TOPOGRAPHIC MAP AND PROCESS FOR SYMBOLIZING PHOTOGRAPHS

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FIG. 7 PRIOR ART



FIG. 1

TOPOGRAPHIC MAP AND PROCESS FOR SYMBOLIZING PHOTOGRAPHS

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FIG. 3



FIG. 2



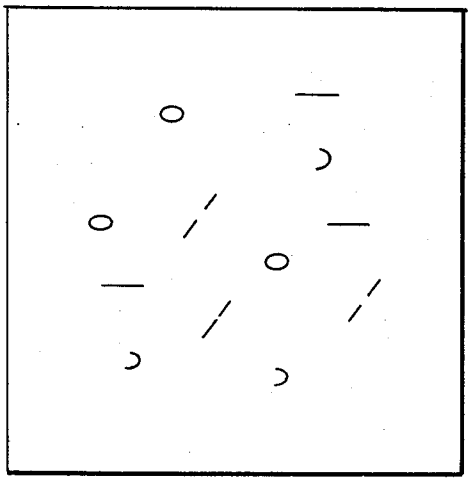
FIG. 4

June 6, 1972 M. MERRIAM 3,667,948

TOPOGRAPHIC MAP AND PROCESS FOR SYMBOLIZING PHOTOGRAPHS

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FIG. 6



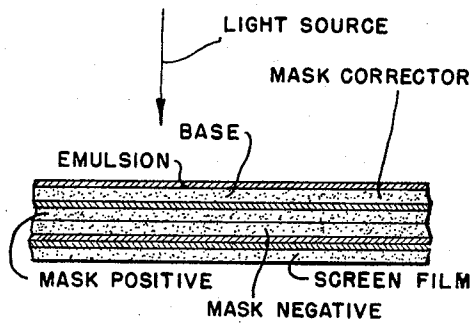


FIG. 5

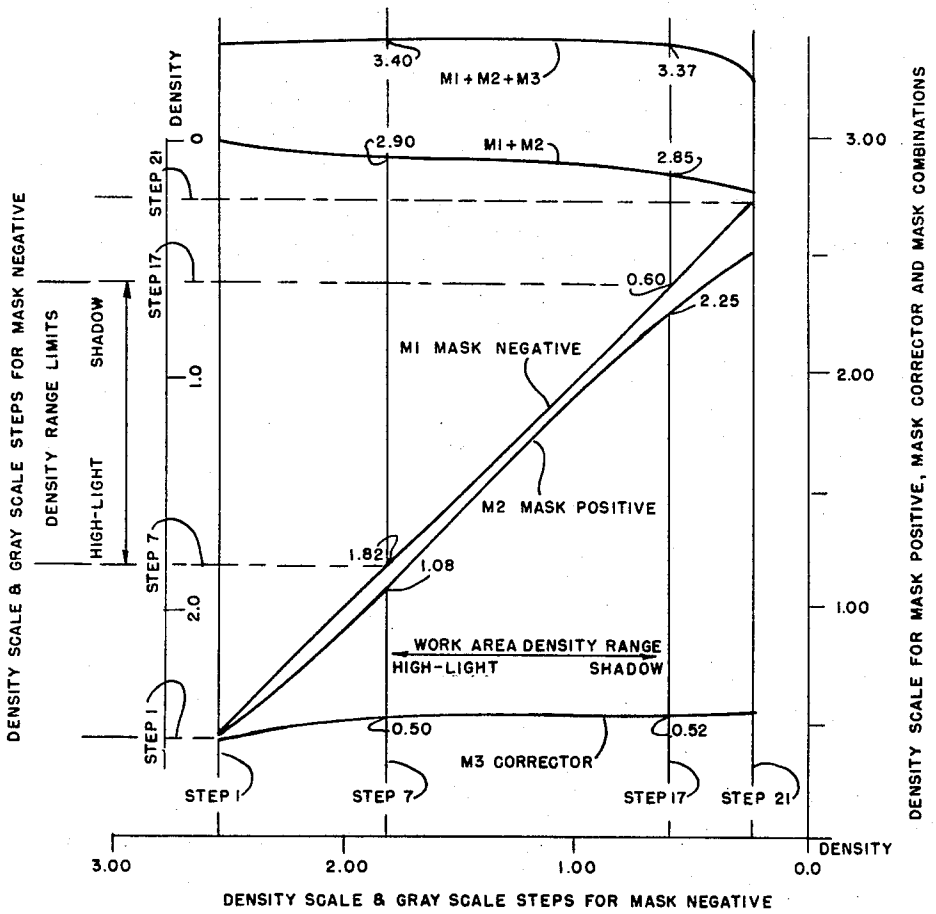


FIG. 8

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United States Patent Office 3,667,948
Patented June 6, 1972

3,667,948

TOPOGRAPHIC MAP AND PROCESS FOR SYMBOLIZING PHOTOGRAPHS

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Continuation-in-part of abandoned application Ser. No. 472,371, July 15, 1965. This application June 6, 1969, Ser. No. 831,193

Int. Cl. G03c 5/00; G03f 1/02

U.S. Cl. 96—44 8 Claims

ABSTRACT OF THE DISCLOSURE

This invention relates to a uniform tone image bearing photographic film screen and the method of preparing the film screen from a photograph. The film screen is subsequently utilized in making a map in which cartographic symbols are displayed as alterations in the tone of the images from the film screen, while maintaining the texture of the photographic image.

The invention may be manufactured and used by or for the Government for governmental purposes without the payment to me of any royalty thereon.

This application is a continuation-in-part of my copending application Ser. No. 472,371, filed July 15, 1965, now abandoned.

BACKGROUND OF THE INVENTION

To understand the significance of this invention, it is necessary to examine the basic differences between photographic images and map symbols. Before proceeding, it should be stated that the invention is not concerned with photogrammetric technology or photographic interpretation. The starting point is a fully interpreted and map graticule oriented aerial mosaic. In simple logical terms, a sign may be considered to state where something is but not what it is. A sign communicates location but not definition. A symbol, on the other hand, can be used to communicate definition but does not, by itself, communicate location. It must be placed. Generally speaking, a photographic image can be considered a sign. It is a natural sign stating features which the eye can discern as being different from one another. The image may not tell what the object is, only that it is there. The indicia which a cartographer adds to a map or photograph can be considered symbols, for example, contour lines, symbols for houses, vegetation, swamps, deserts, and roads. One can see from a map legend what the symbol for a road is, but the symbol must be located on the map by a cartographer before one knows where the road is.

The distinction between sign and symbol is important in cartography, but it is easily and often overlooked. Signs and symbols are often confused. For example, a skilled photographic interpreter may examine an aerial photograph and see what to him is clearly a mortar implacement in a narrow ravine under heavy vegetation. One lacking the interpreter's skill will look at the same photograph and see only a pattern of light and dark areas. He may be able to discern some change in pattern at the mortar site, that is, he sees the sign and knows where it is, but he does not know what it is. If he neglects to take his skill into account, the interpreter may believe the photograph is communicating both sign and symbol, when, in fact, the photograph is communicating only sign and it is the interpreter's experienced mind that supplies the symbol. On the other hand, the cartographer may draw a highly symbolized map which has no or poor signs

and which consequently does not permit a lay reader to orient himself with the terrain. It is these errors that the cartographer must guard against. His goal is to provide a map for an unskilled reader which communicates both sign and symbol; that tells what and where an object or group of related objects is with a minimum of interpretive contribution from the reader. Prior art arrangements have not proven successful in that tonal variations, both natural and accidental, in the aerial photograph have been included in the map together with tonal variations supplied by the cartographer for map symbols and map graphic devices. Thus, the resultant map tended to confuse the reader since the tonal variations from the photograph were often contradictory to the map symbols supplied by the cartographer.

SUMMARY OF THE INVENTION

This invention is concerned with treatment of an aerial photograph to produce a map which conveys sign and symbol to the map reader. An important aspect of the invention is that the texture of the photographic image is used primarily to convey sign or location, while tone is used primarily to convey symbol or definition. The conversion of the photograph to a map comprises two main steps. First, a film screen is prepared in which individual tonal difference of all images is removed, so far as possible, while retaining the texture of the image. Then, those images which the cartographer and interpreter desire to bring together or interrelate by symbolizing are uniformly strengthened in tone so that they are easily distinguishable as a class of distinctive line pattern or tone or both. Photo-masking is a technique for accomplishing these two steps. Previously, the texture of the photographic image and consequently the signs which it inherently conveys have been largely obliterated by the symbols which the cartographer introduces. Overprinting has hidden both the tone and the texture of the original photograph.

It is an object of this invention to provide a map which retains and uses the inherent texture of a photographic image as a natural sign to indicate location and which uses tonal variations superposed on the image as cartographic symbols to convey definition and interrelation.

Another object is to provide a method of making a symbolized map from an aerial photograph while retaining the textural but not the tonal imagery of the photograph.

Another object is to provide a photo-masking technique which will enable the cartographer to remove essentially all tonal differences from a photographic image without destroying the textural image.

Another object is to provide a method of bringing together and uniformly strengthening the tone of those images which are to be symbolized by cartographic tonal variations.

Another object is to provide a film screen of a photographic image which has granular texture but, so far as possible, no tone variation, and a method of making such a screen, the film screen being the basic element for converting the photographic image to a symbolized map ready for press plate, Ozalid, or similar mass reproduction without need of further screening.

Another object is to obtain tonal control over color separations for multi-colored printing of aerial photo bases for photo-based topographic maps, where the photo base is derived from black and white, or, colored aerial mosaics of separate photoprints which are not tonally matched, or, color matched.

Another object is to provide a printed image of aerial photography by use of the film screen which is suitable for field annotations by drafting or sketching in map line and name compilations.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a print made from the basic film screen produced by the process of this invention. The print contains granular texture without tone variation;

FIG. 2 is a print made from the film screen with contour lines, contour numbers and layer tint symbol tones added;

FIG. 3 is a print of the film screen with white and black lines and modulated shaded relief tones added including a pond shown in white;

FIG. 4 is a print of the film screen with a shorter range of original tones of the photograph added;

FIG. 5 shows the composition of the photo-mask used in the process to produce the film screen shown in FIG. 1;

FIG. 6 shows a grouping of arbitrarily chosen symbols used to illustrate map reading;

FIG. 7 is a print of the master photograph used in FIGS. 1–4; and

FIG. 8 is a graph of the range of densities of the individual components of the mask of FIG. 5 and their combined effect to produce the uniform tone film screen of FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENT AND METHOD

Texture and tone exist together in any photograph, and they exist together in the photograph which was the basis for the prints shown in FIGS. 1–4. In producing the basic film screen shown in FIG. 1, the tone is separated from texture, leaving only texture. This separation is accomplished by reducing tone to a substantially uniform gray. The texture of the image which remains is attributable to the structure and clustering of the granules of the photographic image itself. For a general discussion of this granular effect see U.S. Pat. No. 2,420,636, issued may 13, 1947 to J. A. C. Yule and my copending application Ser. No. 402,364, filed Oct. 7, 1964, now U.S. Pat. No. 3,413,119, issued Nov. 26, 1968. The screen of these patents is not suitable for use in the process of this invention, however, primarily because of the large size of their screen granularity and the non-universal spread of the granularity. The separation of tone from texture is accomplished by a photomasking technique using a three piece mask to obtain the film screen. The process is described below in connection with the following table of density data for the three piece mask.

The density data for the above table is displayed in terms of a step wedge, a standard for comparing densities, with a density range of interest extending from step 7 which begins with the highest high-light in all reproductions to step 17 which ends with the deepest shadow in all reproductions.

The first step in preparing a three piece mask is to obtain a suitable mask negative. Generally, the original camera negative cannot be utilized in the mask because it does not have a dense enough image in its shadow areas for the required granularity. Accordingly, a contact positive original is made from the camera negative to provide a transparency having a visual grainy image in the shadow areas which were lightly exposed and developed in the camera negative. The positive original has a heavy exposure and development in the shadows and thus amplifies granularity of the camera negative for these areas. Prior to utilizing the positive original in preparing the mask, the positive original is scanned with a diffuse densitometer having the smallest aperture possible in order to obtain an exclusive reading on the smallest aerial images. An aperture size no greater than 1 mm. in diameter is desirable for this purpose. The scanning of the positive provides an indication of the highest and lowest densities as they occur in the image area of the positive. These densities are then referred to a standard step wedge which in the present case utilized 21 steps at an approximate density increase per step of the square root of 2 and the positive having a density range before reproduction between 0.05 and 2.93 as shown in the table. The highest and lowest densities acceptable for reproduction purposes fall between the gray scale step wedge steps 7 and 17 as shown in the table with a density range of 1.42.

A primary reason for referring densities to a step wedge and its successive reproductions is to avoid the complexity of locating and measuring the same minute spots of highest and lowest densities in the successive negative and positive reproductions. The relatively large and numbered step wedge steps are easy to measure and the original step wedge is cut into the original positive outside the work area and remains there throughout successive reproductions of the wedge and the work area. Steps 7 and 17 remain throughout the process as representative of high-light and shadow with the density range

TABLE OF DENSITY DATA FOR THREE PIECE MASK UTILIZED IN PRODUCING FILM SCREEN FOR THE UNIFORM TONE PRINT OF FIG. 1

	Pos. orig.	M1 mask neg.	M2 mask pos.	Sum M1+M2	M3 mask corr.	Sum M1+M2+M3	Film screen
Gray scale step:							
1	0.05	2.54	0.42	2.96	0.41	3.37	0.50
2	0.23	2.44	0.51	2.95	0.43	3.38	0.50
3	0.39	2.32	0.61	2.93	0.45	3.38+	0.54
4	0.54	2.22	0.69	2.91	0.47	3.38	0.57
5	0.68	2.09	0.81	2.90	0.49	3.39	0.58
6	0.81	1.95	0.95	2.90	0.50	3.40	0.57
Begin highest highlight in all reproductions							
7	0.95+	1.82−	1.08	2.90	0.50	3.40	0.58
8	1.10	1.66	1.24	2.90	0.50	3.40	0.60
9	1.24	1.55−	1.34	2.89+	0.51	3.40+	0.60
10	1.38	1.43	1.46	2.89	0.51	3.40	0.60
11	1.51	1.29	1.59	2.88	0.51	3.40	0.61
12	1.65	1.19−	1.69	2.88−	0.51	3.39	0.62
13	1.79	1.05	1.82	2.87	0.52	3.39	0.64
14	1.92	0.93−	1.93	2.86	0.52	3.38	0.62
15	2.07	0.80−	2.06	2.86+	0.52	3.38	0.64
16	2.21	0.68	2.17	2.85+	0.52	3.38−	0.65
17	2.37	0.60	2.25	2.85+	0.52	3.37	0.68
Range	1.42	1.22	1.17	0.05	0.02	0.03	
Avg. density							0.63
End deepest shadow in all reproductions							
18	2.50	0.49	2.34	2.83	0.53	3.36	0.68
19	2.66	0.40	2.41	2.81	0.53	3.34	0.70
20	2.71	0.31	2.47	2.78	0.53	3.31	0.78
21	2.93	0.24	2.53	2.77	0.54	3.31+	0.85

between such steps being used for quality control for successive reproductions in forming the three piece mask.

Another reason for referring densities to a wedge scale is that the wedge steps generally go beyond the work range limits as shown in the table. This extension of the scale proves useful in two respects. First, the steps immediately adjacent to steps 7 and 17, i.e., 6 and 18, are undoubletedly representative of a few image densities which were too small to measure with a diffuse type densitometer and secondly, at least to begin with, a characteristic curve (H and D, or D log E) including the toe and shoulder portions of the emulsion-developer combination is needed to determine the best rates of contrast and best position of the work range on the characteristic curve in order to achieve quality control. Accordingly, after the positive original is provided with the step wedge as discussed above, a duplicate negative, i.e., the mask negative, is made from the positive original using conventional techniques and provides the first member of the three piece mask.

The second step is the making of a mask positive transparency by exposing the duplicate negative in emulsion-to-emulsion contact with an unexposed film. The film for the positive can be Eastman Kodak's Commercial, Estar base, 0.007 inch thickness. Exposure can be with a 212 bulb at 80 inches operated at 70 volts for 30 seconds, no reflector. Development can be in Eastman Kodak's Selectol Soft, mixed with two parts stock solution with one part water at 68° F., development time preferably being about 3 minutes with agitation by roll-turn of the film every 5 seconds. For purposes of explanation, the mask negative and the mask film positive in the table and in FIG. 8 have been labeled M1 and M2, respectively. In accordance with this invention, the mask positive and mask negative should preferably have a difference in density range within the work area range of approximately .05 for a sum range ($M1+M2$) reading when the positive is registered with the negative. As shown in the table and in FIG. 8, the density readings for M1 vary between 1.82 and .60 providing a range of 1.22 and the density readings for M2 vary between 1.08 and 2.25 providing a range of 1.17 with the sum of $M1+M2$ having a difference in range densities of less than 0.05. The sum range difference of course results from the fact that the mask negative M1 is wrong reading, i.e., high-light to shadow is graduated from dark to light tones and the mask positive M2 is right reading, i.e., high-light to shadow is graduated from light to dark tones. It has been found that although the 0.5 difference in range density is preferred, adequate results are achieved when the difference in range density is between 0.03 and 0.08. However, an important aspect of the invention is that in computing the sum range of $M1+M2$, the positive must always have the shorter range, i.e., the M2 range (1.17) must always be less than the M1 range (1.22) to produce the desired density sum range.

The third step is the production of a mask corrector. The mask corrector is made by exposing through a film sandwich composed of the mask positive and duplicate negative in base-to-base contact and the mask corrector film in emulsion-to-emulsion contact with the negative. The corrector is right reading. The film can be Eastman Kodak's Commercial. Exposure is preferably with a 212 projector bulb at 80 inches operated at 80 volts for 30 seconds, no reflector. Development is preferably for 3 minutes in Selectol Soft, 2 parts stock to 1 part water at 68° F., with agitation by roll-turn of the film every 5 seconds. As shown by the table, the mask corrector M3 has a density range of 0.02. I fthe mask corrector density range were more than 0.05, i.e., exceeded the difference in range densities of the mask negative and positive in combination (about 0.05 above), then a reversal would occur in the image screen texture showing high-lights—dark, shadows—light, or producing an inoperative negative looking screen. Thus, another important aspect of the invention is that, in addition to the requirement that M1 have a greater range than M2 the range of the negative mask M1 (1.22) must always be greater than the sum range of $M2+M3$ (1.19) to produce the desired density.

The use of the mask corrector is an important step in the production of the film screen in that it evens out the differences of the sum densities of the mask negative and mask positive producing a three piece mask having a substantially zero density range and increases the fineness and universal spread of the film granularity. The corrector serves to amplify the finest granularity everywhere and holds back and keeps porous the more solid granular clumps in deep shadow areas and supplies dot structure in the high-light areas which would otherwise be solid black or clear white, respectively. The granularity should exist everywhere on the screen. The perfectly random structure of granular clumping in all non-aerial image areas, including the full range—high-light, middle tone, and deep shadow—made such non-image areas texturally clearly distinguishable from the granular clumps representing the imaged areas when the final film screen is processed. This fineness and spread of film granularity makes possible for the first time the introduction of fine black or white map lines and universally distinguishable tone levels and modulated tone.

The fourth step is the production of the basic film screen of this invention. The screen is made by exposing through a three piece mask, as in FIG. 5, composed of the mask corrector M3 and mask positive M2 in base-to-emulsion contact, respectively, with the duplicate negative M1 in base-to-base contact with the mask positive and in emulsion-to-emulsion contact with the unexposed screen film. Referring to the table, it can be seen that the sum of $M1+M2+M3$ in accordance with this invention has a difference in range density of 0.03 such that the three piece mask has a density range which is less than the two piece mask and which approaches a zero density range in order to produce a uniform tone film screen. As shown in FIG. 8, the plot of the density data for the three piece mask is approximately a straight line with a small slope thereto. Thus, an important feature is that the three piece mask does not attain a zero density range but is substantially close thereto. The film for the film screen can be Eastman Kodak Kodalith Ortho III. Exposure is preferably with a No. 2 photoflood round bulb at 6 feet, in reflector, operated at 120 volts, moved in a 35 degree cone for 1 minute. Development is preferably for one and one-half minutes in Grapholith at 68° F. entirely immersed emulsion up immediately and allowed to soak for 20 seconds, then with agitation by roll-turn of the film every 5 seconds. In general, the film is slightly underdeveloped to keep it a soft screen. This screen is soft and right reading and as shown by the table has an average density of 0.63. The soft screen can be changed to a hard screen by conventionally exposing the soft screen in emulsion-to-emulsion contact with a lithographic duplicating film. The transition from soft to hard screen and the subsequent conventional exposures required to introduce symbol are preferably made with Eastman Kodak Kodalith Duplicating Positive film to prevent degeneration of granularity due to adjacency effect over many photo-duplicating steps. Ozalid prints or positive to positive press plates can be made directly from the film screen. FIG. 5 shows the composition of the film sandwich of the fourth step to produce a positive screen.

The film screen produced by the method just described is the basic building block for converting an aerial photograph to a symbolized map and is an image textured, tonally homogenous record of the aerial photograph. The screen has a uniform neutral gray tone produced by a dense, unbroken granularity of the film screen. The tone of the aerial photograph has been washed out but the texture of the granularity remains. As evidenced by FIG.

1, a surprising amount of photographic information is retained by texture alone. Thus, the fine dot and line structure alone, without tonal change from one area of the photograph to another, retains a clearly distinguishable record of even the smallest images of terrain objects of aerial photography. The screen at this stage conveys signs or location, but not necessarily definition, to a lay reader. A photographic interpreter could read meaning into the screen, however, and it is the cartographer's goal to subtly compensate, by use of symbols, for the expertise of the interpreter. Instead of throwing away the natural sign texture of the photograph, this invention retains texture for sign and permits addition of tonal modulation for symbol.

Reading a map consists of grouping map symbols in the context of topographic relations. FIG. 6 illustrates a grouping of arbitrarily chosen symbols used to illustrate map reading. It is apparent from FIG. 6 that the mind naturally groups like symbols. When one concentrates on the circles, he sees a triangle of circles; not three independent circles, but three interrelated ones. When concentration is shifted to the dashes, the circle relationship automatically dissolves and is replaced by a relationship of dashes.

By carefully selecting and employing his symbols, the cartographer can exploit the natural grouping function of the reader's mind to create the relationship of symbols which the cartographer desires to convey. For example, the addition of relief to a map provides a ground for the relation of map symbols, but more importantly, it also induces certain relationships and limits others. The relief surface logically limits, three-dimensionally contains, and extends the spread of patterned relationships of symbols. Examples of limitation are the zig-zag course of a road up a long steep slope, or a stream line down slope which never crosses the same contour twice. Good relief portrayal, thus not only provides the ground for, but actually induces the relations among symbol elements for the cartographic logic. It is an aid to the visual isolation and stability of very small areas on or between symbols anywhere on the map sheet, when these areas must be translated into graph points for co-ordinate number or for measurement of scale distances, directions, elevations above datum, etc. A direct portrayal of surface relief is thus the most important operator in relating groups of signs and symbols together on a common ground to satisfy cartographic logic principles.

The film screen is the basis for presenting the cartographic logic discussed in the preceding paragraphs. The cartographic expressions are added to the screen by the addition of tones to the uniform gray of the screen. Tones and lines are added by treating the film screen in the same manner as a conventional half-tone screen, the tones being obtained by differential exposure in reproducing the screen. FIG. 2 illustrates the manner in which layer tint relief and contour lines and numbers can be added to the screen of FIG. 1. The relief elevation levels are shown by a series of broad bands or hypsometric layer tints, each of uniform tone. In order to accurately portray relief in this manner, one must start with as nearly a uniform tone as possible. If the base tone varies, then the resultant of base tone and relief tone will vary, thereby introducing error to the relief portrayal. As shown in FIG. 3, if desired, and preferably, relief can also be shown by a modulated tone of relief shading. This shading was made by crayon drawing on double-frosted plastic which was then exposed in contact with the film screen of FIG. 1. Also, if desired, any range of the original tone of the photograph can be added to the screen, as shown in FIG. 4.

The greater detail shown by the print of the original tone photograph made from the film screen of FIG. 1 over a print made from conventional 133 line half-tone as shown in FIG. 7 is apparent from a comparison of the figures. It is apparent from FIGS. 2–4 that, except where the texture is erased by the thin black or white lines, the granularity remains to represent the original aerial image. The texture has not been obliterated by the tone as it has been conventionally. It is also apparent that the uniform gray of FIG. 1 permits addition of black or white lines which are everywhere visible. In photographs having white or black areas, white lines would disappear in white areas and black in black.

The addition of the tone shown in FIGS. 2–4 to the texture of FIG. 1 results in a one-film composite which can be used directly for Ozalid or one-color press reproduction. While gray has been the color used for example, other colors may be used equally well. By use of the one-film composite, the aerial photograph can be quickly and accurately converted to a symbolized map. If desired, symbols such as roads and buildings can be added to the screen conventionally. The symbols should be chosen consistently with the cartographic logic set out in this disclosure.

One of the most important advantages of the film screen of this invention over conventional photo-masking is that it permits the synthetic introduction into the aerial photograph of different levels of flat gray tones and long ranges of modulated gray tones. Slits of gray can be added to represent linear symbols, distinguishable levels of gray can be used for area symbols, and modulated transitions of gray can be used for shaded relief. Thus, many of the cartographer's graphical devices for showing land form and symbolizing surface features can be introduced without blocking out, overprinting, or otherwise obscuring the photographic image as currently happens in the so-called "photo-map." The use of this film screen permits almost perfect control over the synthesis of natural and symbolic imagery by the exact graduation of gray tones. Significantly, the gray gradient control is introduced at the end of the screening process, during the simplest photographic step.

The topographical map of this invention can be produced in any size desired. The desired size must be determined with the selection of the camera negative size at the beginning of the process, however, since the subsequent photo reproduction can be made only by the contact reproduction process. If size is altered by rephotographing through a lens after the film screen granularity has been produced, the fine granularity of the film screen tends to clump together or to drop out so that intended tone variations are replaced by unintended ones, thus destroying imagery.

I claim:

1. The method of preparing a uniform tone, image bearing photographic film screen comprising the steps of:

(a) preparing a film negative from the photograph to be reproduced, said film negative having a first density range;

(b) preparing a film positive from the film negative, said film positive having a density range less than said first density range;

(c) registering the film positive and film negative to form a two piece mask having a density sum range between 0.03 and 0.08;

(d) exposing light through said registered film positive and film negative onto an unexposed film to produce a mask corrector film for reducing the sum density range of said two piece mask;

(e) registering said mask corrector, said film positive, and said film negative to form a three piece mask having a density range which approaches zero; and

(f) exposing light through said registered mask corrector, film positive, and film negative onto an unexposed film to produce a screen which has substantially uniform tone and a fine universal texture of film granularity portraying the images of the photograph to be reproduced.

2. The method of preparing a topographic map from a photograph, said method comprising the steps of:

(a) preparing a film negative from the photograph to be reproduced, said film negative having a first density range;

(b) preparing a film positive from the film negative, said film positive having a density range less than said first density range;

(c) registering the film positive and film negative to form a two piece mask having a density sum range between 0.03 and 0.08;

(d) exposing light through said registered film positive and film negative onto an unexposed film to produce a mask corrector film for reducing the sum density range of said two piece mask;

(e) registering said mask corrector, said film positive, and said film negative to form a three piece mask having a density range which approaches zero;

(f) exposing light through said registered mask corrector, film positive, and film negative onto an unexposed film to produce a screen which has substantially uniform tone and a fine universal texture of film granularity portraying the images of the photograph to be reproduced;

(g) differentially exposing various areas of the screen produced in step (f) to selectively add various tones to the screen to denote map symbols, said differential exposing being controlled within limits which prevent the tone blocking out or dropping out the granular texture of the photographic image; and
texture of the photographic image; and

(h) printing the map from the composite film of step (g).

3. The mehod described in claim 1, wherein the film positive of step (b) is prepared by exposing the film positive in emulsion-to-emulsion contact with the film negative, wherein the mask corrector of step (d) is prepared by exposing the mask corrector film through a sandwich composed of the film positive and film negative in base-to-base contact and the corrector film in emulsion-to-emulsion contact with the film negative, and wherein the film screen of step (f) is prepared by exposing the screen film through a sandwich composed of the mask corrector and film positive in base-to-emulsion contact and the film negative in base-to-base contact with the film positive and emulsion-to-emulsion contact with the screen film.

4. The method described in claim 2, wherein the film positive of step (b) is prepared by exposing the film positive in emulsion-to-emulsion contact with the film negative,

wherein the mask corrector to step (d) is prepared by exposing the mask corrector film through a sandwich composed of the film positive and film negative in base-to-base contact and the corrector film in emulsion-to-emulsion contact with the film negative, and wherein the film screen of step (f) is prepared by exposing the screen film through a sandwich composed of the mask corrector and film positive in base-to-emulsion contact and the film negative in base-to-base contact with the film positive and emulsion-to-emulsion contact with the screen film.

5. The method described in claim 2, wherein the various tones obtained by step (g) are various tones of gray.

6. A three piece mask for producing a uniform tone, image bearing photographic film screen comprising a mask corrector, a mask positive having the emulsion thereof in contact with the base of the corrector, and a mask negative having the base thereof in contact with the base of the positive, the emulsion of the negative being arranged to be placed in contact with the emulsion of a screen film, said corrector, said positive and said negative having a sum density range which approaches zero with said negative having a slightly larger range than the sum density range of said corrector and said positive combined.

7. A film screen having a uniform tone and a fine universal texture of film granularity portraying the images as reproduced from a photograph, said film screen being prepared by the process described in claim 2.

8. A graphic arts film screen containing a photographic image composed of a fine dot and line structure preserving the pattern structure of an original photographic image with all tonal contrast by tonal variations of gray tone of said original photographic image removed, said graphic arts film screen being prepared by the process described in claim 2.

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U.S. Cl. X.R.

96—45, 116