

tion of topography. We feel that Visual Topography is a promising step in the right direction.

Preparation of original copy depends, of course, on the method of reproduction to be employed. Halftone lithography requires the preparation of at least three separate color plates in addition to the conventional line plates; projection, drainage, roads, town symbols and names.

These plates can be made by laying a sheet of Dyrite over the prepared base and applying black ink tone with the Paasche airbrush, Model AB. This brush in the hands of a skillful operator is particularly suited to a rapid production of these tonal plates. One plate to be printed in subdued green covers valley areas, a second in earth brown indicates relief, and a third "shadow" plate in red brown, is added to accentuate the higher areas of plate number two.

This gradual transition of color from a cool receding color (green) in the low areas to a warm color (red brown) on the higher slopes is designed to indicate relative elevation only. No attempt is being made to indicate exact ranges of elevation in the manner of a gradient tint.

These fundamental colors can be varied or supplemented as required to accurately describe a particular area and their selection should be made with extreme care.

Because all three color plates are prepared in black, particular care should be taken in coordinating the blending of one plate into another in order that the final color progression is not interrupted.

SHADED-RELIEF MAPS IN THE GERMAN AIR FORCE

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DURING the last months of the war it became necessary for the USAAF to portray relief on maps and charts of some areas by a method other than contours because of the lack of vertical information and the urgency for compilation in previously uncharted areas. This resulted in the revival of showing terrain features by shading, using the compilation photographs for source material as discussed in the preceding articles in PHOTOGRAMMETRIC ENGINEERING.

For comparison, the following notes on German practices are published.

An investigation of the mapping and charting operations of the German Luftwaffe reveals an intense interest in shaded-relief maps, even in areas where large scale, accurate contour maps were available. Statements of numerous GAF officers indicated a decided weakness in the ability of both officers and soldiers intelligently to interpret and use maps. This led to the use of relief models and anaglyphs in training programs for operational personnel. Information indicates that the average map user could more readily read and interpret contour maps overprinted with shaded-relief, than plain contour maps. This was said to be particularly true for aeronautical charts as pilots and navigators could readily recognize their position by the likeness of land forms shown by this method on the map.

This requirement led to a unique and scientific method for preparing shaded-relief printing plates for overprinting on maps. The method used also indicates the importance the Germans placed on this type of map and the desirability of having it truly portray the terrain in all respects.

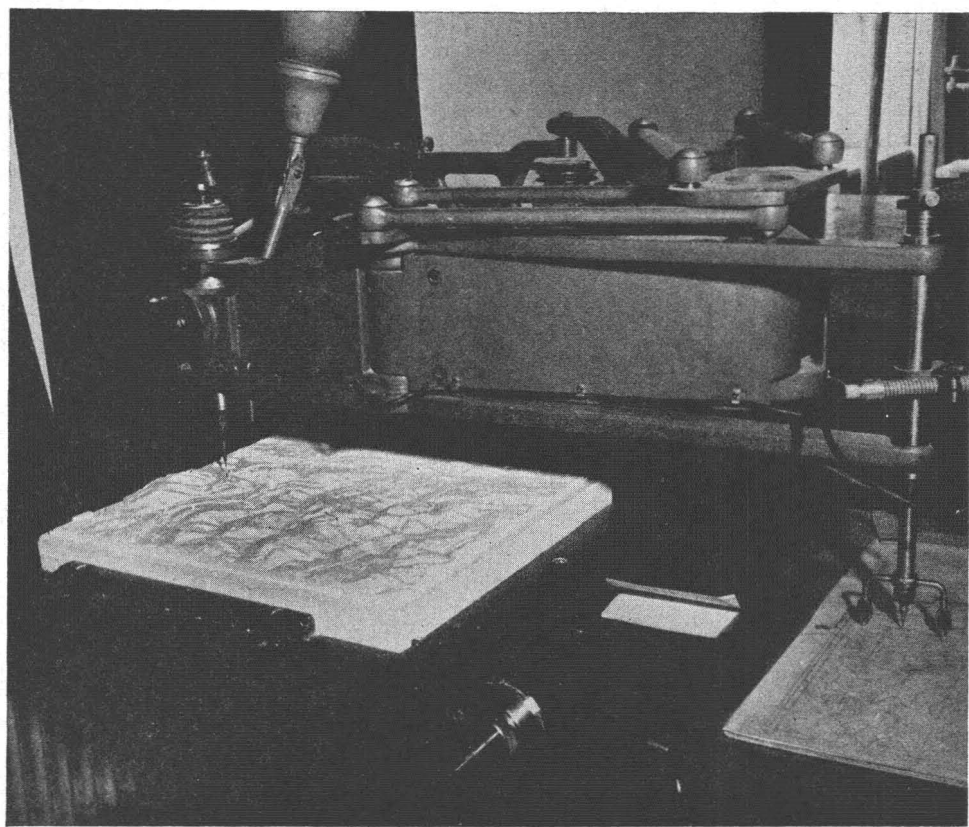


FIG. 1. Relief model cutting machine.



FIG. 2. Battery of 18 model cutting machines in operation.

The requirement for shaded-relief overprint on operational maps and charts together with other relief model requirements resulted in the development and construction of a special plant for relief model production. The plant was equipped with twenty-six power operated model cutting machines of the pantograph type, with vertical adjustment of cutting tool of .01 mm and a horizontal accuracy equal to the machine operator's skill in tracing the shapes on the contour map. These machines, with experienced operators, could produce a model twenty by twenty-two inches in approximately thirty hours. A spot check indicated no errors over .02 mm in either horizontal or vertical scales as compared to the source map.

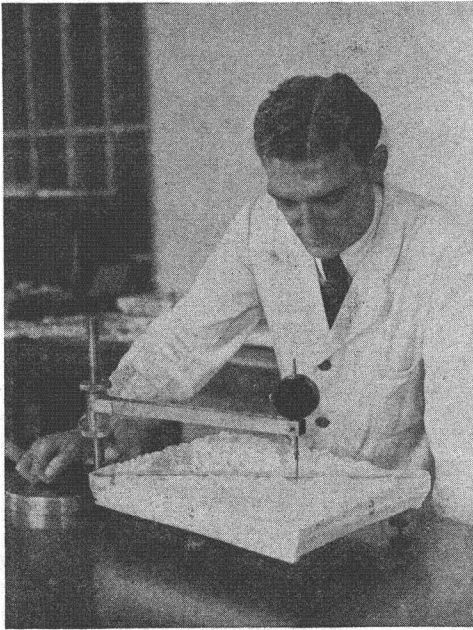


FIG. 3. Precision gauge for checking vertical scale.

The copying was done on a precision camera, $f=90$ cm, located in the second basement to avoid any possible vibrations. The copying was on glass negatives and printing plates were made by conventional methods. The stock of maps were then overprinted with shaded-relief. Numerous series of maps which had been overprinted in this way were examined and it was interesting to note the excellent registration of the overprinted shaded-relief plate, as well as the different gradations of shade, which was governed by the relief of the model.

To further illustrate the importance placed on this type of map, the model company contracted for the construction of a specially designed copy camera having a focal length of fifteen meters in order to more perfectly copy models for shaded-relief overprinting. The camera was completed but destroyed in the contractor's shop by AAF bombers before delivery.

This method of preparing shaded-relief maps merits serious consideration by map producers as it places such map preparation on a standard scientific basis rather than on personal interpretations of source material by the individual. Accompanying are a series of photographs showing stages of model preparation.

A vertical scale of 1 to 1 was used on areas of medium and high relief while an exaggerated vertical scale of 2 or 3 to 1 was used on areas of relatively low relief. The models were cut to such accuracy that a series could be joined together to form a composite.

When the relief models were finished they were sprayed with an aluminum alloy paint, specially toned for copying photographically. The model was then placed on the easel of the copy camera which was adjusted for copying at 1 to 1 scale if the original map was to be overprinted or series of models in many combinations could be combined and copied at the required scale for overprinting maps of larger areas at smaller scales.

Carefully controlled light sources were meticulously adjusted at angles to give the desired shadows on the model both as to length and density.

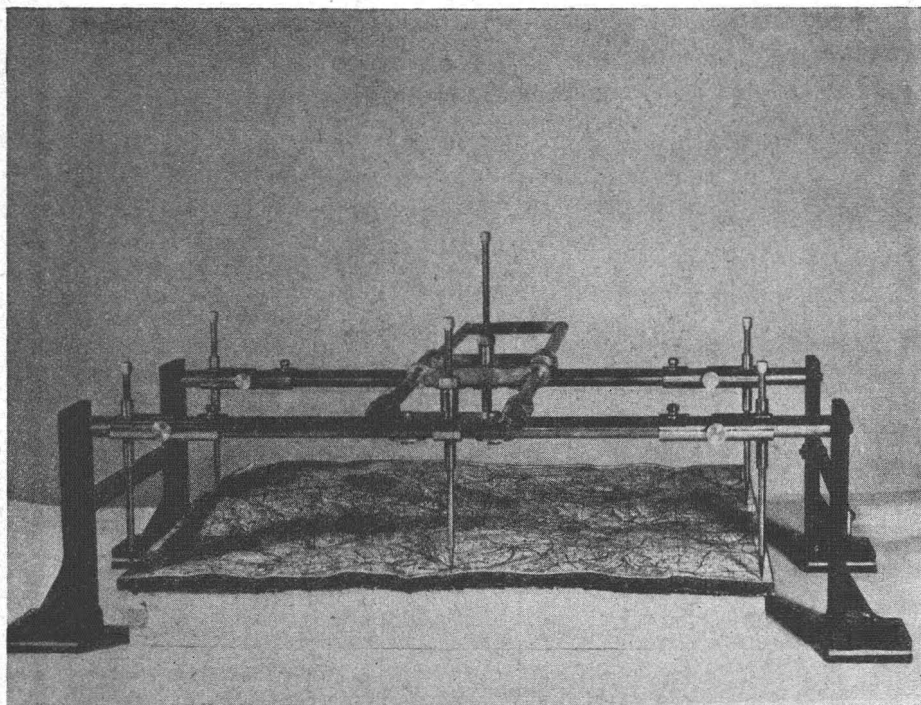


FIG. 4. Precision gauge for checking horizontal scale. Model has been shaved and overprinted with basic map.

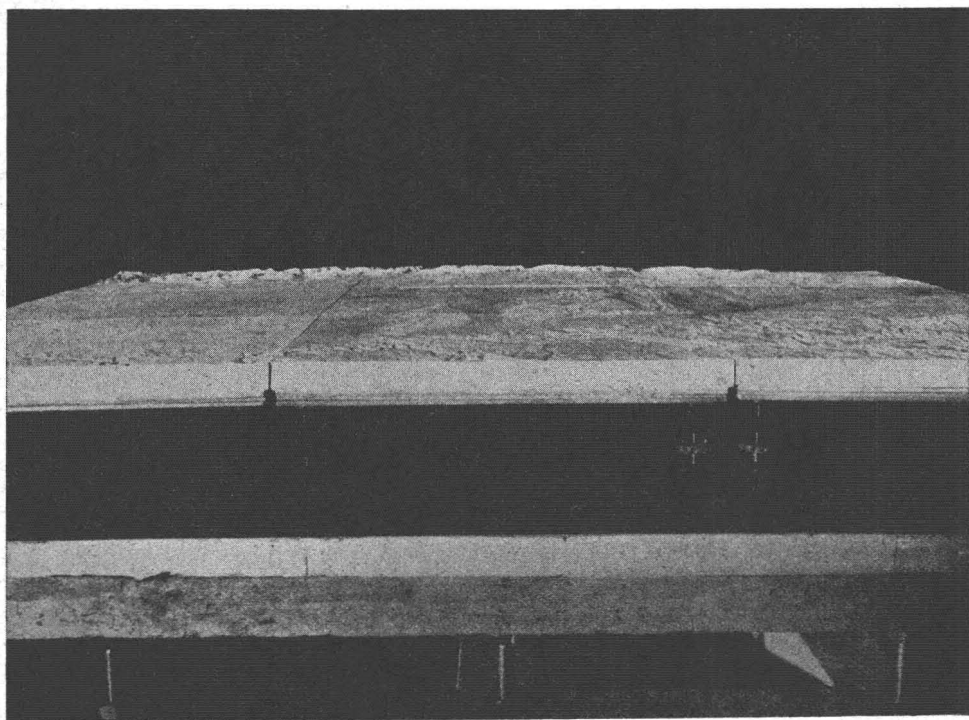


FIG. 5. Method of joining a series of models for copying at smaller scales.

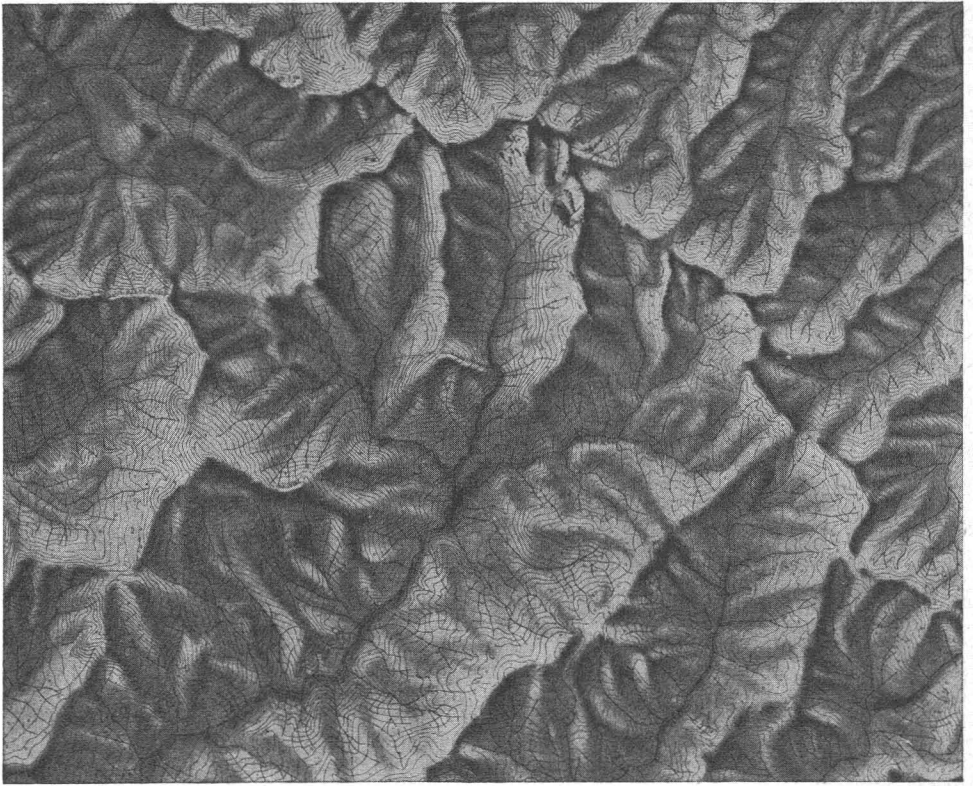


FIG. 6. Example of shaded-relief, contour and drainage combined.