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PHOTOENGRAVING

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This invention relates to photo-engraving and is concerned with a new and improved procedure for producing half-tone photo-engraved plates. In particular, the invention is directed to an improved method for carrying out the operation 5 known as reetching and to novel compositions for protecting the photo-engraved plate during such reetching. This application is a continuation-in-part of my copending application, Serial No. 605,437, filed July 16, 1945, now abandoned. 10

In the production of a half-tone photo-engraved plate, the picture, portrait, or the like forming the subject is first photographed through a screen of the desired fineness to produce a negative reproducing the original in a dot pattern. This negative is inverted and placed on a light-sensitive surface carried by a metal plate, generally of copper or zinc; and a light source is directed against the inverted negative to form a reproduction of its dot pattern on such surface. 15 The undeveloped portions of the sensitized surface are removed to expose the bare metal of the plate; and the developed portions representing the dot pattern of the original are fixed in place by heat or chemical action. 20

The plate is now given a flat etch as by immersion in a still bath of an etching medium or by spraying of the etching medium thereagainst. For copper plates this etching medium customarily comprises an aqueous ferric chloride solution of approximately 30° to 40° Baumé gravity; 25 for zinc plates, dilute nitric acid of approximately 1 to 5% strength. The plate is subjected to the etching medium for a time sufficient to produce a first bite of moderate depth. If a deep etch is necessary or desirable, the flat-etched plate is given a second bite, the sides of the dots, however, usually having been first protected with an acid-resist such as dragon's blood to prevent undercutting of the dot surfaces. 30

The resulting partially etched half-tone plate produces a print in which there is generally insufficient contrast or tonal distinction between the shadows, the middle tones, and the high lights and is satisfactory only for limited purposes. To produce the necessary tonal gradation, the partially etched plate is reetched, an operation in which the high lights and the middle tones are more definitely separated from each other and from the shadows and are made respectively 35 lighter, so that a greater contrast between the light and the dark portions of the resulting print is presented.

Reetching, as customarily carried out, is performed entirely by hand and is a painstaking, 40

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time-consuming operation requiring considerable skill and extensive experience for the production of satisfactory work. The first step is to paint over or stop out the darkest or shadow portions of the plate with a suitable acid-resisting medium, which is generally applied thereto with an artist's paint brush or the like. The application of the acid-resisting medium must be very carefully done so that only the shadow portions are painted over in order to prevent any resulting overlap from appearing obvious in the print; and the reetcher must also be careful to see that all the shadow portions are stopped out. Several types of acid-resisting materials can be used for this purpose, and various asphaltum or similar preparations are commonly employed. Where an asphaltum-containing preparation is used, it must be burnt in after its application to prevent its smearing when the painted-out plate is subjected to the etching medium. 45

The painted-out plate is then treated with the etching medium in order to further etch or re-etch the unprotected portions of the etched surface and thereby increase the tonal contrast between the darkest portions and the rest of the plate. This treatment may be carried out either by placing the plate in a still bath of the etching medium or by locally applying the etching medium to the unprotected portions of the plate as with a suitable brush. In either case, the action of the etching medium is allowed to proceed for a period, generally on the order of a few minutes or more, until a sufficient lightening of the unprotected areas, i. e., an enlargement of the size of the middle-tone dots and a reduction in the size of the high-light dots, has been achieved. (In this specification, the terms "shadow dot" and "middle-tone dot" refer to the etched-out holes or depressions in the shadow and middle-tone sections of the plate, respectively, and the term "high-light dot" refers to the raised portions of the high-light section of the plate.) The plate is then washed free of the etching medium and examined to check the progress of the reetching. 50

This procedure is repeated any desired number of times, that portion of the plate which has been reetched sufficiently being painted out before each subsequent treatment with the etching medium. Generally, this staging operation is repeated three or four or even more times until the tones have been lightened to the desired extent. The acid-resisting medium is then removed, and the plate is cleaned and made ready for proofing. 55

It will be apparent that this staging-out procedure of reetching is subject to serious disad-

vantages. As already indicated, the painting-out of the portions of the plate to be successively protected against further etching is a laborious and tedious operation that, depending on the tonal complexity of the original subject, requires an overall period of time ranging from an hour or so to a day or more to be accomplished. Where the portions to be protected have definite outlines, the reetcher must follow such edges carefully to avoid any obvious overlap or blank space. Where the tones on the original subject blend softly into each other as in foliage and the like or where the original subject has delicate shading as in a portrait or wash drawing, the reetcher must carefully avoid harsh differences in tone and etching marks caused by abrupt stopping-out and obviously must take more time to produce a proper plate. Furthermore, each plate is handled individually because each must be separately staged and treated with the etching medium. This operation obviously seriously limits the capacity of a photo-engraving establishment and materially increases the cost of a half-tone plate. Moreover, considerable care and much experience are needed to determine the amount of reetching required so that the proper relation of the tonal values in the original is maintained.

I have now discovered an improved system of reetching a partially etched half-tone photo-engraved plate whereby the disadvantages of this customary reetching procedure are substantially avoided and a superior printing plate is produced. My invention includes not only an improved method of reetching such a plate but also provides a novel protective material especially adapted for the carrying out of such method.

Essentially, my improved method comprises applying a hard, adhesive, acid-resistant, water-immiscible protective material containing as the major and essential ingredient a plurality of hard waxes including candelilla wax in an amount at least equal to that of any of the other hard waxes to a partially etched plate so that such material fills in the etched areas of the plate. This protective material is then removed from such filled-in etched areas in such a manner as to expose again the bare metal in only a portion thereof; and the resulting partially protected plate is treated with the etching medium for a period of time on the order of a few seconds to etch further the exposed, unprotected etched areas and thereby lighten or reetch the same.

Advantageously, the partially reetched plate, which presents a somewhat improved tonal gradation generally between the high lights and the rest of the plate, is subjected to at least one other and usually several additional treatments with the etching medium so that the desired tonal contrast and separation between the high lights, the middle tones, and the shadows are obtained, the remaining protective material being progressively removed from the plate between successive reetchings. Usually, on the order of three to eight or more such treatments are sufficient to provide the necessary degree of contrast.

Although applicable to the reetching of both copper and zinc plates, my invention has been found especially useful in the production of superior copper half-tone plates at a reduced cost. Moreover, the present system is equally as applicable to the reetching of the several plates required in three- and four-color process work as it is to the reetching of black-and-white plates.

In the practice of my invention, the partially etched plate is first cleaned with a solvent such as benzol or alcohol and then with an acidic cleansing agent such as an aqueous acetic-acid paste of sodium chloride in order to remove any acid-resist such as dragon's blood that may have been applied thereto and any extraneous foreign matter or dirt that may have accumulated thereon. If the plate has been deep-etched with an acid-resist, it may with advantage now be given a further etch in order to substantially lessen or eliminate the resulting shoulder on each dot. The plate is then washed with water to remove the cleansing materials or the etching medium and dried. Drying of the plate is advantageously effected by heating, which is desirably continued until the temperature of the plate is sufficient to melt the hard, adhesive, acid-resistant, water-immiscible waxy protective material and to maintain such material molten during the preparation of the plate as described hereinafter.

The protective material is now applied to the heated plate, and the resulting liquefied waxy material is spread over the entire etched surface thereof. Application of this waxy protective material to the plate can be accomplished simply by rubbing a solid cake thereof over the etched surface and spreading the molten material by manipulation of the solid cake. No particular care or skill is required in such application other than to be certain that the molten waxy material entirely fills all the etched-out areas of the plate; and this object can be assured by using an excess of such material.

The excess molten waxy material is then removed as by rubbing a soft cloth, desirably with a circular motion, over the etched surface of the plate, such rubbing also insuring that all of the etched-out areas are filled with the molten material. Upon removal of the excess molten waxy material, the rubbing of the etched surface of the plate is continued, desirably with a clean cloth, for partial removal of the molten waxy material from the filled-in etched-out areas to expose a portion thereof. As a guide to the duration of such rubbing operation, it can advantageously be terminated when the etched surface of the plate appears bright to the eye. From the many examinations I have made with a microscope of plates prepared in this manner and from the nature of the results obtained during the subsequent treatments with the etching medium, it appears at this point that the molten waxy protective material has been removed substantially entirely from the bottom of the etched-out areas surrounding the high-light dots and to a progressively lesser extent from the etched-out middle tone and shadow dots and has been banked against the sides of the high-light dots and to a progressively greater extent against the sides of the middle-tone and shadow dots.

The molten waxy material having been partially removed from the etched areas, the plate is cooled to solidify the protective material remaining thereon. The plate is now ready for reetching. First, however, a cleansing medium such as the aqueous acetic-sodium chloride paste is advantageously rubbed over the etched surface, this operation facilitating the subsequent reetching and apparently removing any remaining excess waxy protective material therefrom.

The plate is now subjected to the action of the etching medium. This reetching is advantageously accomplished by placing the plate face up in a

still bath of the etching medium for a period on the order of a few seconds to a minute or so. With a copper half-tone, highly satisfactory results have been obtained by immersing the plate face up in an aqueous ferric chloride bath of the proper strength for a time ranging from two or three seconds to twenty seconds or slightly longer. At the end of the reetching period, the plate is removed from the etching medium bath and is preferably again cleansed with the aqueous acetic-acid-sodium chloride paste and then washed with water for removal of the slight scum formed as a result of the etching action.

Although some improvement is noticeable from this single reetching, the plate is advantageously subjected to at least one further reetching and preferably to several further reetchings in order to develop the tonal lightening, gradation, and separation to the finest extent possible. Each reetching is effected by immersion of the plate in the etching medium bath for a period on the order of a few seconds or so. After each reetching it is desirable to examine the plate to be certain that the action of the etching medium is proceeding as desired. Between successive reetchings the plate is preferably cleaned with the aqueous acetic acid-sodium chloride paste.

The effect of subjecting the plate to the several successive reetching periods is to produce a marked lightening of the middle-tone as well as of the high-light dots. The precise manner in which the hard, adhesive, acid-resistant, water-immiscible waxy protective material acts to bring about this improved result is not known. In any event, however, it is certain that there is a gradual and progressive lightening of the high lights and the middle tones and to some extent of the shadows as the plate is given the successive reetchings.

Apparently, there is a gradual removal of the waxy protective material from the plate, which result is probably attributable both to the successive cleansings of the plate after each reetching period and to the action of the acidic etching medium during each reetching period. Each treatment with the cleansing agent, which is desirably rubbed over the plate with a light circular scrubbing motion, apparently effects the removal of a portion of the waxy material remaining thereon. In addition, the etching medium, being able to etch more deeply the exposed bottoms of the high-light areas and the middle-tone and shadow dots, is apparently enabled thereby to begin to undercut and, as a result, slightly loosen the protective material banked against the sides of the dots so that, when the plate is cleansed immediately following each reetching period, a portion of the banked waxy material is broken off and removed. The best results appear to be obtained when a cleansing agent such as the aqueous acetic acid-sodium chloride paste is used to clean the plate between successive reetchings; but fairly good results can be obtained by only washing the plate with water.

Whatever the exact explanation may be, there is no doubt that the waxy material remaining on the plate is gradually and progressively removed therefrom and that reetching of the plate is accomplished. Moreover, by means of my invention it is for the first time possible, so far as I am aware, to simultaneously reetch the middle tones and to some extent the shadows, if desired, as well as the high lights without successively staging out the sufficiently etched areas of a plate.

As the plate is subjected to the successive re-

etching periods, a gradually increasing shine can be observed particularly after several reetchings (generally from two to six or more depending on the duration of the reetching periods). This shine indicates that the banked waxy material is being progressively removed from the plate and that lightening of the middle tones and to some extent the shadows is being progressively effected simultaneously with the continued lightening of the high-light dots.

The plate is subjected to the successive reetching periods until the desired degree of tonal lightening or reetching and the desired tonal separation between the high lights, the middle tones, and the shadows are accomplished. Generally, the shadows will have been etched to the desired extent, and no reetching thereof is necessary. The shadow dots will, however, also gradually lose the waxy material initially retained therein although, because of their smaller size, the waxy material is retained thereby longer than by the middle-tone dots. If and when the waxy material has been substantially removed from the shadow dots, they will, of course, be lightened simultaneously with the continued lightening of the middle-tone and the high-light dots although customarily such extreme reetching is neither desirable nor necessary unless a graying of the shadows is additionally desired.

The number of reetchings possible to which a plate can be subjected is governed to some extent by the initial size of the high-light dots since the entire reetching should generally not be carried to the point where any significant portion of the high-light areas is entirely etched away. Accordingly, inasmuch as the initial size of the high-light dots is controlled and governed by the manner of the production of the dot pattern of the negative, a relatively large initial high-light dot permits the plate to be subjected to a greater number of reetchings.

Similarly, the number of reetchings to which a plate is subjected is partially dependent on the degree of removal of the waxy protective material as a result of the successive reetchings, the extent of tonal lightening being controlled thereby. The number of reetchings necessary to produce a desired result is also governed by the particular composition utilized. The nature of the enamel is important, for a more severe scrubbing action is required with a harder than a softer top. And, as will be readily understood, the duration of each reetching treatment is partly controlled by the strength of the etching medium and by its temperature.

After the final reetching, the plate may be washed with water and is cleaned with a suitable solvent to remove the waxy protective material remaining thereon. The plate is preferably then again cleaned with the aqueous acetic acid-sodium chloride paste, washed, and dried. It is now ready for chalking up and final examination.

The resulting plate represents a material improvement over a plate reetched by the customary procedure and has an extremely fine and sharp tone gradation and separation that can only rarely, if ever, be equalled under the customary practice even when an exceptionally high degree of skill is utilized for the purpose. Moreover, not only is the tonal value of the original faithfully reproduced, but it is generally materially improved especially where the original comprises a poorly taken photograph or a similar subject.

As already indicated, the protective material

utilized in this reetching procedure comprises a waxy composition containing a plurality of hard waxes as the major and essential ingredient. Typical hard waxes that can be used for this purpose include the hard vegetable waxes such as candelilla wax, carnauba wax, and ouricury wax, the hard mineral waxes including the high melting point microcrystalline waxes, particularly those having a melting point on the order of 180°-190° F. or higher, and the hard synthetic waxes and wax-like materials such as the high melting point complex nitrogen derivatives of the higher fatty acids including the amides of higher fatty acid esters.

All these waxes possess those characteristics which I have found desirable or essential for use in the present procedure. In particular, they are solid at ordinary temperatures, and their melting points are not excessively high. Accordingly, my protective material can readily be utilized in the form of a solid cake, which, as previously described, can be simply applied as by rubbing over a plate heated to a temperature sufficient to melt the particular material employed.

They are acid-resistant; and, being water-immiscible, these waxes do not spread or run when the protected plate is subjected to the etching medium. In molten condition they have such a viscosity that the protective material can easily be spread over the plate and are not so thin that the protective material is likely to run off the plate if it happens to be tipped. These waxes are also relatively hard, and, being relatively nongreasy as well, they permit the protective material to be handled without any discomfort. They have no noticeable effect on the life of the etching medium.

Of primary importance is that these waxes, both in their solid and liquefied conditions, are adhesive and sticky with respect to the plate metal. It is this adhesive or tenacious quality which, together with the hardness of these waxes, appears to account in large part for the gradual and progressive removal of the protective material as a plate protected therewith is subjected to the successive reetchings. Only with such gradual and progressive removal of the waxy protective material is it possible to obtain a balanced reetched plate which presents a gradual even increase in tonal density from the lightest high lights to the deepest shadows. Moreover, because my protective material is relatively adhesive and hard, a plate can be evenly reetched without the appearance of any streaks or lines, which would otherwise be produced by the use of a material that is soft or does not adhere sufficiently strongly to the plate.

For the production of satisfactorily reproducible and consistent results, I have found that the plurality of hard waxes forming the major and essential ingredient of my protective material should include candelilla wax, which should be present in an amount at least equal to that of any of the other hard waxes. Apparently, candelilla wax gives the protective material an adhesive quality and imparts thereto a certain smoothness without which a plate tends to reetch more or less unevenly. Those compositions which do not include candelilla wax as one of the hard waxes or which contain candelilla wax in an amount less than that of any of the other hard waxes, while effecting a reetching of sorts, produce a ragged-appearing plate that is generally unsatisfactory.

These protective materials can be prepared

simply by mixing the several hard waxes in the desired proportions and heating and stirring the resulting mixture until a homogeneous composition is formed. Alternatively, each wax can be individually melted, and the several molten waxes blended together. Care should be observed, of course, that the several waxes selected are compatible in the proportions desired since otherwise a nonhomogeneous unsatisfactory composition will result.

It is frequently possible or desirable to blend or compound various other substances in a minor proportion with the several hard waxes forming the basis of my protective material. For example, it may be desired to reduce the cost of the protective material, in which case such substances should be so selected and should be used in such amounts as not to materially alter the essential characteristics thereof. Again, it is possible by judicious selection and proportioning of such substances to effectively improve or modify one or more of such characteristics. Typical substances that I have found suitable for these purposes, particularly for modifying one or more characteristics to advantage, include beeswax, rosin, stearic acid, talc, and ethyl cellulose. Obviously, any such substance should be compatible and miscible with the mixture of hard waxes used.

I have found that an especially good reetching is produced with a protective material containing such a mixture of candelilla, carnauba, and ouricury waxes as the major and essential ingredient. A blend of all three waxes in approximately equal proportions by weight, for example, produces a reetched plate having a satisfactory dot structure. Small amounts of beeswax, rosin, or stearic acid and/or amounts, less than that of the candelilla wax, of other hard waxes such as montan wax or a relatively high melting point microcrystalline wax can be effectively compounded with this base mixture. Advantageously, the ratio of the candelilla wax to the carnauba wax and the ouricury wax together in such a composition is at least 2:1 by weight.

I have had particular success in using as the protective material a composition containing a major proportion of such a mixture of these three waxes and a minor proportion of rosin and beeswax. Typical examples of such a composition especially suitable for the reetching of copper plates include the following (all parts by weight):

Candelilla wax	12	12	15	8
Carnauba wax	3	1	2	2
Ouricury wax	3	2½	4½	4
Rosin	1½	4	4	2½
Beeswax	3	1	1	1½

Very satisfactory plates can be produced with these compositions. One to two parts of ethyl cellulose and/or talc can be compounded with these formulations with advantage.

The following examples are representative of compositions of this type specially designed for use in the reetching of zinc plates, particularly those with a relatively coarse screen (all parts by weight):

Candelilla wax	8	4
Carnauba wax	2	2
Ouricury wax	1	1
Stearic acid ester amide (melting point of about 280° F.)	3	5
Microcrystalline wax (melting point of about 190° F.)	--	4
Rosin	2	2
Beeswax	4	--

Again, small amounts of talc and/or ethyl cellulose can be blended with these formulations. A particular advantage of such compositions is that they permit a very lightly flat-etched plate not only to be reetched but also to be simultaneously deep-etched to a very satisfactory extent.

Other typical examples of compositions that can be used as the protective material in the present procedure, comprise the following (all parts by weight):

Candelilla wax-----	3	7	15
Carnauba wax-----	2	--	--
Ouricury wax-----	--	2	1
Montan wax-----	1	4	--
Rosin-----	1	1	1
Stearic acid-----	--	--	1

A small amount of beeswax can be added to such compositions if desired.

The application of these compositions is not limited to any particular screen fineness, for I have successfully employed a number of such compositions in the reetching of plates made from a wide range of screen sizes—from as coarse as 60-line to as fine as 175-line.

The present procedure possesses definite and distinct advantages over customary reetching practice. It is substantially mechanical in nature and eliminates the tedious hand work, artistic skill, and extensive experience customarily required for satisfactory results. The reetching of a plate can accordingly be standardized as to such factors as the number of reetchings and the length of each reetching for a given initial high-light dot size and a given degree of flat-etching. No particular skill is necessary for carrying out such procedure, and it can be taught to an ordinary operator within a short time.

Moreover, so far as I am aware, it is for the first time possible to reetch an entire flat containing any number of plates in a single operation. Accordingly, not only does the present method save considerable time in the reetching of a single plate, but it permits a great many plates to be reetched together substantially in the time that would be required for any single one of such plates. As an example, a flat containing as many as 50 small plates can be completely and uniformly reetched in less than half an hour with my procedure whereas, with customary practice each individual plate has to be separately reetched by hand, each reetching requiring from ten to thirty minutes or longer.

It will be at once apparent that, because of the very nature of the present procedure, the production of a photo-engraving establishment can be tremendously increased. Simultaneously, the cost of producing a finished half-tone plate can be materially reduced.

Furthermore, my invention permits accurate control of dot structure and even reetching over the entire etched surface. A superior tonal contrast and a finer gradation and separation of the high lights, the middle tones, and the shadows are obtained; and a deeper etching is generally obtained at the same time. There is no possibility of the production of undesired sharp outlines or harsh areas in subjects with delicate shading. In addition, it is possible to bring out all of the detail of the original subject.

Although I have indicated that plates to be reetched in accordance with my invention are advantageously placed face up in a still etching bath, they may also be placed face down therein. Moreover, they may also be reetched in an etch-

ing machine of any suitable type if desired. In such cases, however, care must be observed that the duration of each reetching period and the necessary number of bites may be somewhat different.

The production of substantially identical "duplicate" plates can be simply accomplished with my invention. Two or more plates of the same negative can be printed on a single flat, which is then subjected to flat-etching and to reetching in accordance with the present procedure. The resulting plates are identical with one another, and the customary costly method of making "duplicate" plates by careful reetching and comparison of each plate with the other is eliminated.

My invention can also be used to reduce the cost of vignetting. In such case the entire plate is reetched at the same time that the marginal areas thereof are being substantially completely etched away, and a deeper overall etching is obtained.

The present reetching procedure may be considered the reverse of customary reetching practice: in accordance with the present invention, the entire plate is covered with the hard, adhesive, acid-resistant waxy material, which is then gradually and progressively removed to expose the high lights first and then the middle tones up to the shadows whereas in customary practice, the shadows, the middle tones, and occasionally a portion of the high lights are successively painted out in such order.

I am aware that the Murray patent, No. 1,225,477, suggests the use of paraffin wax in the reetching of high lights. Paraffin wax is entirely unsatisfactory for the present purpose, however, because it is much too soft and because it does not adhere or stick sufficiently or properly to a plate. Its use is wholly unreliable and results in the production of streaks and lines across the plate and, at the most, produces only a partial but completely unsatisfactory reetching of the high lights without any noticeable reetching of the middle tones.

The use of a mixture of beeswax and petrolatum for high-light reetching has also been proposed heretofore. This mixture, however, is even more unsatisfactory than paraffin wax. Its use is uncertain and is even less reliable because it results in a very streaky plate bearing little resemblance to the original subject. Moreover, like paraffin wax, it contaminates the acidic etching medium after a few bites to such an extent that it is deposited out on the face of a plate being reetched, thereby resulting in a speckled appearance. The use of beeswax, also previously suggested, is similarly unsatisfactory and unreliable.

Various modifications may be made in the practice of my improved reetching procedure without departing from the scope of my invention.

I claim:

1. The method of reetching a partially etched half-tone photo-engraved plate to effect a gradual lightening of the tones thereof, which comprises applying to the etched surface of the plate to fill in the etched areas thereof a hard, adhesive, acid-resistant, water-immiscible protective material containing as essential ingredients a plurality of hard waxes including candelilla wax, said hard waxes together comprising the major proportion of said protective material, the amount of candelilla wax being at least equal to

that of any of the other hard waxes, removing the protective material from such filled-in etched areas of the plate to expose only a portion thereof, then treating the plate with an acidic etching medium to effect an initial reduction in the size of the printing dots in such exposed, unprotected portion, removing the protective material from a further portion of the etched areas of the plate, again treating the plate with an acidic etching medium to effect a further reduction in the size of the printing dots in the resulting unprotected portion thereof, and repeating such removal of the protective material from the etched areas and such treatment with the etching medium until the desired degree of lightening is accomplished.

2. The method of reetching a partially etched half-tone photo-engraved plate to effect a gradual lightening of the tones thereof, which comprises applying to the etched surface of the plate to fill in the etched areas thereof a hard, adhesive, acid-resistant, water-immiscible protective material containing as essential ingredients candelilla wax, carnauba wax, and ouricury wax, said three waxes together comprising the major proportion of said protective material, the amount of candelilla wax being at least equal to that of either of the other two waxes, removing the protective material from such filled-in etched areas of the plate to expose only a portion thereof, then treating the plate with an acidic etching medium to effect an initial reduction in the size of the printing dots in such exposed, unprotected portion, removing the protective material from a further portion of the etched areas of the plate, again treating the plate with an acidic etching medium to effect a further reduction in the size of the printing dots in the resulting unprotected portion thereof, and repeating such removal of the protective material from the etched areas and such treatment with the etching medium until the desired degree of lightening is accomplished.

3. The method of reetching a partially etched half-tone photo-engraved plate to effect a gradual lightening of the tones thereof, which comprises melting on the etched surface of the plate a solid hard, adhesive, acid-resistant, water-immiscible protective material containing as essential ingredients candelilla wax, carnauba wax, and ouricury wax, said three waxes together comprising the major proportion of said protective material, the amount of candelilla wax being at least equal to that of either of the other two waxes, spreading the melted protective material over the etched surface of the plate to fill in the etched areas thereof, removing the melted protective material from such filled-in etched areas of the plate to expose only a portion thereof, solidifying the melted protective material remaining on the plate, then treating the plate with an acidic etching medium to effect an initial reduction in the size of the printing dots in such exposed, unprotected portion, removing the protective material from a further portion of the etched areas of the plate, again treating the plate with an acidic etching medium to effect a further reduction in the size of the printing dots in the resulting unprotected portion thereof, and repeating such removal of the protective material from the etched areas and such treatment with the etching medium until the desired degree of lightening is accomplished.

4. The method of reetching a partially etched half-tone photo-engraved plate to effect a grad-

ual lightening of the tones thereof, which comprises applying to the etched surface of the plate to fill in the etched areas thereof a hard, adhesive, acid-resistant, water-immiscible protective material containing as essential ingredients candelilla wax, carnauba wax, and ouricury wax, said three waxes together comprising the major proportion of said protective material, the ratio of the candelilla wax to the carnauba wax and the ouricury wax together being at least 2:1, removing the protective material from such filled-in etched areas of the plate to expose only a portion thereof, then treating the plate with an acidic etching medium to effect an initial reduction in the size of the printing dots in such exposed, unprotected portion, removing the protective material from a further portion of the etched areas of the plate, again treating the plate with an acidic etching medium to effect a further reduction in the size of the printing dots in the resulting unprotected portion thereof, and repeating such removal of the protective material from the etched areas and such treatment with the etching medium until the desired degree of lightening is accomplished.

5. The method of reetching a partially etched half-tone photo-engraved plate to effect a gradual lightening of the tones thereof, which comprises applying to the etched surface of the plate to fill in the etched areas thereof a hard, adhesive, acid-resistant, water-immiscible protective material comprising a major proportion of candelilla wax, carnauba wax, and ouricury wax and a minor proportion of rosin and beeswax, the amount of candelilla wax being at least equal to that of either the carnauba wax or the ouricury wax, removing the protective material from such filled-in etched areas of the plate to expose only a portion thereof, then treating the plate with an acidic etching medium to effect an initial reduction in the size of the printing dots in such exposed, unprotected portion, removing the protective material from a further portion of the etched areas of the plate, again treating the plate with an acidic etching medium to effect a further reduction in the size of the printing dots in the resulting unprotected portion thereof, and repeating such removal of the protective material from the etched areas and such treatment with the etching medium until the desired degree of lightening is accomplished.

6. The method of reetching a partially etched half-tone photo-engraved plate to effect a gradual lightening of the tones thereof, which comprises applying to the etched surface of the plate to fill in the etched areas thereof a hard, adhesive, acid-resistant, water-immiscible protective material comprising a major proportion of candelilla wax, carnauba wax, and ouricury wax and a minor proportion of rosin and beeswax, the ratio of the candelilla wax to the carnauba wax and the ouricury wax together being at least 2:1, removing the protective material from such filled-in etched areas of the plate to expose only a portion thereof, then treating the plate with an acidic etching medium to effect an initial reduction in the size of the printing dots in such exposed, unprotected portion, removing the protective material from a further portion of the etched areas of the plate, again treating the plate with an acidic etching medium to effect a further reduction in the size of the printing dots in the resulting unprotected portion thereof, and repeating such removal of the protective material from the etched areas and such treatment with

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the etching medium until the desired degree of lightening is accomplished.

7. A hard, adhesive, acid-resistant, water-immiscible waxy protective material for use in the acid-reetching of half-tone photo-engraved plates, which comprises as the major and essential ingredient a mixture of hard waxes including candelilla wax, the amount of candelilla wax being at least equal to that of any of the other hard waxes.

8. A hard, adhesive, acid-resistant, water-immiscible waxy protective material for use in the acid-reetching of half-tone photo-engraved plates, which comprises as the major and essential ingredient a mixture of candelilla wax, carnauba wax, and ouricury wax, the amount of candelilla wax being at least equal to that of either of the other two waxes.

9. A hard, adhesive, acid-resistant, water-immiscible waxy protective material for use in the acid-reetching of half-tone photo-engraved plates, which comprises as the major and essential ingredient a mixture of candelilla wax, carnauba wax, and ouricury wax, the ratio of the candelilla wax to the carnauba wax and the ouricury wax together being at least 2:1.

10. A hard, adhesive, acid-resistant, water-immiscible waxy protective material for use in the acid-reetching of half-tone photo-engraved plates, which comprises a major proportion of candelilla wax, carnauba wax, and ouricury wax and a minor proportion of rosin and beeswax, the amount of candelilla wax being at least equal to that of either the carnauba wax or the ouricury wax.

11. A hard, adhesive, acid-resistant, water-immiscible waxy protective material for use in the acid-reetching of half-tone photo-engraved plates, which comprises a major proportion of candelilla wax, carnauba wax, and ouricury wax and a minor proportion of rosin and beeswax, the ratio of the candelilla wax to the carnauba wax and the ouricury wax together being at least 2:1.

12. A hard, adhesive, acid-resistant, water-immiscible waxy protective material for use in the acid-reetching of half-tone photo-engraved

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plates, which comprises the following ingredients in approximately the following proportions by weight:

5	Candelilla wax -----	12
	Carnauba wax -----	3
	Ouricury wax -----	3
	Rosin -----	1½
	Beeswax -----	3

10 13. A hard, adhesive, acid-resistant, water-immiscible waxy protective material for use in the acid-reetching of half-tone photo-engraved plates, which comprises the following ingredients in approximately the following proportions by weight:

15	Candelilla wax -----	15
	Carnauba wax -----	2
	Ouricury wax -----	4½
	Rosin -----	4
20	Beeswax -----	1

25 14. A hard, adhesive, acid-resistant, water-immiscible waxy protective material for use in the acid-reetching of half-tone photo-engraved plates, which comprises the following ingredients in approximately the following proportions by weight:

30	Candelilla wax -----	8
	Carnauba wax -----	2
	Ouricury wax -----	1
	High melting point fatty acid ester amide -----	3
	Rosin -----	2
	Beeswax -----	4

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