

CONVERSION TO NEGATIVE ENGRAVING FOR NAUTICAL CHART PRODUCTION BY THE CANADIAN HYDROGRAPHIC SERVICE

by W. O. HODGINS

In 1952, the Canadian Hydrographic Service learned that considerable progress had been made in the development of a new technique for the production of maps and charts by negative engraving.

The development of this process was considered sufficiently promising by the Dominion Hydrographer to warrant our production of a chart by this method.

Since we had converted from wet-plate glass negatives to stable-base plastic, it was decided to produce our first chart by engraving on plastic.

When the prototype chart was completed in 1953, it was evident that a number of problems must be resolved before the advantages of this method could be fully utilized.



FIGURE 1
Pencil type rotary dotter

One such problem was the simple dot used so extensively on a nautical chart for depth contours, sand, borders, etc. An instrument not much bigger than a pencil was developed which incorporated a spiral drive to rotate the point (Figure 1). This was later supplemented by a commercial instrument operating on the same principle but attached to a base and stand (Figure 2).

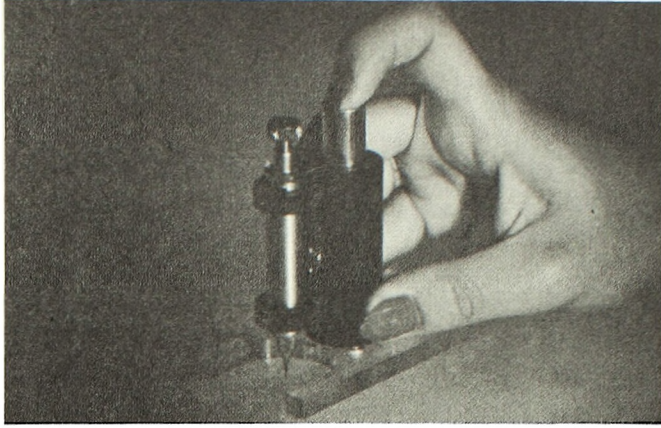


FIGURE 2
Stand type rotary dotter

One of the major problems was to find a method of engraving the depth figures which constitute a large portion of the work in the engraving of nautical charts.

Since a large part of the charting programme involved production of new charts, it was considered essential that instruments be designed for use by numerous draftsmen in preference to a large copper-plate engraving machine whose operation would be limited to one person at a time.

Engraving experiments were carried out with a "Leroy" lettering scriber fitted with a carbide cutting point in place of the normal pen. Templates available commercially were found to be unsatisfactory for this work, but the results of our experiments were so encouraging, it was decided to design and manufacture our own.

All templates for use with a Leroy scriber require a reverse slant to produce the desired shapes. This objective was accomplished by making a template with upright figures of correct proportions $1/2''$ high. Using this template and a Leroy scriber a negative was engraved having the

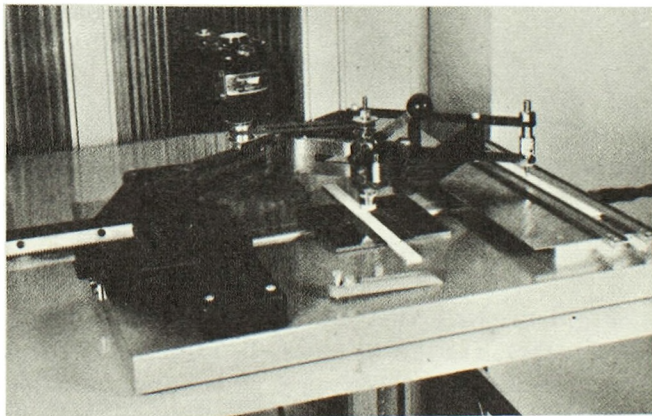


FIGURE 3
Pantograver used to make templates

correct slant. A positive was made from this negative and a photo-engraving obtained for use as a master template with the pantograver (Figure 3).

The choice of material for the working templates was the next consideration, as plastics available were found to wear too rapidly. A special magnesium alloy was tried because of its lightness, but it created a squeal from the tracing point which prevented the desired smoothness of operation. Engraver's brass was finally selected as most suitable and, to prevent wear, it was chrome plated after engraving.

It was found that the small size of the figures, especially those used for fathoms and feet and fractions of fathoms, made tracing and engraving difficult. By designing a new tracing arm for the Leroy scriber, 61/64" longer than the original to produce a slight reducing action, it was possible to increase the height of the figures on the templates by 1/5, thereby making them much easier to follow (Figure 4).

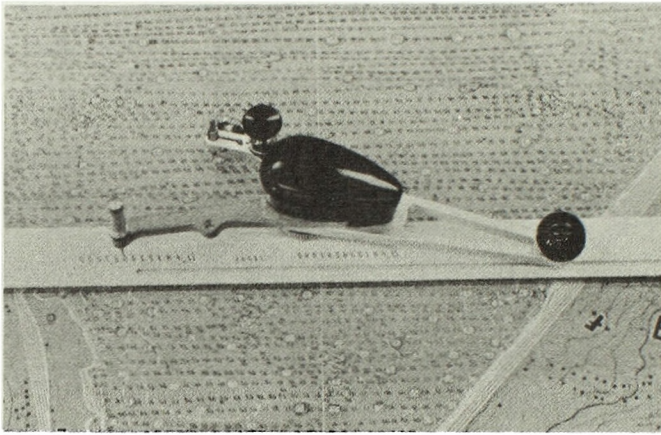


FIGURE 4

"Leroy" scriber with extended tracing arm

Three sizes of figures and rock symbols were engraved by pantograver on the final working templates with cutters sharpened to 24 degrees included angle, 35 degrees clearance and .003" flat tip.

A universal drafting arm is used to facilitate the positioning of the soundings (Figure 5). It should be noted that a piece of thin plastic is attached to the under side of the scale to permit sliding the template back and forth without injury to the coated material.

Engraving soundings by this method has proved to be very satisfactory and it is intended to provide each draftsman engaged in this work with individual templates and scriber.

This equipment worked excellently for numbers, but in order to facilitate the following of the intricate detail of buoys and similar chart symbols with the scriber, it was necessary to enlarge the symbols on the template and to introduce a reduction action into the scriber.

A small pantograph was designed and developed which would give

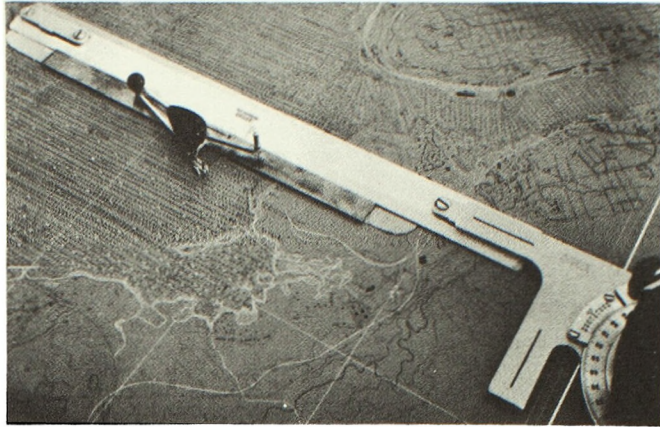


FIGURE 5

Template in use with universal drafting arm

a 2.5 to 1 reduction (Figure 6). It was constructed with four miniature ball races in brass arms which were anchored to a lucite base by a universal bearing to permit free vertical and lateral movement.

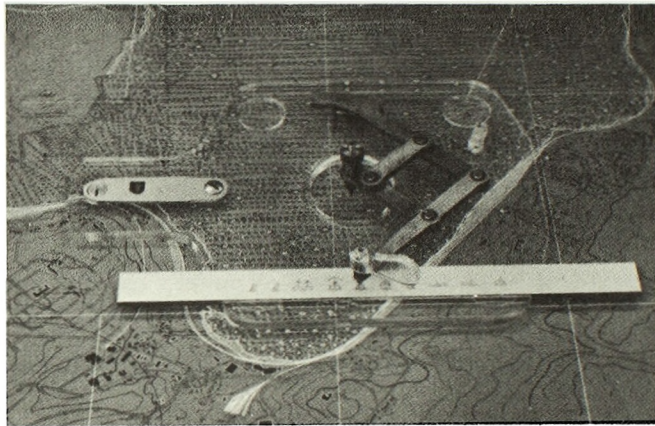


FIGURE 6

Pantograph for engraving symbols

The carbide steel engraving point is equipped for micro adjustment and the tracing point is spring loaded. The templates were developed in a similar manner to those used for figures, but these did not require the backward slant. This instrument also utilizes the universal drafting arm for positioning (Figure 7).

Several types of engraving points were tried, including ordinary phonograph needles and sapphires, but the points best suited to our operations are those made with carbide tips which permanently retain their sharpness. The initial cost is greater than other types of points, but is amply justified when consideration is given to the time lost in sharpening and resharpening points of ordinary steel. These points are made to rigid specifications and the different sizes are readily identified by a spot of

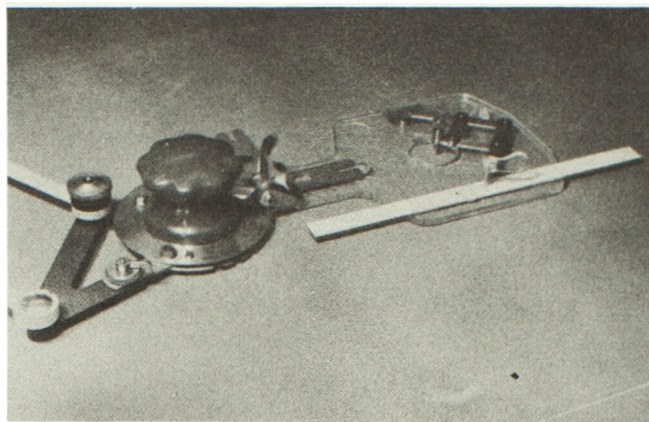


FIGURE 7
Pantograph in use with
universal drafting arm

colour inserted in the end. They can be designed to perform various operations in a single stroke. Figure 8 shows a border-cutting point which cuts two thin lines centred by a very broad one. The holder, shown in this illustration, is used for all straight lines and has a rectangular base slightly raised toward the front half. The cutters are brought into action by tipping the front downward very slightly.

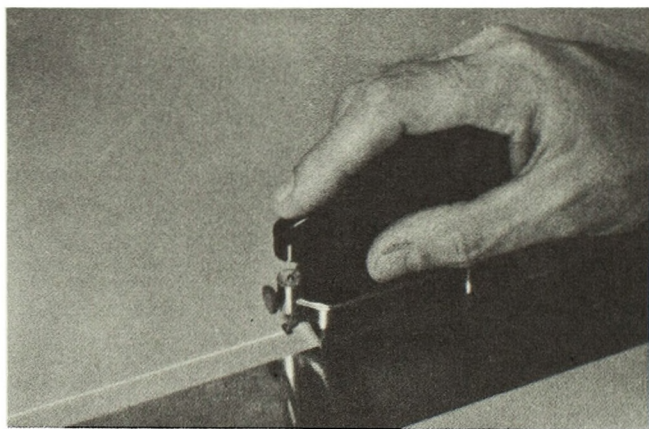


FIGURE 8
Straight-line graver
with border cutter

Considerable freehand work is done with "Jensen 75" Durosium Tip phonograph needles, which are clamped in mechanical drafting pencil holders and used as they are produced without further sharpening (Figure 9).

By the time some of the original problems were resolved, the tremendous advantages of chart production by negative engraving became so obvious, that it was decided to accelerate conversion to this method.

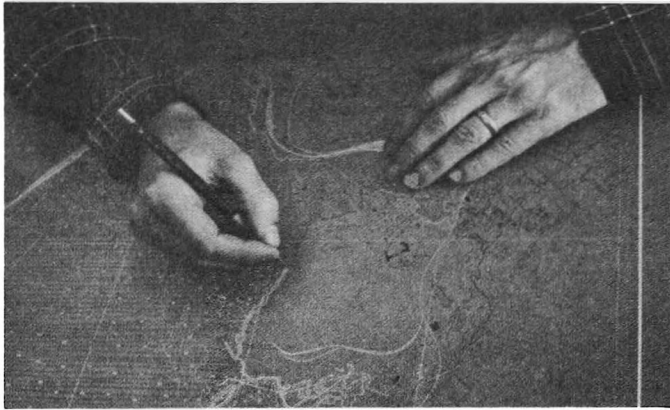


FIGURE 9
Pencil holder using
Durosium Tip
phonograph needles

A suitable light source had to be provided beneath each of the existing desks, but light tables in use at that time were equipped with multiple fluorescent tubes which became uncomfortably hot. To avoid this heat and still give an even light across the entire top surface, a parabolic reflector was designed which used a single 24" - 20 W fluorescent tube. These reflectors were mounted beneath an opening 18" \times 28" cut in the top of each desk and covered with 1/4" frosted glass (Figure 10). The reflectors are only 6 3/4" deep and do not interfere with the draftsmen's knees.

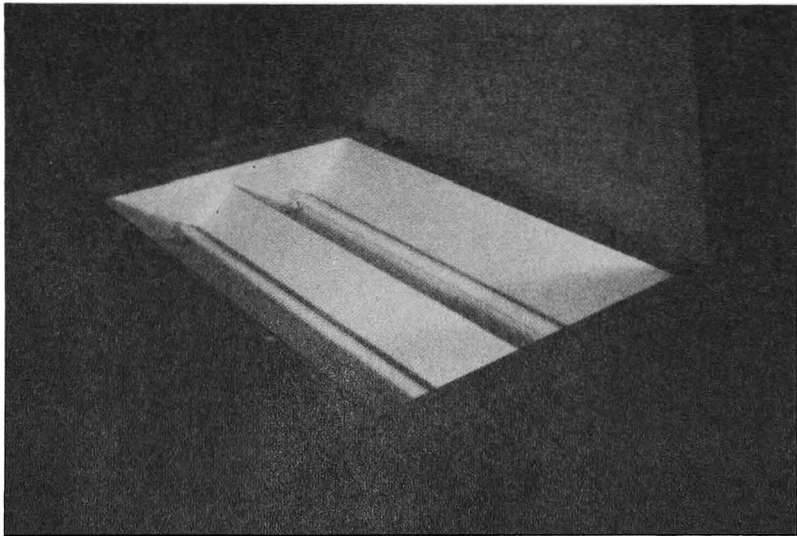


FIGURE 10
Parabolic reflector mounted
beneath drafting desks

The large-size light tables used for borders, projections, checking, etc., are similarly equipped, but with double parabolic reflectors, which require

only two 48" - 40 W tubes to give an even light over an area 33" \times 53" and still remain comfortably cool (Figure 11).

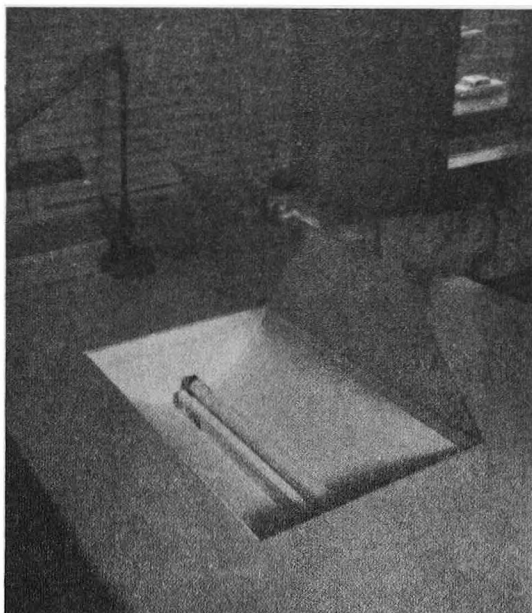


FIGURE 11

Double parabolic reflector for large light table

Carbide points were developed to fit a coordinatograph which has proved extremely useful for engraving special projections and grids.

Names, notes, etc., are printed in perfect register on both sides of .0015" gauge matte acetate to provide a light-opaque image. This is accomplished by a Vandercook proof press equipped with an offset blanket cylinder (Figure 12).

The prints are coated with a thin film of adhesive wax and are applied in correct position on a transparent overlay. A contact negative is made which is combined with the engraved negative at the plating stage.

Numerous charts have been produced using a separate engraved negative for roads and building fill. These are engraved solid and are either screened at the plating stage or printed in grey on the finished chart. It is particularly effective on certain harbour charts where the number of roads and buildings are extensive, as the names may be printed across them without loss of clarity.

Recent experiments to devise a satisfactory method for making extensive revisions to engraved negatives have been most successful. The area to be revised is surrounded by a mask of "Blue Zip-a-Tone" or "Scotch Tape". The engraved coating is then dissolved with a suitable solvent and wiped clean. Without removing the mask, the area is recoated by brush or spray with a diluted solution of transparent or translucent "Keuffel & Esser Touch-Up Fluid". When dry, the mask may be removed and the area re-engraved. The coating, while non-actinic, can be so applied as to be quite transparent, a decided advantage in revision work.

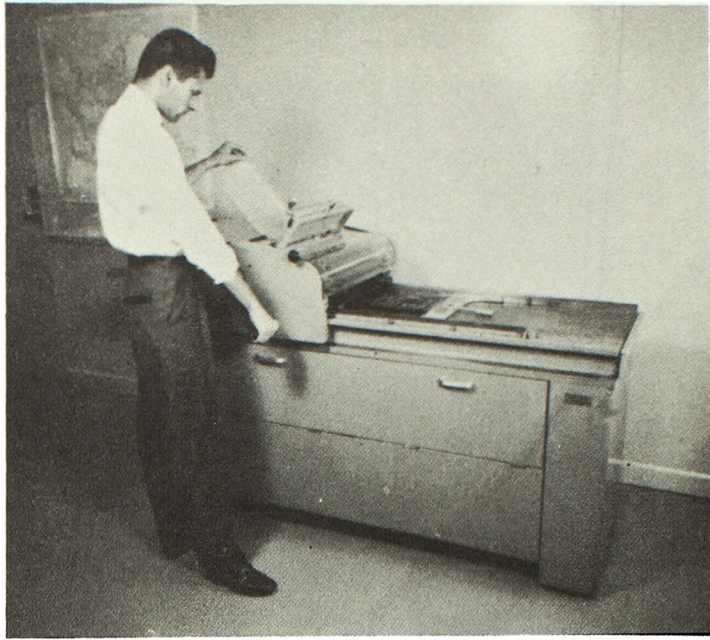


FIGURE 12
Vandercook proof press
with offset blanket
cylinder

Experience has shown that production time can be reduced and quality of the finished chart improved upon in many ways by the use of negative engraving. Although knowledge, experience and skill are still the prime requisites for a good draftsman, it is now possible to train men to use engraving instruments in considerably less time than it formerly took for conventional drafting instruments. As a result, the Canadian Hydrographic Service has converted to this form of engraving for almost all new charts, technical illustrations and other projects.

