Sept. 19, 1944. F. T. POWERS 2,358,590

STRIP FILM

Filed Oct. 10, 1941

Fig. 1

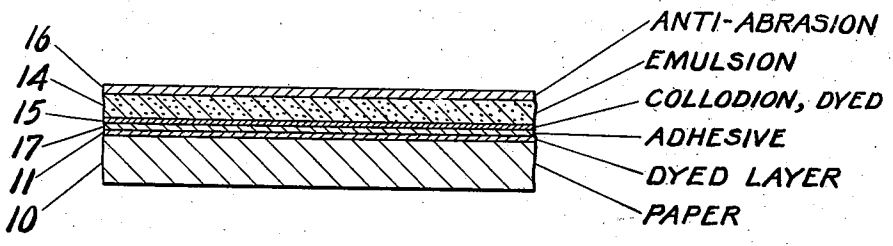
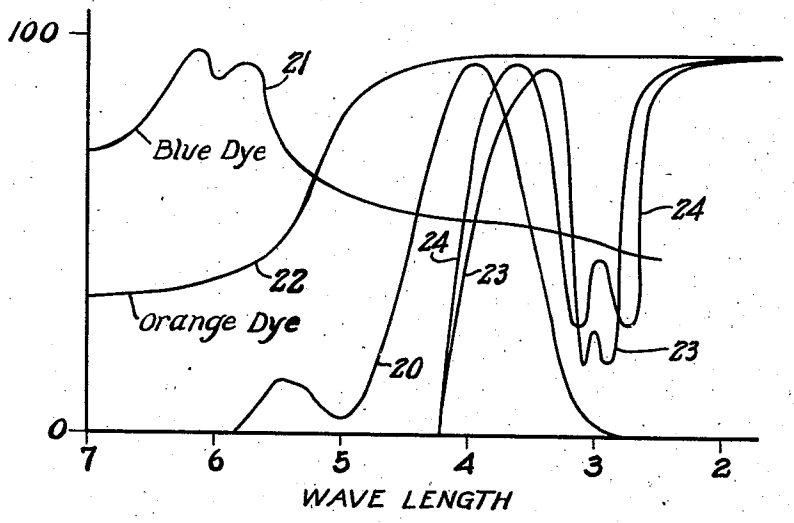


Fig. 2



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STRIP FILM

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4 Claims. (Cl. 95—9)

The present invention relates to novel improvements in photoengraving and photomechanical reproduction and more particularly to an improved strip film and halftone process for photomechanical use.

Objects and advantages of the invention will be set forth in part hereinafter and in part will be obvious herefrom, or may be learned by practice with the invention, the same being realized and attained by means of the instrumentalities and combinations pointed out in the appended claims.

The invention consists in the novel parts, constructions, arrangements, combinations and improvements herein shown and described.

The accompanying drawing, referred to herein and constituting a part hereof, illustrates one embodiment of the invention, and together with the description, serves to explain the principles of the invention.

Fig. 1 is a diagrammatic sectional view of a typical and illustrative sheet of photosensitive material in accordance with the present invention; and

Fig. 2 is a graphical representation of certain general characteristics of the various materials used with the present invention.

The present invention has for its object the provision of a novel and improved photosensitive sheet material particularly adapted for photomechanical use where relatively high contrast and resolving power are desired. A further object is the provision of a novel and improved anti-halation strip film primarily adapted for photomechanical use, especially for halftone work with high intensity mercury vapor illumination. The invention also provides an improved strip film for the photoengraving process which eliminates or greatly reduces the finishing operation required for the production of halftone photoengravings.

In accordance with the typical and illustrative embodiment of the present invention, there is provided a strip film particularly adapted for use in the making of halftone negatives which comprises a photosensitive film, such as a silver halide emulsion, releasably secured to a base, such as a sheet or web of paper. Incorporated in a thin layer permanently affixed to and carrying and supporting the emulsion, is a dye which allows the transmission of most of the light having a wave length shorter than 5,500 Å., and absorbs most of the light of a wave length longer than 5,500 Å., while the base member is complementarily colored, as by coating, with a dye absorbing most of the light shorter than 5,500 Å. Thus, the only light reaching the paper base and which might otherwise reflect from the base is substantially completely absorbed, and substantially no light is reflected to the emulsion which might fog the photosensitive material.

The dyed support between the base member and the emulsion layer also preferably absorbs much of the light scattered by the silver halide in the emulsion, so that both the scattered light, and the reflected light from the base are greatly reduced, causing a great reduction in halation, an increase in contrast and a high effective resolving power of the photosensitive material.

The photosensitive film is releasably secured to the base member or other surface, and after development, fixation and washing, the photosensitive film may be removed from its base member and stripped onto a sheet of glass or other negative support. During the fixation and washing operations some of the dyestuff may be washed out of the film and what remains does not substantially interfere with the transmission of light during the operation of printing the negative on the metal. This printing operation is usually carried out by a carbon or mercury vapor arc using a bichromated or chromated colloid as the photosensitive resist on the surface of the material to be etched. Furthermore, the dye with which the support is dyed is substantially transparent to the light with which the copy is illuminated, as well as to the rays which principally affect the emulsion layer, although I have found that some advantage is obtained in using a dye which filters out certain portions of the spectrum of the light used for illuminating the copy.

The invention will be described in detail in connection with strip film particularly adapted for making halftone negatives using mercury vapor arcs as the source of light for the photographic and printing operations.

As shown in Fig. 1, the strip film comprises a paper base 10, the upper surface of which is covered with a coating 11 of gelatin or other colloidal material which is dyed to absorb most of the light of a wave length shorter than 5,500 Å., although I prefer to use a dye which absorbs all of the light from the violet to at least 5,000 Å. Such a dye usually has an orange or reddish color, and in fact, orange and red dyes in general are suitable, although their visual appearance is not always a sufficient test of their suitability as some may have strong transmission bands in the blue and violet.

The photosensitive film comprises a silver halide-gelatine emulsion 14 which is orthochromatic or panchromatic and is coated on thin support layer of dyed collodion 15, dyed and permanently attached to and in optical contact with the emulsion layer 14. The dye in support 15 absorbs most of the light of a wave length longer than 5,500 A., and transmits most of the light of a wave length shorter than 5,500 A. The silver halide layer is preferably associated with an outer anti-abrasion coating 16 which comprises a thin permeable coating of unhardened gelatine.

The photosensitive film, comprising layers 14, 15 and 16, is preferably releasably attached to the colored base member 10 by means of a thin adhesive layer 17 so that the first three layers are retained together during exposure and developing, and separate from the base member 10 during the fixing or subsequent washing. Thus, the silver halide emulsion layer containing the negative becomes detached from the paper base member 10 and may be stripped on to a clear glass plate, with coating 16 against the glass plate.

In Fig. 2 of the drawing there is shown diagrammatically the general relation of the different factors entering into the specific embodiment of the invention described above. In this diagram absorption of the various dyestuffs, the sensitivity of the silver halide, the chromated or bichromated photosensitive resist, and the principal lines of the mercury vapor arc spectrum are all plotted against wave length in a single diagram.

As shown, the mercury vapor arc emits light having the approximate wave lengths 3,650 A., 4,080 A., 4,360 A., 5,460 A., 5,760 A. and 5,790 A., the vertical length of the lines indicating roughly the relative intensities of these various wave lengths in the mercury vapor arc spectrum.

Curve 20 shows, roughly, the sensitivity of the silver halide-gelatine emulsion, such as constitutes the layer 14, and this emulsion has a maximum sensitivity at approximately 4,000 A., and a secondary maximum sensitivity at approximately 5,500 A. No data is shown below 3,200 A. as light of the shorter wave length is not appreciably transmitted by the various glass plates and lenses used in the photographic apparatus.

The curve 21 illustrates in general the absorption of a typical and illustrative dye such as used for dyeing the collodion support 15. Typical suitable dyes are the Aniline Blues (Schultz, No. 792). The dyes are preferably chosen so that they transmit some light to which the silver halide is chiefly sensitive, while also preferably transmitting only a small amount of the light corresponding to the secondary maximum sensitivity at 5,500 A.

Curve 22 illustrates generally the absorption spectra of the orange dye used for the coating of the paper base 10, and this dye preferably absorbs most of the light of a wave length shorter than 5,500A. or at least 5,000 A., thereby preventing reflection of any actinic rays transmitted through the emulsion layer 14 and dyed layers 15 and 11.

As an example of a dye suitable for dyeing this layer 11, toluene fast orange (Schultz No. 709) may be given as suitable.

The generally blue or bluish-green dye with which the support 15 is dyed and the generally orange dye with which the coating 11 is dyed are substantially complementary in color so that any light transmitted through the support 15 is not reflected back through the underneath coating 11, thereby eliminating substantially all the halation which would otherwise be caused by reflection from the surface of the paper base 10 or the colored coating 11. The bluish-green dye in the support 15 further serves to prevent halation due to scattering of light by the emulsion as it tends to absorb rather than reflect the shorter wave lengths scattered by the silver halide particles.

Curve 23 illustrates generally the sensitivity curve of a coating of chromated colloid such as is generally used in photosensitive resists for the printing of halftone negatives on copper, and may be considered typical of various "cold top" enamels, this sensitizing material having its maximum sensitivity at approximately 3,700 A. Curve 24 is a similar curve illustrating the sensitivity of bichromated colloids which have their maximum sensitivity at approximately 3,600 A., and it will be noticed that both the chromated and bichromated colloids may be insolubilized by the mercury vapor arc lines 3650 and 4080.

In actual practice it has been found that strip film, in accordance with the present invention, yields negatives which have greatly increased contrast between the halftone dots and the intervening portions, preserve the range of tones, reproduces much finer detail and can be etched and finished in much shorter time than with similar negatives made on conventional strip film material, and in many instances no re-etching, staging or hand finishing is required on the halftone photogravings. The strip film of the present invention also allows much wider latitude in exposure, both in the camera and on the metal. In fact, by the use of the strip film material of the present invention, the usual staging or finishing operations, requiring a great deal of skill and consuming a great deal of time, are almost completely eliminated.

The exposure required for the negative in the camera is not greatly lengthened, as the bluish dyed support 15 affects only the light transmitted by the emulsion and might be reflected by the base 10 to cause halation, as will be noted from curves 20 and 21 in Fig. 2.

It will also be noticed from curves 20 and 22 of Fig. 2 that the orange dye of coating 11 almost completely absorbs any light which might affect the principal sensitivity of the silver halide emulsion, and such small amount of reflected light as might affect the emulsion in the neighborhood of 5,500 A. is absorbed by the bluish dye in support 15.

During the fixing and washing operations following the development of the halftone negative, some of the bluish dye may be removed from the support 15 thereby increasing the transparency, but such dye as does remain, does not materially reduce the transmission of the light from the mercury vapor arc to which the photosensitive coating on the metal is sensitive, this light lying principally between the wave lengths 3,300 and 4,200 which is also the range of maximum transmission by the bluish dye.

While I prefer to use an orange or reddish dye in the coating 11, it is also possible to use the brown or other dark colors so long as they absorb the reflection of the actinic rays, although these dark colors would seriously interfere, in many instances, with the rapid handling and clear visibility of the image during the developing operation. The orange is readily visible and forms a strong contrast with the blackened dots in the negative formed in the emulsion layer 14,

thereby enabling the operator to readily see the character of the negative and determine when development has been completed and whether or not the negative is of satisfactory quality.

It is not necessary, although it is preferable, that any of the bluish dye remain in the support 15 after development. Its effect is exerted primarily during the photographic steps in the camera, but to some extent, the same effect is also obtained during the printing of the negative onto metal sensitized with the bichromate or other chromic acid salt sensitizer, the sensitizer and blue dye being complementary to each other.

Except as described, the operations in the production of a halftone negative and its printing on metal, may be carried out with the present invention as with conventional strip film material, and the same developing and fixing solutions may, in general, be used.

The invention in its broader aspects is not limited to the specific elements shown and described but departures may be made therefrom within the scope of the accompanying claims without departing from the principles of the invention and without sacrificing its chief advantages.

What I claim is:

1. A photosensitive material for photomechanical reproduction including a color sensitive silver halide emulsion layer sensitive to wave lengths substantially longer than 5,500 A., a supporting base, an intermediate filtering layer dyed relatively fast to the treating solutions, the filtering layer transmitting light to which a chromic acid salt is sensitive and absorbing most of the remainder of the light and the base being colored substantially complementary to the color of the filtering layer and a releasable layer between the filter layer and base.

2. A photosensitive material for photomechanical reproduction including a color sensitive silver halide emulsion layer sensitive to wave lengths substantially longer than 5,500 A., a supporting base, and an intermediate filtering layer of permanently bluish dyed collodion, the filtering layer transmitting light to which a chromic acid salt is sensitive and absorbing most of the remainder of the light and the base being colored substantially complementary to the color of the filtering layer and a releasable layer between the filtering layer and base.

3. A photographic negative strip film material for photomechanical use including a silver halide emulsion sensitized to light of wave lengths substantially longer than 5,500 A. supported on a layer colored with a substantially fast coloring material to transmit most of the light of a wave length shorter than 5,500 A. and to absorb most of the light of a wave length longer than 5,500 A. and a colored base on which the layers are adherent for easy detachment, said base absorbing most of the light of a wave length shorter than 5,500 A.

4. A photographic negative strip film material for photomechanical use including a silver halide emulsion layer sensitized to light of wave lengths substantially longer than 5,500 A., a colored layer colored with a substantially fast coloring material, a colored base to which said colored layer and emulsion are adherent for easy detachment with the colored layer intermediate the emulsion and base, said colored base absorbing most of the light of a wave length shorter than 5,500 A. and said colored layer transmitting most of the light of a wave length shorter than 5,500 A. and absorbing most of the light longer than 5,500 A.

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