

## PREPARING GRADIENT TINTS FOR LITHOGRAPHIC REPRODUCTION

U. S. Coast and Geodetic Survey.

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(Extracts)

### AERONAUTICAL CHARTS.

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Colors on charts and maps are most helpful in distinguishing features that need to be emphasized. Blue for the water area accentuates both land and water. A simple color such as buff or gray for the land area improves the appearance of the chart or map.

Contrasting colors, single and combinations of solids and rulings, are used to distinguish political divisions, various characters of soils and geological formations, etc.

In the production of the aeronautical chart the standard practice is to emphasize in color such features as water areas, cities and larger towns, contour lines, gradients of elevations and aeronautical data.

Gradient tints to accentuate elevations of aeronautical charts require at times as many as 8 or more distinctions, of which 2 are secured in green and the remaining 6 in brown. These distinctions are secured through the use of solid colors and various rulings, and as the preparation of these gradients, together with preparation of the water and city area colors, constitute an immense labor, the following is a description of how the task is performed at the Coast Survey and the saving effected by the adopted method.

The medium on which these color areas are prepared is plastic vinylite, grained one side and smooth back, which we have found to have a negligible coefficient of expansion. The economy results from the manner and method by which two or more gradients are prepared chemically, with practically no work by the draftsman; in avoiding the work required to paint around the water and city areas on each gradient; painting positive instead of negative; avoiding camera work; avoiding any necessity for composite bluelines; in the reduced number of bluelines required; and in the ease afforded the draftsman in following boundaries of the colors on bluelines that are not complicated by composite prints of culture, drainage and contours.

The diagram Fig. 1 (*not reproduced here*) graphically illustrates the details of the method as explained in the following text.

Blueline prints for draftsmen's use in making gradient tints, water and city areas, are chemically made on the smooth back of the vinylite and the work added to the face or grained side, producing the reversed work required.

Bluelines for the gradients are made from the negatives of the contours; for the water areas from the drainage negatives; and for the city areas from the culture negatives, no combination blueline prints are made. The necessary bluelines for a chart of 8 gradients are shown in the first column of Figure 1 (*not reproduced here*) and the draftsman's work on the bluelines in the second column.

The blueline prints for the water and city areas are each painted out by the draftsman with a water soluble opaque paint, filling in on one vinylite the area occupied by water and on the other the area occupied by the cities and towns, doing the work on the grained side only.

These drawings as completed are together superimposed in a vacuum frame, to secure a composite duplicate on vinylite for use as a mask in the later steps of the method. The use of this mask obviates the necessity of sparing out the water and town areas when working on the gradient tint vinylites, and here effects a considerable saving.

After the mask has been made, the painted vinylites of water and city areas are changed to negatives by dyeing the vinylites and washing away the water soluble opaque.

A detailed explanation of the procedure by which the making of the gradients Green 2, Brown 1, and Brown 2 is accomplished, including the making of contact prints, more fully illustrates this method.

It will be noted that the gradient for Brown 1 is painted on the vinylite blueline by the draftsman and the following steps (see numerals on diagram) indicate the procedure to secure the final vinylite negatives of these three gradients.

1st. A facsimile contact print of the Brown 1 gradient is made on vinylite. The facsimile contact, an important factor in the method, is accomplished by coating a sheet of vinylite with a gum-bichromate emulsion and exposing the coated sheet and the painted sheet together (each face down) in a vacuum printing frame, using one arc lamp at some distance from the frame. After exposure the print is developed with chemicals, the same as those used in the lithographic deep etch process, which removes the unexposed or unhardened image. When development is complete, the vinylite is coated all over with a non-actinic dye and immersed in warm water, to which if necessary is added a little hydrochloric acid, this bath dissolves away the hardened gum-bichromate emulsion and leaves a facsimile print of the draftsman's drawing.

2nd. The facsimile print is then painted out to cover all areas above Brown 1. By simply noting the higher areas and with no concern for the water and city areas this can be accomplished easily as there are no fine boundaries to follow, overlapping the dye print does no harm, in fact speeds the painting.

3rd. A vinylite contact print produced as explained in step 1, is now made from the painted contact print and when completed becomes the gradient negative for Green 2, and which needs no additional work.

4th. The painted vinylite contact print, is now covered with the non-actinic dye and the water-soluble paint dissolved away, which leaves the completed gradient negative for Brown 2.

5th. Returning to the gradient Brown 1 which was painted out with water-soluble opaque, this vinylite is now dyed and the soluble paint dissolved away to provide the gradient negative for Brown 1.

The procedures followed for obtaining contact positives or negatives as required for the other colors are shown on the diagram and produced as explained above.

In plate making the metal plate is sensitized with an emulsion of albumen and dichromate of ammonia and when dry is placed in the vacuum printing frame. The negatives are registered on the plate in proper order, 1st the screen or ruling, 2nd the mask of water and city areas, and 3rd the gradient, and exposed to the arc lamps; successive exposures are made to the same plate to produce the two or three gradients required in the given color.

As blueline prints are made only for those gradients which will be painted by the draftsmen, the diagram, Figure 2 (*not reproduced here*), furnishes a means for determining the number of blueline prints required for drafting and the number of gradients that can be made chemically, for any chart in the range of gradients illustrated.

While it is possible to determine this from the diagram, it is desirable also to examine the chart for possible exceptions. When gradient areas are small in extent as often occurs in the higher altitudes it may be more advisable to secure the vinylite negatives of such gradients by painting and dyeing rather than chemically.

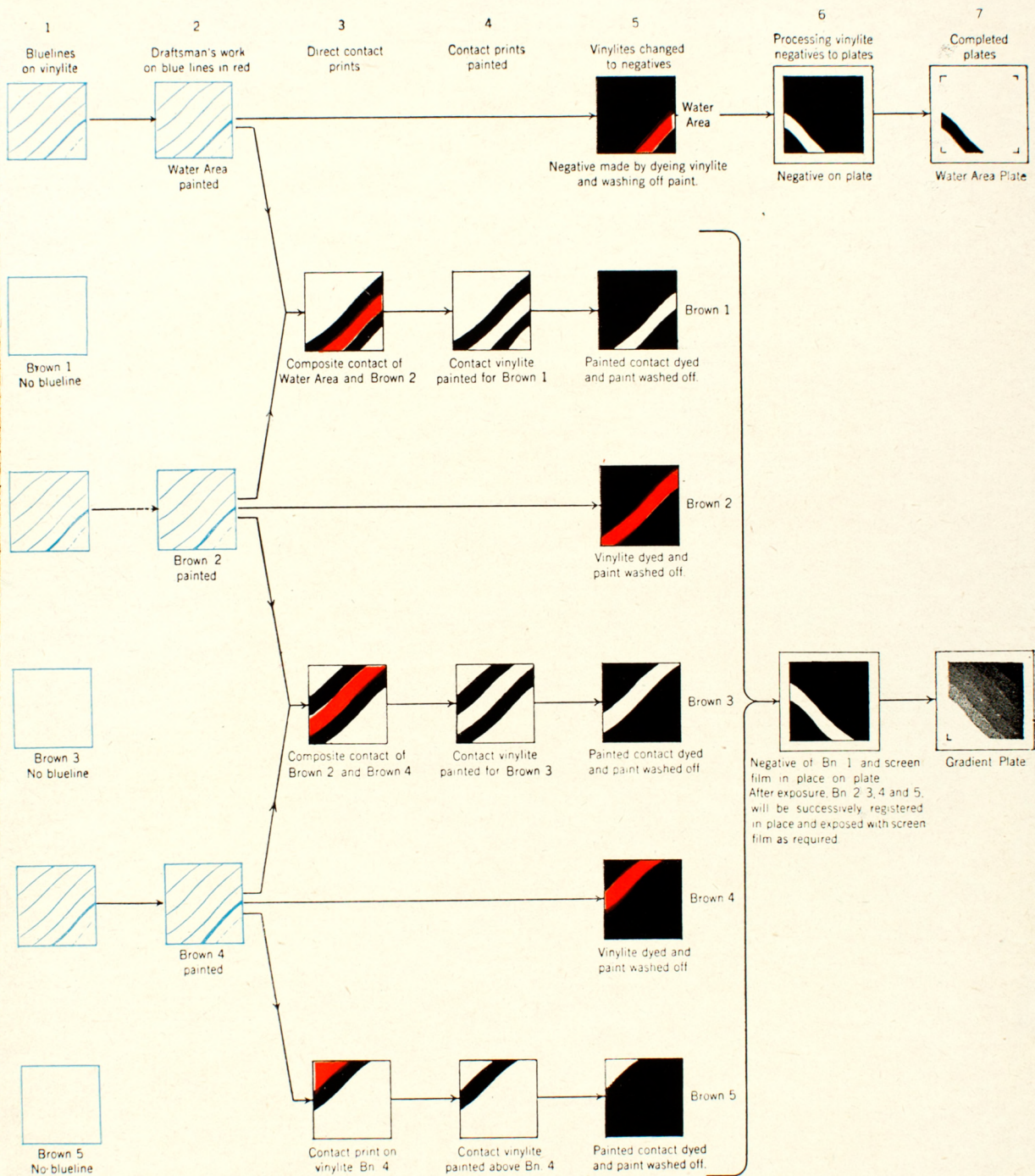
Blueline prints are always needed for water areas, and for city areas when color is used for cities.

Note that for a chart with a single gradient no blueline print is needed, the mask of the combined water and city areas is used as a negative for the gradient.

## NAUTICAL CHARTS.

To secure vinylite negatives for the gradient tints of nautical charts, the techniques of painting on blueline prints, contact positive prints, and dyeing, are identical with that for the aeronautical chart as explained above.

The procedure, Figure 3 (*given on the opposite page*), to obtain the gradient tints for the nautical chart, included a gradient in blue for the water between the shoreline and a selected fathom line, such as the 20, 30 or 50 fathom curve. The land gradients, usually five in number, consist of five tones of brown from the same printing plate, secured by using varying halftone screen tints for four gradients and a solid color for



## Preparation of Nautical Chart Colors

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FIG. 3

the fifth. Screen tints selected for the tones required must be sharp and clear in definition.

It will be noted that alternate vinylites, beginning with the water gradient, are painted on the blue-line prints, and that by superimposing the alternates in a vacuum frame, contact positive prints are produced which after some painting are dyed to produce the final negatives of brown 1 and brown 3 ; brown 5 is produced by making a contact positive of brown 4 which is then painted and dyed. The exception to this would be to paint on blue-line the gradient of the highest elevation if the area is small.

The painting required on the contact positives is easily accomplished as the area to be painted falls between two wide bands of adjoining gradients. The paint is applied to protect the area in the dyeing that produces the negative.

The blue plate is produced by contact with the blue vinylite negative ; while the brown plate requires five successive exposures of the vinylite negatives registered in place with the proper screen between negative and plate for four of the exposures, the fifth exposure is for the solid color.

