photographically produced is also useful in some cases. Another material which is useful in the preparation of the diffusion masks is cellulosic, gelatin, Celluloid, or the like film, which is grained or embossed under hydraulic pressure with an embossing die so as to produce a surface having slight irregularities much like a sand blasted surface.

When using any of the foregoing materials, the clarification may be obtained by scraping or burnishing, by coating with lacquer, oil, solvent, or the like, or by a combination of any of these treatments. In preparing the mask from such materials, the matte surface is burnished, ironed, dissolved, or otherwise rendered transparent in the selected areas. Good results are obtained by placing the film directly over the negative, or over a glass plate interposed between the negative and the film either permanently or during the preparation of the mask, and then treating the selected areas of the matte surface by rubbing as, for instance, with a blunt smooth steel, until a bright area appears. This convenient method of preparing the mask is readily adaptable to production methods. If desired, the surface may be scraped off in a manner similar to that described above with reference to the lacquer film on glass, or it may be dissolved away in selected areas by using a solvent which removes or consolidates the surface without however destroying or impairing the clarity of the film body material. The solvent may be just sufficient to soften the surface so as to allow the surface tension of the material to yield an even surface. For instance, the irregular surface of a cellulosic film may be dissolved or partially dissolved with sodium hydroxide, which forms a cellulose sodium complex; a cellulose acetate film may be dissolved or partially dissolved with acetone, amyl-acetate or common Celluloid cement. Regenerated cellulose films may be dissolved slightly with cuprammonium solution or with sodium thiocyanate solution, all applied to the selected areas, or mere Celluloid cement, oil, or lacquer may be used to consolidate and clarify specified areas of the diffusion mask of a cellulose acetate or other similar film.

A further desirable manner of accomplishing the clarification of the selected areas is first to scrape, etch, melt or burnish the coating or the diffusion surface if no separate coating is used to achieve partial transparency and then apply a solvent, swelling or consolidating solution. For instance, where partial diffusion is desired, as with hair areas of a portrait (see Fig. 1), the translucent matte may merely be etched away, but with the eye area **3**, it is sometimes desirable to apply a drop of solvent capable of slightly dissolving, unifying, or otherwise clarifying the surface matte after the initial scraping, rubbing, etc., thereby to enhance the light transmitting ability of the mask at these areas. A slight amount of heat may be used to cause the matte surface to coalesce and become transparent. Heating and burnishing either alone or in combination, or alone or combined with a subsequent treatment with a solvent, partial solvent, softening agent, swelling agent, lacquer, balsam, varnish, oil, wax, fat or sugars, various salt solutions or the like, give good results. Thus a blunt heated surface may be used to "iron" the surface irregularities of selected portions of the translucent light diffusing matter. For instance, if the matte surface is a sand blasted, hard gelatin film, or cellulose acetate film, good results are obtained by burnishing the selected areas or burnishing with heat, and then by following this, if desired, with an application of solvent.

For cellulose acetate, acetone may be used as the solvent or various ethers, amyl-acetate, or various oils capable of dissolving, partially dissolving, swelling, or merely capable of filling in between and evening out the surface irregularities may be used. In every case, however, whether the method is by dissolving, scraping or consolidating, the clarification is made throughout selected areas only of a previously uniformly covered sheet of diffusion material. Any other desired combination of scraping, rub-

bing, dissolving may be used. Thus, in some instances, it is desirable first to burnish a relatively large area, then scrape a central portion of this area, then dissolve and thus further clarify a still smaller central area.

In some instances it is desirable to apply the diffusion medium directly to the uncoated surface of the negative glass or film, as shown in Fig. 4. In this figure, the diffusion mask **18** is formed directly on the uncoated side of the photo-film base material **19** and the image bearing surface is on the other side. The diffusion mask must, as always, be placed between the image bearing film and the photoprint paper, as shown in Fig. 4. In order to insure that the finished picture not be reversed, the film may be placed in the camera with the sensitized surface **20** of the film away from lens **23**, as shown in Fig. 5. When this is done, the finished photoprint will be optically similar to the subject.

Another method of carrying out the invention is with a film material which carries, or is impregnated with a diffusion producing ingredient capable of being clarified chemically. Thus a gelatin film may be soaked in lead acetate and then immersed in a solution of sodium carbonate to give a lead carbonate precipitate. The thus treated film is an excellent diffusion mask and may be clarified in the selected areas by the application of diluted hydrochloric acid.

Figure 8 shows a composite negative in which **20** is the unexposed sensitized surface, **19** is a glass plate, and **22** a gelatine coating carrying lead acetate. The film **22** is clear, so that the negative may be exposed in the camera, in the position shown in Fig. 5. When the negative is developed, a carbonate salt, such as sodium carbonate, which is ordinarily used in the developer solution, converts the lead acetate to an insoluble light diffusing compound, lead carbonate. The composite negative—glass—light diffusion mask is then treated, as outlined above, by etching away the mask in selected areas, or by converting the lead carbonate into a material which does not diffuse light as by the application of an acid such as hydrochloric acid.

Ordinary flexible negatives, previous to exposure, may be floated on a solution of lead acetate or barium chloride, to impregnate the backing with these materials. After this is done, the film is dried in the dark and exposed after the manner shown in Fig. 5. When a film thus treated, is developed, it likewise yields an insoluble lead or barium carbonate salt coating, as the case may be, which can subsequently be removed in the selected areas by burnishing or by alternate applications of hypo and acid such as hydrochloric acid. Other acids, such as acetic or acid salts, may be used.

Obviously, other materials capable of reacting with various ingredients of ordinary photographic developers and fixing baths, or with a new and entirely separate solution, not ordinarily used in photography, may be used for converting the impregnating salt, the essential thing being that the layer be clear during exposure and capable of being clouded during a subsequent treatment.

It is desirable in some instances, as, for example, in production work or in an individual studio, where head size and features are relatively uniform, to use stock masks in which the facial oval only is covered with a diffusion surface and in which the areas juxtaposing the features such as the eyes, teeth, nose, etc., are previously clarified. It is desirable in such instances to have a set of, say one hundred, previously prepared masks of varying proportions so as to have available a mask for the range of facial proportions and sizes ordinarily met with in the studio or finishing plant in question. Such masks are preferably made with the diffusion areas gradually faded out to the adjacent clear areas at the boundaries of the facial oval or at the boundaries of the eye, teeth, nostrils, etc. In this way, a slight missizing of the stock mask is compensated.

In some instances the translucent light diffusing film may be composed of two clear sheets cemented together with a diffusion carrying substance. This cement layer in this case is of the non-drying, non-hardening type so that when the composite three layer diffusion mask is squeezed, rolled, or rubbed the two outer layers will be moved into contact with each other and the diffusion cement substance displaced laterally so that light can pass directly through the squeezed together areas, but will be diffused at the other parts of the mask. In using such a composite mask, it is placed over the negative and simply squeezed, rubbed or rolled, at the points desired to be rendered clear.

The most diverse substances may be used as the cement layer of such a material. Canada balsam-white lead mixture is good. Any non-drying glue with a bit of white paint or lead is excellent. Even oil, or grease, such as vaseline to which a slight amount of salt such as lithopone, white lead, zinc white, is added may be used.

While for illustration the invention has been described with reference to a portrait negative, it is to be distinctly understood that the utility of an invention, such as the present invention, is not limited to portraits but is applicable to all manner of photoprinting from negatives. For instance in commercial photography of still figures, it may be desirable to diffuse the entire picture and yet bring out the high lights. Thus in a picture of a glass bowl, silver pitcher, etc., it is desirable to diffuse all but the high lights. With the present invention, this is readily accomplished by removing the diffusion coating over the high lighted areas.

Having described our invention, what we claim as new and desire to secure by Letters Patent, is:

1. A composite photographic negative and diffusion mask comprising a photographic negative, a spacer member for the photographic negative arranged between the negative and diffusion mask adjacent edge portions only of said negative outside the central image bearing portion, said diffusion mask being in juxtaposition with the spacer member and the photographic negative and having portions relatively freely light transmitting, and means for holding the photographic negative, the spacer member and the mask from lateral displacement relative to each other.

2. A composite photographic negative and diffusion mask comprising a predeveloped photographic negative, a diffusion mask, a spacer means between said negative and mask arranged adjacent edge portions of said negative and leaving free the central image bearing area thereof, and means securing said negative, spacer means and mask together as a unit, said diffusion mask having areas which are relatively transparent corresponding to areas of the negative desired to

be left relatively undiffused in the photoprinting thereof.

3. A process of making enlarged prints from portrait negatives comprising placing a flexible membrane over the negative and securing it thereto, said membrane having a translucent surface but being otherwise transparent, rendering transparent areas of said surface corresponding to areas of said portrait negative desired to be printed in sharp detail, arranging the negative and flexible membrane in a projection apparatus without releasing the securing means or disturbing the alignment and with the flexible membrane spaced a small distance from the image bearing surface of the negative and on the side thereof opposite from the light source, projecting an enlargement of the negative through said flexible membrane onto sensitized photoprint paper, and developing said photoprint.

4. A process of making enlarged prints from portrait negatives comprising placing a diffusing member over the negative and securing it thereto, said diffusing member having a translucent surface for diffusing light on the side opposite from the negative but being otherwise transparent, treating selected areas of said surface to clarify and render them more freely light-transmitting, said areas corresponding to portions of the portrait negative desired to be printed in sharp detail, arranging the negative and diffusion member in a projection apparatus without releasing the securing means or disturbing the alignment and with the said surface of the diffusing member spaced a small distance from the image bearing surface of the negative and on the side thereof opposite from the light source, projecting an enlargement of the negative through said diffusing member onto a sensitized photoprint paper, and developing said photoprint.

5. A process of making prints from portrait negatives comprising superimposing a membrane over the negative with a spacer member arranged between said membrane and negative along an edge of the negative outside the central image bearing area, positively securing together as a unit said negative, spacer and membrane, said membrane having a translucent outer surface but being otherwise transparent, rendering substantially transparent areas of said surface corresponding to areas of said portrait negative desired to be printed in sharp detail, arranging the unit in proper alignment in a projection apparatus with the said membrane spaced a small distance from the image bearing surface of the negative and on the side thereof opposite from the light source, projecting an enlargement of the negative through said membrane onto sensitized photoprint paper, and developing said photoprint.

6. A composite photographic negative and diffusion mask comprising a pre-developed photographic negative, a diffusion mask of flexible translucent material superimposed over the negative with a spacer member arranged between said mask and negative along an edge of the negative outside the central image bearing area, and means securing together as a unit said mask, spacer member and negative, said mask having areas which are relatively transparent corresponding to areas of the negative desired to be left relatively undiffused in the photoprinting thereof.

7. A composite photographic unit comprising a predeveloped image-bearing member designed to be employed in the exposure of sensitized material, a diffusion mask adjacent to and substantially parallel to said member, a spacer means arranged between said member and mask along an edge of said member outside the central image-bearing area, and means securing together as a unit said member, spacer means and mask, said mask having areas which are relatively transparent corresponding to areas of said member desired to be left relatively undiffused in the exposure thereof.

8. A process of projecting onto a sensitized photographic material images from a developed light-transmitting photographic member, comprising placing a diffusing member over said photographic member and securing it thereto, said diffusing member having a translucent surface but being otherwise transparent, treating selected areas of said surface to clarify and render them more freely light-transmitting, said areas corresponding to portions of the photographic member desired to be produced on the sensitized material in sharper detail, arranging said members in substantially parallel relation to each other in a photographic exposure apparatus without releasing the securing means or disturbing the alignment and with the said surface of the diffusing member spaced a small distance from the image-bearing surface of said photographic member and on the side thereof opposite from the light source, and exposing the sensitized material.

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