RADIAL PLOTTER

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A PLOTTER based on radial line principles would seem to be a valuable adjunct to the various radial control systems now in use, and in fact several such plotters have been devised.[1]

Radial plotters are not generally complex; indeed a recent article[2] described a form of plotter built of pins and string. Moreover, it is comparatively easy to incorporate the advantages of stereoscopic observation and picture separation,

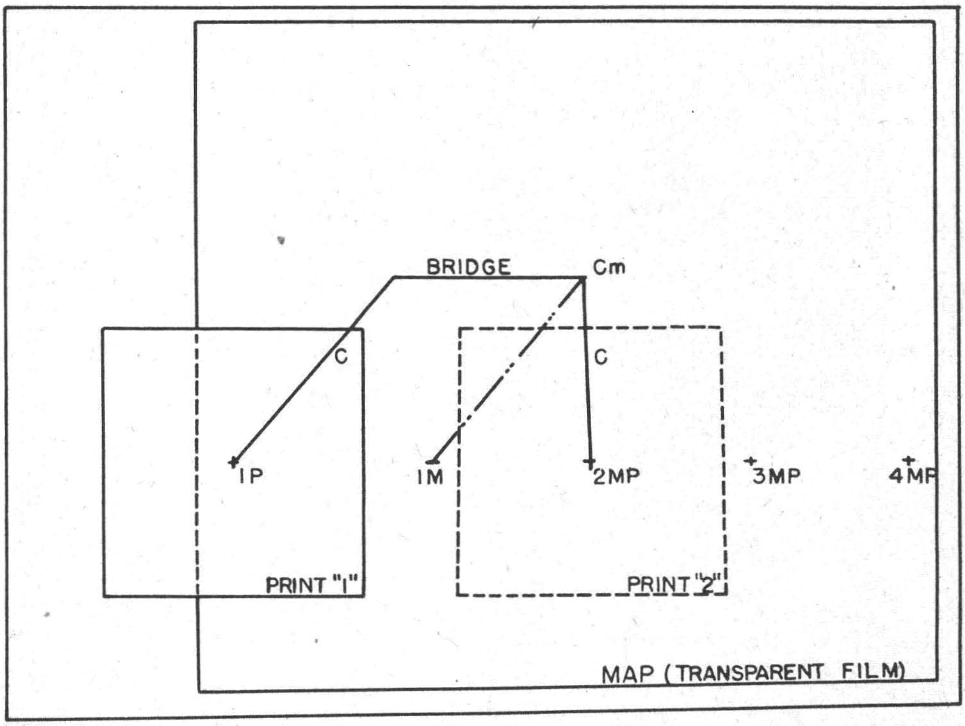

FIG. 1

and assuming the possession of a suitable stereoscope and drafting arm, the plotter can be built at small expense.

Incidentally, simple plotters should prove of increasing value in the future since it appears that the general use of stabilized mounts will greatly improve the quality of photography obtainable. The device to be described results from reducing the plotter of Field and Burns[3] to the essentials necessary for planimetric mapping. Basic radial principles were, of course, divulged by O. Von Gruber at an early date.

To demonstrate the principles and application of the machine, imagine the

[1] J. W. Bagley, "Aerophotography and Aerosurveying," fig. 92, page 213.
[2] Louis Desjardin, PHOTOGRAMMETRIC ENGINEERING, Vol. IX, No. 3.
[3] E. L. M. Burns and R. H. Field, PHOTOGRAMMETRIC ENGINEERING, Vol. III, No. 4.

map, (Fig. 1) to be of thin transparent matte film. Points *1M*, *2MP*, *3MP*, are the map positions of the principal points of photos numbered 1, 2, and 3. Point *CM* is the map position of pass Points *C1* and *C2*. The transparent control sheet is placed over print No. 2 and oriented with respect to radials to controlled images. Print No. 1 is then placed over the control sheet at any convenient stereoscopic viewing distance from print No. 2, taking care that all points on the air base are on the same straight line. Now imagine radial motion about *1P* to be transferred to *1M* by a bridge parallel to the air base. If the radial arm centered at *1P* is directed toward the image *C*, and the arm at *2MP* (which is both the map position and the principal point of photo 2), is directed toward *C2*, the radials *2MP-C2* and *1M-CM* will intersect at *CM* giving the true position of *CM* at the scale of the map. Now if the bridge is jointed at *CM* with radial *2MP-C2* and the arms allowed to slide over *1P* and *2MP*, the bridge always remaining parallel to the air base, the radial arm *1M-CM* can be eliminated and all pairs of points on the prints can be sighted with the two outer arms. (This construction is termed the Zeiss "Parallelogram.") If a pencil is placed at *CM*, the correct map position is spotted. Any other point on the bridge would, of course, have the same relative motion. If the arms and bridge are of transparent material with radials etched on the bottom side of the arms, any suitable stereoscope can be set over them and the resultant view will be a very nice intersection. By allowing this intersection to follow the stereo-view, map detail is automatically plotted to the desired scale (preferably somewhat larger than the photos). If form lines have been added to one of the photos, they can be traced off at correct scale and position.

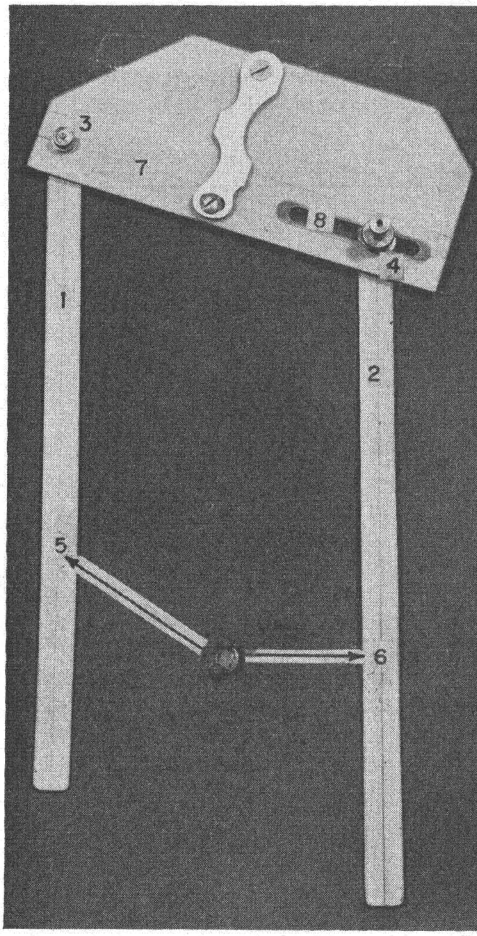

FIG. 2

Any stereoscope with wide leg spread, or, better still, one swung from the edge of the table[4] can be used. It will be found that the mirrors of most stereoscopes are not perfectly enough parallel to give the best possible view of an otherwise correctly oriented stereo-pair.

It is better to discontinue plotting as the arms approach a straight line (the air base). The strength of the intersection will be readily apparent as the arms are viewed under the stereoscope.

To determine the most accurate location of images lying along the air base, the plotter can be reset at new centers an equal distance from the respective

[4] Bagley, *loc. cit.*

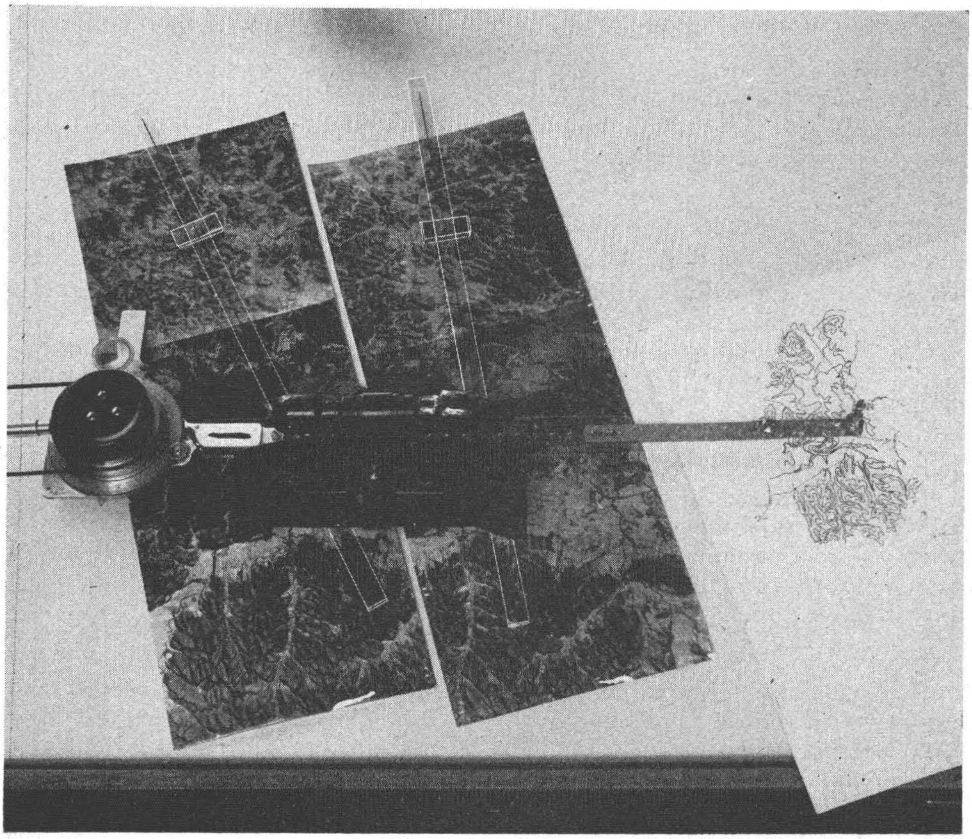

FIG. 3

principal points and perpendicular to the air base. The map point so plotted will be displaced only by "Y" parallax from the true position. A line drawn perpendicular to the air base through this point is the locus for the true map position. The point is located on the line by drawing or sighting a radial from the principal point of the oriented photograph. (2MP—Fig. 1)

Fig. 2 shows one form of the plotter as made of transparent plastic. 1 and 2 are radial arms hinged at 3 and 4 and sliding through retaining rings at 5 and 6. The rings are pivoted on the map surface. The bridge 7 has an etched line on its underside through the centers of joints 3 and 4. This is used in setting the bridge parallel to the air base. A pencil through the center of joint 4 slides in the milled slot 8 and can be clamped rigidly in place without interfering with the rotation of radial arm 2. Slot 8 is used in adjusting the plotter to the map scale. The procedure is direct and will be illustrated by referring to Fig. 1:

Make the bridge parallel to the air base. Set the pencil at *CM*. Loosen the nut at the pencil and slide the bridge until the radial lines apparently intersect the stereo-image of the control point. Clamp the nut in position and check on other control points. The scale in this case is controlled by the radial plot. However, in any case, the scale will be represented by the difference in distance between photo centers less the length of the bridge; in other words, the map air base.

Fig. 3 illustrates an experimental application of the device. Form lines, which have been placed on one of the prints by known means, are being plotted on the map sheet, as previously mentioned.