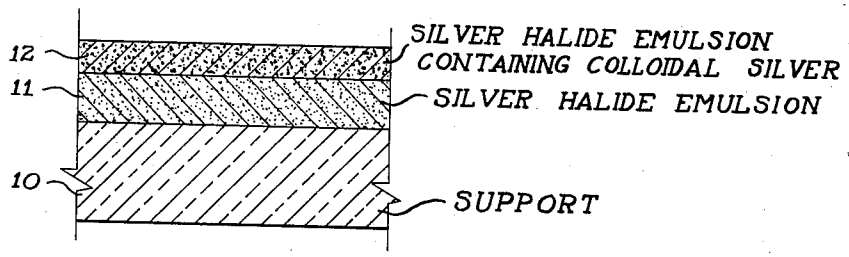
Aug. 3, 1954 E. C. YACKEL 2,685,510

SENSITIVE PHOTOGRAPHIC ELEMENT FOR USE IN THE SILK SCREEN PROCESS

Filed Nov. 14, 1951



EDWARD C. YACKEL
INVENTOR.

BY Daniel J. Mayne,
R. Frank Smith
ATTORNEYS

Patented Aug. 3, 1954

2,685,510

UNITED STATES PATENT OFFICE

2,685,510

SENSITIVE PHOTOGRAPHIC ELEMENT FOR USE IN THE SILK SCREEN PROCESS

Edward C. Yackel, Rochester, N. Y., assignor to Eastman Kodak Company, Rochester, N. Y., a corporation of New Jersey

Application November 14, 1951, Serial No. 256,243

3 Claims. (Cl. 95—8)

1

This invention relates to photography and particularly to a sensitive photographic element for use in the silk screen process.

Silk screen processes in which an image is formed photographically in a bichromated gelatin layer by exposure and washing to form a relief image, and the image then transferred to a silk screen to form the desired printing element are well known. Silver halide emulsions may be used in place of the bichromated gelatin and the relief image formed in various ways such as by tanning development or tanning bleach and washing out the unhardened portions, or by use of an etch bleach solution as described in British Patent 587,957. In any of these cases the relief image is transferred to the silk screen and the support removed to form the printing screen.

It is also possible to incorporate a tanning developing agent such as 4-phenyl catechol in the silver halide emulsion, develop the exposed emulsion and form a relief image therein and then transfer the relief image to a silk screen. This material is useful for some processes but exposure is limited to some extent by the hardness of the tanned layer which will adhere satisfactorily to the screen. That is, the exposure must be limited in those areas which are not critical to exposure as far as subject matter is concerned because overexposure may cause too much physical hardness of the tanned gelatin even though this effect is minimized by the gelatin to silver halide ratio in the preparation. Since the exposure must be limited in these areas to keep physical hardness down to a usable level, other areas which require more exposure for optimum results are adversely affected.

It is, therefore, an object of the present invention to provide an improved sensitive material for use in the silk screen process. A further object is to provide a novel photographic element. Other objects will appear from the following description of my invention.

These objects are accomplished by using as the sensitive element a double coated silver halide emulsion layer, the outer emulsion being about half the thickness of the inner emulsion and containing yellow colloidal silver or other non-wandering yellow dye or pigment dispersed therein.

The drawing shows in sectional view a sensitive element constructed according to the preferred embodiment of my invention.

The photographic element according to my invention is prepared as follows:

2

A support of cellulosic material such as cellulose acetate 0.003 inch thick was coated with a silver halide gelatin emulsion of photographic printing paper speed. It may be modified by the incorporation of optical sensitizers or other addenda. Such emulsions are disclosed in Eder's Handbuch der Photographie. One kilogram of this emulsion containing one mole of silver per 4.2 kilograms of emulsion was added to 180 grams of a low viscosity, low physical strength gelatin. The emulsion and dry gelatin were mixed and melted at 40° C. When melted, 200 grams of an aqueous resin dispersion prepared as follows were added to the gelatin emulsion.

A commercial ethyl acrylate monomer was washed free of inhibitor by four short washes with one-tenth its weight of aqueous 5% sodium hydroxide solution followed by four short washes with water, and a commercial acrylonitrile was distilled to remove inhibitor. Five kilograms of the ethyl acrylate and 528.3 grams of the acrylonitrile were mixed in a 22 liter flask, 200 grams of an alkyl aryl polyether sulfonate (Triton 720) and 33.3 grams of potassium persulfate were dissolved in 5 kilograms of distilled water and the temperature was brought to 55° C. Stirring was begun and continued throughout the reaction. About 200 cc. of the mixed monomers were added. After five minutes and every fifteen minutes thereafter was added 25 cc. of a solution of 16.7 grams of sodium bisulfite dissolved in 200 cc. of distilled water. The rest of the mixture of monomers was added continuously with adjustment of a bath temperature to maintain a polymerization temperature of 50 to 60° C. After all of the monomer was added the contents of the flask were cooled to 30° C., filtered through cloth and 700 grams of Triton 720 added to adjust the concentration of dispersing agent on a dry weight base to 2.2% of the total weight. The pH was adjusted to pH9 by addition of 1 Normal sodium hydroxide.

In addition to the 200 grams of aqueous resin dispersion, 200 grams of an aqueous dispersion of 4-phenyl catechol in gelatin solution, containing the following ingredients were added:

	Grams
Dibutyl phthalate	25
4-phenyl catechol	15
Gelatin	15
Water	195
Glycerol	50

The first emulsion coat was spread over 130 square feet of base and a second emulsion coat of the same composition as the first coat but con-

taining 5 grams of colloidal silver dispersion in approximately 1580 grams of emulsion, was spread over 300 square feet of the first coat. The colloidal silver dispersion was prepared as follows:

The colloidal silver dispersion was prepared by the Carey Lea dextrin method, as modified by Wiegel (Zeit. wiss. Photo. 24, 316 (1927)). After formation, the sol was dispersed in a gelatin solution, set up in a refrigerator, shredded, and washed in cold water to remove the soluble impurities. It was then melted up and the weight adjusted with distilled water so that the dispersion contained 238 grams of gel per mole of silver, and weighed 4300 grams.

In place of the ethyl acrylate and acrylonitrile used in preparing the resin dispersion, dispersions were made with methyl acrylate as the only monomer and also with a mixture of the methyl acrylate and ethyl acrylate monomers.

After the coatings were dry the sensitive element was placed with the base side in contact with a positive image and exposed through the positive by means of a suitable light such as tungsten, white flame arc, etc. The exposed element was then immersed in an alkaline solution of the following composition:

	Grams
Sodium carbonate (monohydrate)	75
Sodium hydroxide	5
Sodium sulfite	2
Water to 1 liter	

Development was carried out for 45 seconds at 65 to 75° F. This was followed by rinsing for 30 seconds in tap water at 65 to 75° F., immersion in a stop bath containing 50 grams of 28% acetic acid in 1 liter of water for 30 seconds and washing in tap water at about 100 to 110° F. Washing was continued until the undeveloped untanned portion of the stencil was dissolved out, which took about 3 to 5 minutes.

The washed out stencil was placed with the tanned gelatin side in contact with a water-wetted silk screen and thoroughly dried. When dry, the stencil was treated from the silk side with enough chloroform to wet it thoroughly for about 1 to 2 minutes. At this time the cellulose acetate base was thoroughly swollen and softened. The base could then be easily and cleanly stripped from the stencil. The residual chloroform evaporated in a minute or two and the screen was then ready for masking and printing.

The cellulose acetate base may also be removed from the finished stencil by using heat instead of solvents to soften the base. It has been found that by holding the silk screen with the stencil dried on it under infrared heaters the base softens sufficiently to permit easy stripping. The temperature to which the base must be heated is limited on the lower side by the temperature at which the base becomes pliable and on the upper side by the temperature at which it melts or loses its cohesion to the extent that it falls apart. This temperature range is in the neighborhood of 275–300° F. for the cellulose acetate base used.

In the accompanying drawing which illustrates a sensitive material constructed according to my invention, 10 is a support of cellulose acetate or other suitable material coated with a silver halide emulsion layer 11 and a silver halide emulsion layer 12 containing colloidal silver, the emulsion layer 12 being about half as thick as the emulsion layer 11.

The method which I have described provides a very satisfactory means for forming a silk screen stencil. In my sensitive material, exposure of the emulsion is limited because of the filtering effect of the colloidal silver emulsion thus permitting more exposure in the small aperture areas of the positive and effectively increasing exposure latitude. The colloidal silver also acts as an antihalation backing. A further result is that a graded area of tanned gelatin to untanned gelatin always exists except on very great overexposure in the colloidal silver emulsion layer. Because of this graded area of tanned to untanned gelatin, improved adhesion of the gelatin to the screen results.

Instead of yellow colloidal silver, I may use as the coloring material of the outer emulsion layer a non-wandering yellow dye or pigment. Chrysophenin (Schultz, Farbstofftabellen, 7th Edition, No. 726) is a suitable dye, and lead chromate is a suitable pigment.

The support for my sensitive element must be removable, and any suitable material, such as cellulose esters or ethers, or synthetic resins such as polyvinyl acetate, may be employed.

It will be understood that the examples and modifications included herein are illustrative only and that my invention is to be taken as limited only by the scope of the appended claims.

I claim:

1. A photographic element for use in the silk screen process, comprising a cellulosic support having thereon a gelatino-silver halide emulsion layer, and on said emulsion layer a second gelatino-silver halide emulsion layer of the same composition as the first emulsion layer but containing colloidal silver dispersed therein, both emulsion layers containing a dispersion of a tanning developing agent.

2. The element of claim 1, in which the emulsion layers contain a dispersion of 4-phenyl catechol as a tanning developing agent.

3. The element of claim 1, in which the emulsion layers contain a dispersion of 4-phenyl catechol in dibutyl phthalate, and the second emulsion layer is approximately half the thickness of the first emulsion layer.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
2,143,736	Mannes et al.	Jan. 10, 1939
2,219,987	Gaspar	Oct. 29, 1940
2,219,988	Gaspar	Oct. 29, 1940
2,320,693	Yauck et al.	June 1, 1943
2,415,624	Brown et al.	Feb. 11, 1947
2,500,877	Sharples	Mar. 14, 1950