ments involving fifty mice no favorable effect on mortality was observed in the treated group. In a small series of mice placed on a diet containing 1 per cent. sulfapyridine for forty-eight hours before injection, there appeared to be a prolongation of life by a few hours in the treated group over that of the control group. The final mortality, however, was not affected.

It appears that a single injection of gold sodium thiomalate (myochrysine) will protect mice against rapidly fatal doses of *Streptobacillus moniliformis*, whereas neoarsphenamine and sulfapyridine are ineffective against this organism.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

PATTERNS ON MAPS AND DRAWINGS BY THE CARBON TRANSFER PROCESS

THE preparation for photolithographic reproduction of large numbers of isorithmic maps at the Muskingum Climatic Research Center[1] has led to the development of a simple and inexpensive process for shading them in distinctive patterns of black and white. It was necessary that the method be suitable for rapid use by workers having no experience in mechanical drafting or related techniques, that it cover large and small areas equally well and that the result be suitable for photomechanical reproduction. Hand ruling and stippling proved too difficult and too slow and failed to produce uniform results. Commercial pattern transfer methods were also slow and too expensive for the large total areas to be covered.

The new method, called the carbon transfer process, used successfully for the past year, is reminiscent of the simple childhood amusement of putting a paper over a coin and reproducing the pattern by rubbing with a pencil. In the new method, however, the marking is done by carbon paper and the back of the copy is rubbed with any hard smooth burnisher.

Maps or drawings to be patterned should be on thin paper or the areas should be outlined on the back by tracing or by the use of carbon paper so that they can readily be followed. To pattern the desired areas, place a sheet of wire cloth or other master pattern on a desk blotter spread on a smooth hard table top. Lay a sheet of moderately soft typewriting carbon paper on the master pattern, *face up,* and on this the drawing to be patterned, *face down.* A few lead weights will help keep this drawing and carbon paper in position on the pattern. To transfer the pattern, tool or burnish the back of the drawing smoothly but firmly in the areas where this particular design is desired. The bowl of a teaspoon, rounded back of a comb, bone-type hairpin, toothbrush handle or other smooth firm tool can be used, depending on the shape and size of the areas to be covered and on the coarseness of the pattern. Spraying the completed pattern with a suitable artist's "fixatif" will prevent smudging.

A large variety of patterns are available. Embossed book covers in grain or line patterns will serve for temporary use. More permanent are window screening and other types of wire cloth which are produced in hundreds of sizes and weaves. The usual square weave of sizes from 2×2 to 80×80 to the inch in various materials and wire sizes were tried. The coarsest and finest meshes were difficult to tool evenly, but those of intermediate size gave very satisfactory patterns. Weaves of unequal mesh, such as the 6×24, 14×88, "twilled," "flat warp," "double crimp," "rolled top" and many other kinds are available from the large manufacturers of wire cloth and give a variety of special effects. Some of these screens give two or more designs, depending on the tool selected and the direction of stroke. For uniformity of result it is generally more satisfactory to use a combination that gives the same pattern regardless of direction of tooling.

Patterns of a different type can be obtained from the molded plates used for making designs on mimeograph stencils. For line patterns, printer's brass rule can be set to the desired weight of line and spacing and locked in a form. Individual lines or pairs of lines can be tooled across the area to be shaded more rapidly than they can be drawn with a ruling pen and straight edge. Square or diamond patterns can be obtained by a second tooling with the lines crossing the drawing at a different angle.

Periods, colons, dotted leaders or other symbols in printer's type can be set to provide almost any weight and spacing of dotted patterns. Stereotype castings can be made from the type and preserved for permanent use. This work can be done by almost any newspaper office, and extra stereotype mats can be obtained so that additional plates can be cast later at small expense if those in use become worn.

Several of the patterns obtained by the carbon transfer process are shown in Fig. 1. Patterns A, B and C are produced from stereotype plates cast from periods. Pattern U is from mimeograph plate No. 1648. All other patterns in Fig. 1 are produced from

[1] Operated jointly at New Philadelphia, Ohio, by the U. S. Soil Conservation Service, the Works Projects Administration, the Muskingum Watershed Conservancy District and the National Youth Administration, in cooperation with the U. S. Weather Bureau and the Ohio Agricultural Experiment Station. C. W. Thornthwaite, SCIENCE, 86: 2222, 100–101, July 30, 1937.

wire screen or cloth. Patterns R and S are both from the same screen, R being produced by vertical, and S by horizontal tooling.

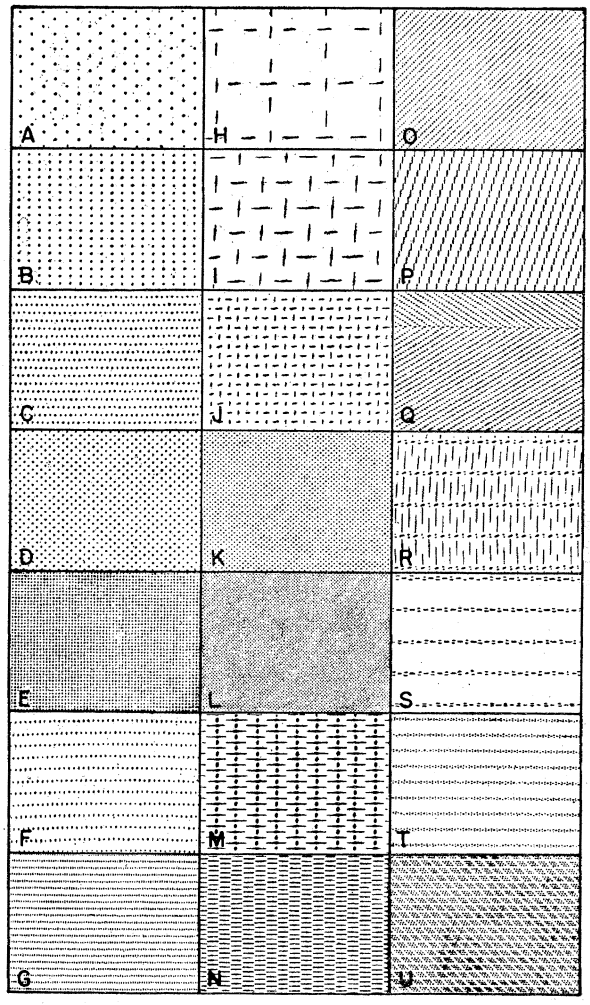

FIG. 1. Patterns from selected stereotype and mimeograph plates and wire cloth and screen. A–C: Stereotype plates cast from periods. A: Coarse, staggered; B: medium, not staggered; C: fine, staggered. D–T: Wire cloth and screen. D: 22×24 "flat warp;" E: 30×30; F: 8×38; G: 14×88; H: ½" opening, .063 wire, diamond; I: 4×4, .047 wire; J: 10×10, .025 wire; K. No. 40; L: 60×60, .008 wire; M: No. 617 "ton-cap"; N: No. 2475 "ton-cap;" O: 50×50 twilled, .011 wire; P: 14×40 twilled, .023 wire; Q: 60×40 twilled, herringbone; R: 3×14 (tooled vertically); S: 3×14 (tooled horizontally); T: 6×34 (tooled horizontally). U: Mimeograph plate No. 1648.

Five graded patterns (A through E) are used on the maps made at the Climatic Research Center (Fig. 2). These screens and stereotype plates have had almost daily use for more than a year and are still serviceable. Pattern D is from 22×24 mesh flat warp phosphor bronze wire cloth and pattern E from 30×30 mesh brass wire cloth. Finer meshes, such as were used for pattern L, tend to block up and will not stand much reduction.

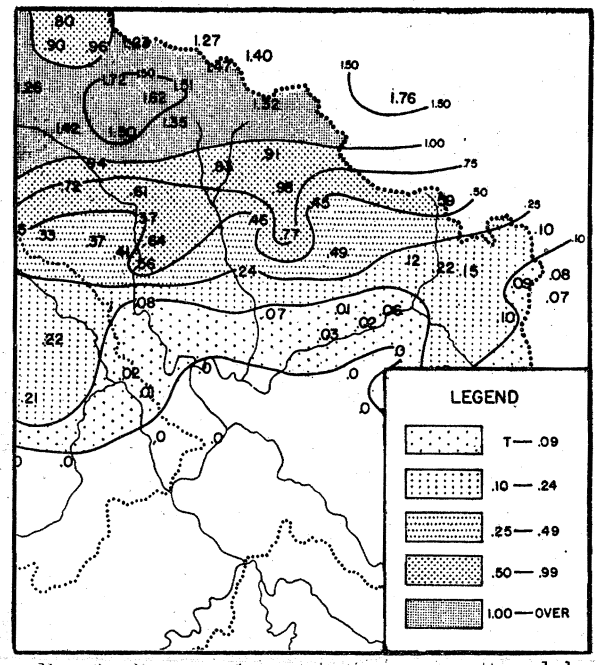

FIG. 2. Portion of precipitation map patterned by carbon transfer process at Muskingum Climatic Research Center (reduced about 2½ times from original).

The carbon transfer process can readily be adapted to special needs. It is useful not only for patterning on maps and graphs but for shading sketches such as those widely used in commercial illustration. Patterns made in this way can be reproduced by blue print, ozalid or photographic processes. Considering its simplicity, speed and relatively small cost, the carbon transfer method should be of use to workers in many branches of the physical and social sciences.

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