

March 18, 1941.

F. G. YANES

2,234,997

DIRECT PHOTOMECHANICAL REPRODUCTION

Filed March 8, 1939

2 Sheets-Sheet 1

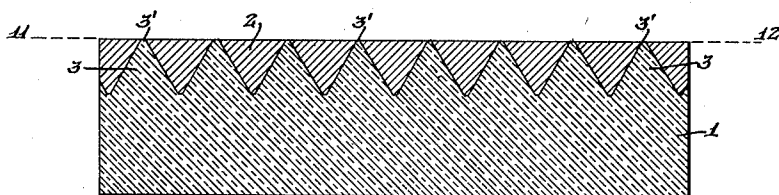


Fig. 1

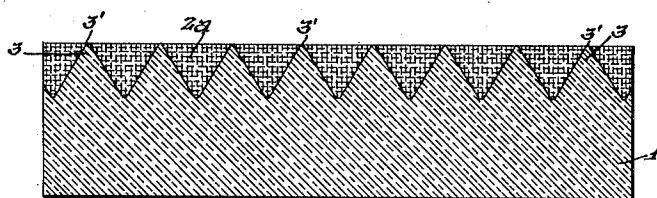


Fig. 2

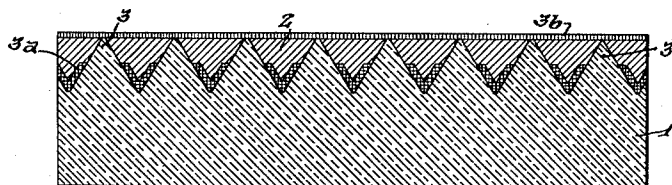


Fig. 3

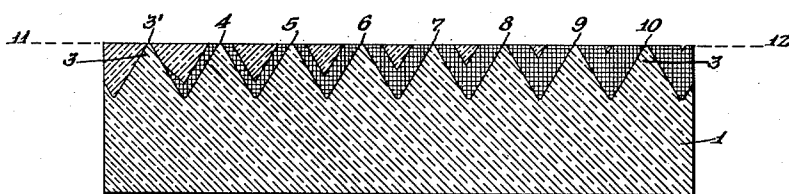


Fig. 4

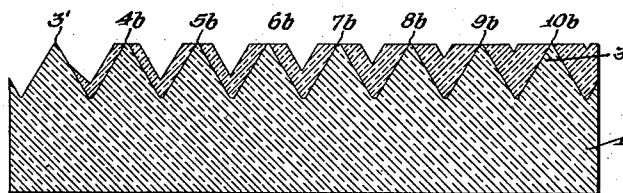


Fig. 5

F. G. Yanes
INVENTOR.

March 18, 1941.

F. G. YANES

2,234,997

DIRECT PHOTOMECHANICAL REPRODUCTION

Filed March 8, 1939

2 Sheets-Sheet 2

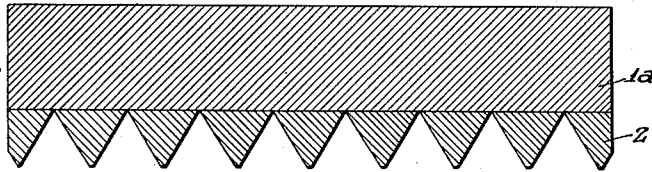


Fig. 6

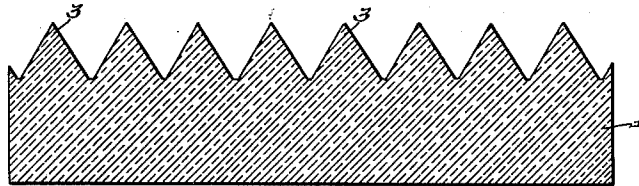


Fig. 7

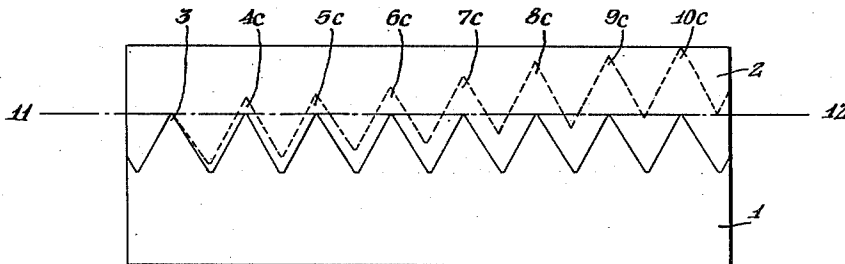


Fig. 8

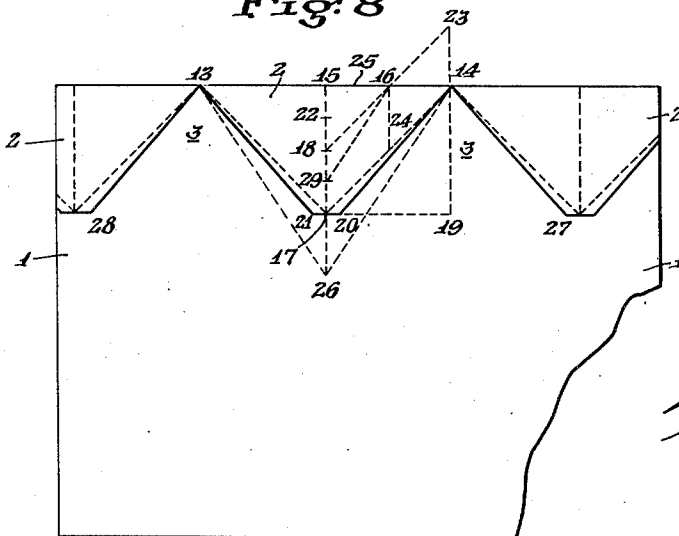


Fig. 9

F. G. Yanes
INVENTOR.

UNITED STATES PATENT OFFICE

2,234,997

DIRECT PHOTOMECHANICAL
REPRODUCTION

Francisco G. Yanes, New York, N. Y.

Application March 8, 1939, Serial No. 260,519

17 Claims. (Cl. 95—5.6)

The invention relates to a method of photo-mechanical reproduction similar in results to photoengraving but based upon another principle and using other means than those utilized in the known art.

In the ordinary process two different operations are necessary to produce a half-tone plate. First a half-tone negative is obtained through a special screen by means of which the photographic values are divided and converted into values suitable for mechanical reproduction, and then a positive is printed from said negative, usually on a metallic plate, so as to form a resist to etching solutions which finally produce the required relief for typographic printing purposes.

According to the present invention the photographic values are at once converted into printable relief values. Such result is obtained by means of a new sensitized element which, due to special conditions of substance and structure, can be exposed under an ordinary negative and then transformed by the photographic process into a printing plate.

Besides simplification and economy, both in equipment and manipulations, the new method presents several advantages which will become apparent in the course of the present disclosure.

The principle upon which the new invention is based, is that photographic values can be not only divided but also shaped, as for instance, in a plurality of cones. If a sensitive coating is moulded by a pattern producing a plurality of minute depressions of a conical shape and then an image is printed on said material, the light effect will always be produced in depth, but such depth will begin at the inner surface of the empty cones and naturally a plurality of geometrically similar cones of different diameters and of different heights will represent the light effect. If we now suppose that these cones are cut by a plane parallel to their bases, the sections will have a circular form and different diameters proportional to the heights of the different cones, which are proportional to the light effect. If we wish that the smallest values be represented by the smallest possible sections of said cones the sectional plane must be tangent to the vertices of the depressions so that a faint light effect will only slightly increase the height of the respective cone and the section will correspondingly be very small. Now, if we materialize the idea and actually mould that pattern on and through the thickness of a sensitive emulsion coated on a porous paper, so that all the layers of the emulsion be penetrated by the pattern, the light effect will be produced in a series of truncated cones having tops of different diameters and ending at the plane separating the emulsion and the paper. If then we apply to the material a suitable substance filling the depressions and cement

the exposed side of the emulsion to a supporting surface, the image can be developed through the porous paper, the emulsion hardened by known treatments in the places occupied by the shaped image, while the unhardened emulsion and the paper may be washed away in hot water. The result will be a plate having printable values proportional to the light effect and represented by small dots similar to those produced in the ordinary photoengraving process.

In the invention such principle has been reduced to practice in a simpler way. Instead of filling the depressions of the moulded emulsion after the exposure, these are already filled by a support made of a substance which transmits the light to which the medium is sensitive, so that this can be exposed as if there were no support on that side. That makes the porous paper unnecessary and greatly simplifies the processing, because as soon as the emulsion is exposed, developed, hardened in the places occupied by the image and the remainder eliminated, the plate can be dried and is ready for printing. The invention, however, must fulfill certain requirements which will be later disclosed.

In the drawings:

Fig. 1 is a section showing one form of the material.

Fig. 2 is the element with a screened emulsion.

Fig. 3 is the element provided with light controlling means.

Fig. 4 shows the light effect after the element is developed.

Fig. 5 illustrates the processed final plate.

Fig. 6 shows the shaped medium without the printing support.

Fig. 7 is the new support without the medium.

Fig. 8 is a diagram showing how the photo-mechanical values are formed.

Fig. 9 is a diagram demonstrating the requirement of height in the projections of the support.

In Fig. 1 is shown a transparent support provided on one face with minute salient portions 3 projecting into the light sensitive medium 2 whose sensitivity or preferably the medium itself does not extend beyond the plane 11—12 at the vertices 3', 3', of the projections. To simplify the description the word "medium" has been adopted to express the matter filling the spaces between the projections, but as it will be found in the course of the disclosure such matter may include plural sensitized media and combinations of a sensitive medium and substances insensitive to light. In the example the portions 3 are uniformly distributed to provide a regular typographical pattern which will print dots equivalent to the high-lights of a half-tone plate. Such pattern, however, may be irregular and the projections may print different designs, as straight or undulated lines, small commas, and 60

many other graphic elements susceptible of producing in their normal size an impression equivalent to the conventional white in half-tones and which, when increasing in size, will furnish the half-tone effect. A condition of the pattern, whatever its design, is that it be uniform, that is to say, showing the same appearance all over the plate. The protruding pattern must fulfill a requirement concerning the height of the projections. From the bases to the vertices of the small cones, the height must be more than half the distance between the vertices of two adjoining projections. Such requirement establishes a difference of operative structure between the support of the present invention and a support having the usual depth of high light dots in the regular half-tone block, as these, even for the coarser screens, do not present that depth as it will be shown later. Outside of structural requirements the support must be susceptible of transmitting a light to which the medium 2 is sensitive. In the example the support has been illustrated as transparent and colorless which is suitable for an ordinary light sensitive medium and regular printing light. But obviously an ortho or panchromatic emulsion could be exposed through a colored support; or a specially sensitized emulsion through a support made of certain substances opaque to ordinary light but transmitting special rays to which the emulsion is sensitive. Furthermore, when the light sensitive medium is initially applied to a porous paper in moulded form as illustrated in Fig. 6, in order to expose the moulded material before the final support is provided, the latter need not to be transparent at all. In the preferred form, as explained, the transparency of the support greatly facilitates the manipulations. Another condition of the support is to be susceptible of standing printing pressure. There are many substances which besides being transparent are strong enough for the purpose, as bullet-proof glass, transparent cast resinoids, hardened gelatine, cellulose nitrate, cellulose acetate and equivalents. I have found that the substance commercially known as cellulose acetate, is a suitable plastic, because it is transparent, slow burning, and more adaptable for embossing than cellulose nitrate, although the last is preferable as less absorbent of moisture. Either one can be sharply cut in an ordinary photo-trimmer and are easily filed and shaped. Those plastic materials are more or less abrasible but on account of the remaining medium wear well in printing outside of the fact that photomechanical plates are seldom printed directly but cast by stereotype or electrotyping. When making the matrices for embossing the support I may prefer to produce the ruling by mechanical means well known by engravers; or by etching in depth a "shadow" plate with "flash" dots of suitable size. To carry far enough the etching of a "high-light" plate offers the danger of undercutting and the difficulties inherent in the even re-etching of a plate which has to be moulded by electro-deposition. There are other known means of securing different grains with the advantage of directly producing the plate or cylinder to shape the support of the invention. In regard to thickness of the support there is no special limitation because, being transparent, the image can be focused at the desired plane. A gauge of .85 furnishes a very solid and practically rigid plate. For contact printing, and also for economy, plates of a thinner gauge are desirable which may be easily cemented on a thicker plate

or block. As to form, the support may be pre-cut or in flexible lengths, according to the applications of the new material, which offers many possibilities.

The medium 2 must be sensitive to light. This does not mean that it must necessarily be sensitive when coated on the support, for gelatine and different compounds may be applied to the support to be later sensitized by the worker with a bichromate solution. It must also be susceptible of being hardened at the places which receive the image. The medium may be applied plain or mixed with other filling matter which may contribute to strengthening its wearing conditions. Known substances may be added to the medium or processing solutions to prevent excessive swelling. A preferred sensitive medium is a silver emulsion, which is faster and desirable for enlarging. The image produced in such emulsion can be hardened by known means. Another requirement of the medium is that it must be applied in limited amounts so that when dry it will surround the minute projections, without, however, substantially extending beyond the vertices of said projections. The limited coating is purported to prevent that the hardened medium after the processing be retained beyond the printing plane of the support, thus a limitation of the sensitivity of the medium beyond that plane will be equivalent even if the projections are covered by said medium as shown in Fig. 3, which will be later discussed. This limited coating or sensitivity, is a feature desirable to produce the photomechanical half-tone values which we shall now consider.

The formation of the values is illustrated in the diagram of Fig. 8, where the support 1, provided with projections 3, is completely covered by a sensitive emulsion 2, for the purpose of demonstration. In that material, if used as in my invention, the light effect of a scale of grays will appear as a succession of cones of different heights 4c to 10c, showing values only in depth. But if we cut those cones by a plane tangent to the vertices of the jutting sections, represented by the line 11-12, we shall have a succession of truncated cones of the same height under that plane and a succession of small cones of different heights above. As these small cones are geometrically similar, the diameter of their bases will be proportional to their heights which at the same time are proportional to the light effect. As the bases of the small cones and the upper sections of the truncated ones under the plane 11-12 are the same area, the proportional values in depth will be transformed in proportional values on this plane, having as center the axis of the respective cones. Now, if we actually produce that section by limiting the coating or the sensitivity of the medium to the vertices of the projections, the photomechanical values will be automatically produced, with the same height and on the same plane.

The height of the projections is illustrated in the diagram of Fig. 9, where the support 1, limitedly coated with the emulsion 2, shows two adjoining jutting sections 3, 3, having a height 14-19 which is half the distance between the vertices 13-14. Assuming that the projections touch one another at 17, the triangle 15-14-17 will be rightangled and any rightangled triangle formed upon part of the same hypotenuse and having one side perpendicular to one of the sides of the first triangle will be geometrically similar and so, whichever be the light effect,

shown as example in the diagram on the lines 17—18, it will be the same at 24—16 and will produce on the outer plane an equal effect 16—14. In other words, the section of maximum light effect which along the hypotenuse of the triangle would be a losange 17—18—23—14 in a material unlimitedly coated as in Fig. 8, is now—in the limitedly coated material of the invention—a trapeze in which the sides 17—18 and 14—16 are equal. It is easy to realize that when 15—17 is shorter or longer than 15—14 the middle point 18 will be lower or higher, but, as the line 17—14 will also change, the parallel will always cut 15—14 at 16. So, a light effect reaching half the distance between 15—17, which is the thickness of the emulsion, will produce a half-tone effect of half the distance 14—15. Whatever the length 17—18 in relation to the line 17—15, the effect 14—16 will be in the same relation with the line 15—14. This shows that in the material of the invention the photographic values in depth are changed into proportional photomechanical values on the printing plane automatically and regardless of the height of the projections.

We shall now see what must be the proper high-light depth, or height of the salient parts of the support, in order that a half-tone light effect, whose depth is the line 15—18 in Fig. 9, should produce the required depth of a half-tone dot in a printable half-tone plate.

According to Halftonometer readings on a large number of new plates by Mr. F. W. Gage of Battle Creek, Michigan, the depth of the etching in the average half-tone plate, is in ten thousandths of an inch:

Screen lines	High-lights	Half-tones	Shadows
55.....	80	50	30
85.....	46	31	22
100 (zinc).....	32	22	14
100 (copper).....	26	18	10
120.....	25	17	10
150.....	22	14	9
175.....	18	10	6

Taking as a basis for calculation the known separation between dots produced by different screens we shall have in ten-thousandths of an inch:

Screen lines	Dot separation	Half	Quarter
55.....	182	91	45.5
85.....	118	59	29.5
100.....	100	50	25
120.....	83	41.5	20.8
150.....	67	33.5	16.8
175.....	57	28.5	14.3

The above figures will now be examined in the diagram of Fig. 9. Let the figures of the column "dot separation" be the distance 13—14, those of the "half" column the heights of the projections 14—19, and those of the "quarter" column the printing depth 15—18 of the half-tone dots. The last will be very close to the half-tone etching depth column shown before in "Mr. Gage's" measurements of printable plates. So the half-tone dots will be printable whenever the height of the projections is half the distance between their vertices, which, of course, applies to any grain or texture of the pattern, whether regular, irregular, dotted, lineal or otherwise.

When the protruding pattern of the support is not the result of a specially etched, engraved or

moulded plate, but a replica of a regular printable plate representing a high-light tint, the situation is different for the half-tone dot will not have a proper printable depth. Let the figures of high-light depth of "Mr. Gage's" measurements be the height of the projections 14—19, half of those figures the half-tone depth 15—18, and compare them with the printable depth in the referred measurements:

Screen	High-lights	Half	Printable	Short
				Percent
55.....	80	40	50	20
85.....	46	23	31	26
100.....	32	16	22	28
120.....	25	12.5	17	26
150.....	22	11	14	21
175.....	18	9	10	10

The question of the shadow-dot depth in the diagram of Fig. 9 must now be examined. When the light effect at the bottom instead of 17—18 is 17—22 the light effect at the surface forms the shadow 14—25 and the printing depth is 15—22. We shall assume 17—22 to be one-and-a-half the half-tone effect 17—18. So 15—22 is half of the depth 15—18. If we compare the regular depth of the etched shadow-dot in average printable plates, first with the depth obtainable when 14—19 is half 13—14 and second when it is the regular high-light depth in the etched average blocks, we will have in tenthousandths of one inch:

Screen	Printable	First case	Second case
55.....	30	22.7	20
85.....	22	14.7	11.5
100.....	14	12.5	8
120.....	10	10.4	6.3
150.....	9	8.4	5.5
175.....	6	7.1	4.5

Which shows not only that the depth of the shadow-dot would be inoperative when the height of the projections is that of the regular high-light etched dot but that as far as the shadow-dots are concerned the depth falls slightly short of requirements even when the height of the projection is half the distance between two adjoining ones; therefore, it will be on the safe side to adopt for the projections a height greater than half the distance between the tops of two adjoining projections in order to secure printable shadow detail.

In the examples of the invention, the height of the projections is shown as being about $\frac{3}{4}$ the distance between the vertices of two adjoining projections. Although a height such as that is not necessarily essential to secure a printable plate, the printing depth of half-tone and shadow dots will be secured in this case for it is greater than the regular depth in etched plates:

Screen	Half-tones	Regular	Shadows	Regular
55.....	68.3	50	34.1	30
85.....	44.3	31	22.1	22
100.....	37.5	22	18.8	14
120.....	31.2	17	15.6	10
150.....	25.2	14	12.6	9
175.....	21.4	10	10.7	6

In the example the shape of the projections has been described and illustrated as conical, but pyramidal protruding elements or any jutting sections decreasing in size from base to top and ending in the same plane will do. The form of the dot or line will naturally depend on the struc-

ture of the projections. The structure may be produced by engraving machines cutting with angular stylus crossed grooves, or drilling conical depressions on a suitable substance, and then producing the embossing mould by electro-deposition. I have found this kind of relief pattern superior to the one produced by etching which does not furnish the required shape and specially the necessary depth. An etched pattern can of course be obtained but the production of such deep high-lights are beyond the ability of the ordinary worker and etching does not offer facilities for producing uniform and suitably shaped projections. When the etching is produced as intaglio the danger of undercutting disappears but the sharp ends of the projection loses in fineness and the reproduction although possible is not so satisfactory as when the pattern is directly engraved.

After examining the proportional formation of the values and the required printing depth for every dot, we shall now consider the question of contrast, or relative value formation among several dots. Although this side of the question is mostly photographic and familiar to those skilled in the art, we shall make a survey of its principal aspects for completion of the present description.

As the invention has been thus far disclosed, the whites are already formed and the photomechanical values are automatically and proportionally produced on the printing plane. The question remaining is to adjust the sensitivity of the element so that when exposing for the half-tones the shadows and particularly the blacks will fall in place. This question may be solved: 1. By selecting a type of emulsion of suitable contrast according to the fineness of the pattern which, for different types of plates will have different depths, and will hold coatings of different thickness. 2. By adopting an emulsion of average contrast and developing the printing negative so that the half-tones will not be over-printed when the shadows attain their full value. 3. By producing several types of material to suit negatives of different contrast as practiced in the photographic industry for positive films and papers. 4. By coating the material with two emulsions of different color sensitivity, as an orthochromatic or panchromatic followed by a plain one and printing with a composite color light transmitting more light for the selected layer; or by separately exposing with different color lights. 5. By coating with a plain medium at the bottom and a sensitized medium on top, the side or rather central support of the projections making immaterial whether the shadows have a hardened support from the bottom. 6. By shortening the height of the projections to the possible minimum near the required half of top distance. 7. By screening the vertices of the projections with a slight tint. 8. By printing or projection control. 9. By printing for the shadows and then reducing the half-tones by after treatments. 10. By any other means known to the art or a combination of means.

Another question which must be borne in mind when selecting the type of emulsion or the means to secure the desired contrast is that the light-effect forming the shadows does not only act straight from the bottom but it is also reflected inside of the projections. That reflection could be eliminated by adding a dye to the emulsion and printing with a light complementary to the transmission of the pigment. Or it may be in-

creased by a semi-transparent silvering of the support before coating. If we examine the projections of Fig. 9, it is easy to realize that part of the light falling upon the side 14—27 will be reflected upon the side 14—20, a circumstance which can be utilized in the manner shown in one of the illustrated types of the material now to be examined.

In the example of Fig. 1, the transparent support 1 is provided with projections 3, 3, having a height of more than half the distance between the vertices of two adjoining ones. This support 1 is limitedly coated with a sensitive medium 2 of suitable contrast.

In Fig. 2, the support is limitedly coated with an emulsion 2a in which a screening yellow dye is incorporated. Such provision, as it is well known, gives a better rendition of the values and furnishes a greater range of exposures. It may be utilized to counteract the side light-effect caused by reflection within the projections and also in combination with other contrast controlling means.

In Fig. 3, examples of means to modify the effect of exposure of the medium 2 are presented in 3a and 3b.

The portion 3b in Fig. 3 represents a layer impervious to the printing light; this layer may be opaque or red colored, as illustrated, for an ordinary emulsion, and it may serve different purposes as to prevent halation or to limit the sensitivity of the medium 2 to the printing plane of the support 1, which is equivalent to a limitedly coated support, as long as unaffected by light such layer will not be hardened and will be washed away. This layer 3b may be an extra coating or it could be produced by dyeing to the required depth the surplus emulsion in a support coated beyond the printing plane; the last by known dyeing operations utilizing the properties of certain dyestuffs or the addition of alcohol to the coloring liquor.

The screening means illustrated in 3a Fig. 3, is an opaque substratum deposited and fixed at the bottom of the pattern; or may equivalently consist of a dye which would color the lower layers of emulsion at the bottom of the support; or of any other provision to reduce or even to suppress the light-effect around the bases of the projections. It may be observed in the drawing that the light obstructing means 3a, Fig. 3, is uniformly distributed and extends from the bottom of the support to part of the projections themselves, leaving clear the upper portions ending at their vertices. Such support provides a sort of screen in which the light-obstructing sections 3a represent the lines and the clear section 3 the openings, the slanting sides of the projections providing means to proportionally increase the size of the dots by effect of exposure, as illustrated in Fig. 9. When so screened the material will be suitable for harsh negatives, for the light furnished by the almost transparent parts of such negative cannot produce through the bottom of the pattern more than a half-tone dot and it is only by side light-effect that the shadow dots will be completed after a long exposure; in the meantime the light tones buried in the negative density will produce their values. It is obvious that for a flat negative, instead of an opaque substratum as 3a a transparent one of plain gelatine could be substituted, which will speed up the formation of the shadows and increase the contrast. In either case there will not be any exposure at the bottom and no hardened medium to support the shadows,

but the side support provided by the projections will make that immaterial.

The above examples seem sufficient to show the new material and some of the means to modify it for the different kinds of photographic negatives. In Fig. 6 the same material is presented on a provisional support of porous paper 1a. Although this is not a preferred form of the material, it may produce the same result through a more elaborate processing and will be an article of much reduced cost of manufacture. In Fig. 7 is finally illustrated a bare support, which may be coated with a sensitized medium by the worker himself, as for instance with bichromatized compound. This bare support is made of the same transparent, pressure resisting substance heretofore referred to and has the required depth and shape above discussed.

We may now proceed to describe the simple processing of the material.

The new sensitive element is exposed through its support under an ordinary photographic negative, either by contact or by enlarging. In certain cases, as in newspaper work, it may save considerable time. As the exposure is made by transmitted light there are no disturbing reflections as in copy work. Instead of the usual glossy and contrasty original where so many values are already lost, the negative with all its range of tones is utilized. As has been shown, the support of the new material is susceptible of printing typographically a high-light tint, so the whites are already formed, and the opacities of the negative, transmitting no light, will leave those whites unaffected. The exposure is thus simplified to properly expose the shadows and the rest of the values will fall in place because they are always proportional to the light effect. A test piece of the material may be exposed by steps and developed without fixing, to better judge the values on the surface of the plate. Once the convenient time is selected and the material exposed it may be treated by any known sulphiteless developer which will harden the image or, in case that some correction of contrast is desired, by an ordinary developer, to be later hardened by any known formula. After the hardening the plate is treated by hot water around 120° F. to remove the unhardened medium and then finally dried. It is now ready for proofing, mounting and printing.

The process may require some additional steps when the negative is too contrasty or too flat to produce the desired relative proportion of the values. As there is no danger of disturbing the whites the exposure of the half-tones may be increased as far as necessary and a cutting solution such as Farmer's, used to better the contrast between shadows and half-tones. Even the high-lights could be corrected by giving a flash exposure without the negative if a larger high-light dot is desired.

It must be understood that the essential step of the processing method is to produce in the sensitive element of the invention the required values by exposing the same through its support, for once said values are obtained there are quite a number of relief processes, known to the art from old, to eliminate either the exposed or unexposed sections of originally sensitized matter carrying a picture.

The formation of the values 4c—10c was demonstrated in Fig. 8. The same values 4—10 corresponding to a scale of grays, are shown after development in the material illustrated in Fig. 4. And the final plate, after the image

has been hardened and the unhardened colloid dissolved away, is shown in Fig. 5, with the printable values 4b—10b.

When instead of a silver emulsion a bichromate mixture is used as medium, the light effect produces the hardening and the rest of the process is the same. Both in this case, as when using silver emulsions, I may submit the final plate to a second hardening in a solution of formaldehyde or basic alum.

The invention is also suitable to produce line blocks due to the fineness of the high-light pattern which is practically a white. For that purpose the form of the material illustrated in Fig. 6 may provide a real line cut by using a soluble substance to fill the depressions after the exposure, for both the unhardened parts of the medium and the filling substance supporting these parts will wash away in the processing.

In regard to other possibilities of the new invention it is worthwhile to observe that by printing under a positive instead of negative the same material treated in the same manner will furnish an intaglio printable plate. For that purpose of course, a more suitable pattern may be provided, but even the one illustrated will furnish a dotting for the protection of the shadows and give a good print. Still another possibility is to use the same plate, printed and processed in the same manner, both for typographic printing with a greasy ink and for dye printing as in the Wash-off process. As the values are formed by a colloidal substance this, though hardened, will take the water soluble pigments by known means, with the advantage that the high-lights, where the projections do not retain any medium, will not show any dotted effect, while the half-tones representing the colors will be brightened with a beautiful pointillist effect. A fine pattern would be convenient for this application of the invention.

During the course of the above disclosure same as in the claims defining the invention a geometrical language has been adopted to facilitate the understanding of the principle and materialization of means, ways and products. Terms have been employed such as cones, triangles, bases, vertices, tangent planes etc. As such words convey a mathematical and exact meaning, it must be understood that, within the limits of operativeness, they are not meant to so limit the invention in practical manufacture.

After having described to the best of my knowledge the present invention, I wish to be understood that the present disclosure is for the purpose of illustration only and that the invention includes any variations and equivalents within the scope of the following claims.

I claim:

1. In a photographic element, a support provided on one face with projections of triangular sections perpendicular to the plane of the element and ending in a common plane tangent to their vertices, and a medium between said projections having light-sensitive areas terminating on said plane.

2. In a photographic element, a support provided on one face with projections decreasing in cross-sectional area from their bases ending in a plane tangent to their vertices and forming a printable pattern, and matter sensitive to light in the spaces between said projections terminating substantially on said plane.

3. In a photographic element, a support provided on one face with projections progressively

decreasing in cross-sectional area from their bases and forming a printable pattern at a plane tangent to the apices of said projections, matter on said face of the support having light-sensitive areas between said projections terminating on said plane, said matter also having other areas insensitive to light.

4. In a photographic element, a transparent support provided with uniformly distributed projections on one face progressively decreasing in cross-sectional area from their bases and terminating on a common printing plane, and a light-sensitive medium in the spaces between said projections also terminating on said printing plane.

5. In a photographic element, a transparent support provided with uniformly distributed projections on one face progressively decreasing in cross-sectional area from their bases, terminating at a common plane and forming thereon a printable pattern, matter sensitive to light in the spaces between said projections also terminating on said plane, and means for modifying the effect of exposure at selected portions of said matter.

6. In a photographic element, a porous support, and matter sensitive to light of substantially uniform thickness on one face of said support having depressions or recesses of the same size and shape progressively decreasing in cross-sectional area, said depressions having a depth substantially equal to the thickness of said matter.

7. In a photographic element, a support, and matter susceptible of being sensitized to light on said support, said matter having a plurality of uniform minute depressions progressively decreasing in cross-sectional area through the thickness of the matter, ending sharply at the same plane and substantially penetrating all the body of said matter.

8. In the art of photomechanical reproduction, a support for matter sensitive to light said support transmitting light to which the matter is sensitive, said support provided with minute projections on one face to form a printable high-light even pattern, and having sufficient strength to resist typographic printing pressure, said projections of triangular sections perpendicular to the plane of the support, the cross-sectional area of said projections progressively decreasing from their bases to the printing plane of the pattern, said projections having a height exceeding one half the distance between the vertices of two adjoining projections, and said projections limited in number to a minimum of thirty and a maximum of two hundred and fifty projections to the inch.

9. In the art of photomechanical reproduction, a plate provided with minute projections on one face to form a printable high-light even pattern, said projections progressively decreasing in cross-sectional area from their bases to the printing plane of the pattern, having a height exceeding one half the distance between the apices of two adjoining projections and being limited in number from thirty to two hundred and fifty projections to the inch.

10. In the art of photomechanical reproduction, a support for matter sensitive to light, said support provided with minute projections on one side to form a printable high-light pattern, said support transmitting light to which the matter is sensitive and having sufficient strength to resist typographic printing pressure, and screen-

ing means fixed at selected sections of the side of the support provided with projections, other sections of said support remaining clear, said screening means being uniformly distributed, the clear sections in the support including the upper side portions and printable vertices of the projections.

11. In the art of photomechanical reproduction, a sheet of transparent pressure resistant material, provided with minute projections on one face to form a printable pattern, said projections progressively decreasing in cross-sectional area from their bases to the printing plane of said pattern and having a depth exceeding one-half the distance between the apices of two adjoining projections and a light-sensitive medium between and upon the surfaces of said projections and terminating on the printing plane of said pattern.

12. In the art of photomechanical reproduction the method which comprises producing a photographic record in depth on and through a thickness of matter sensitive to light and characterized by having at the exposure side a plurality of uniformly distributed minute depressions or recesses decreasing in cross-sectional area and sharply ending at the other side; providing for said matter a support filling and fitting the depressions; and treating in known manner the supported matter by a relief process suitable to remove the matter from the support except in those sections occupied by the positive values of the photographic record when these are as usually the ones to be reproduced.

13. The method of producing a photomechanical plate suitable for typographic printing which consists in first producing a photographic element including a temporary porous support bearing a thickness of matter sensitive to light and characterized by having on the bare side a plurality of depressions or recesses decreasing in cross-sectional area and sharply ending at the side contacting the support; second photographing a subject on the bare side of said element and through the sensitive matter, giving sufficient exposure as to produce at the plane of the vertices of the depressions minute sections corresponding to photomechanical values; third providing for the element a second and final support by filling the depressions with/and extending over the exposed side matter susceptible of resisting printing pressure; and fourth, treating in known manner the exposed element by a relief process suitable to remove the temporary porous support and the originally sensitive matter from the element except in those sections occupied by the positive values when these are as usually the ones to be reproduced.

14. In a photomechanical process the step of transforming photographic values of different depths into photomechanical values of different superficial areas which consists in first photographically recording light values on a light sensitive body provided on the exposure side with minute depressions decreasing in cross-sectional area and sharply ending on the other side, said depressions presenting at the ending plane a pattern of high-light values, the inner structure of the depressions causing the light effect to begin at different depths and to become shaped into a geometrically similar surrounding structure around the depressions, this sort of shaped light effect being proportional to the amount of light, the surrounding structures which represent it having different sizes and

heights, all limited by the ending plane where different light effects correspond to sections of different superficial areas geometrically similar to the high-light areas of the pattern; and then treating the exposed body as a photographic material in order to develop and utilize the transformed values in the photomechanical process.

15. A method of photomechanical reproduction which consists in first producing a high-light printing plate, said plate transmitting light and characterized by having projections of suitable shape and printing height decreasing in cross-sectional area to and sharply ending at the same plane; surrounding said projections by matter having areas sensitive to light, said sensitive areas substantially ending at the plane of the vertices of the projections; second, photographing a subject through the bare side of the light transmitting plate on and through the sensitive matter, giving sufficient exposure as to produce at the plane of the vertices of the projections minute sections corresponding to photomechanical values; third, treating in known manner the exposed plate by a relief process suitable to remove the matter from the element except in those sections occupied by the positive values when these are as usually the ones to be reproduced; and drying, inking and printing the processed final plate.

16. In a photomechanical plate including a plurality of minute printing elements substantially having a common printing plane, a number of sharply ended elements of high-light printing areas, and a number of second elements having a greater printing area, said second elements formed by first elements carrying additional matter which surrounds their bodies without substantially extending beyond the printing plane of the plate, such additional matter increasing the printing area in said second elements.

17. A half tone block comprising a plate provided with a fundamental high-light printing surface formed by minute printing elements substantially having a common printing plane, some of said printing elements being substantially bare and some others having additional matter surrounding their bodies at and near the printing plane, said additional matter held in different proportions by said second elements and respectively increasing to different sizes their printing areas without substantially extending beyond said plane, thus forming beside the bare elements of high-light printing areas other elements of tone and shadow printing areas.

F. G. YANES.