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TILT-SETTING MEANS FOR RECTOBLIQUE APPARATUS

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Fig. 1

Fig. 2

Fig. 3

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The invention described herein may be manufactured and used by or for the Government of the United States for governmental purposes without the payment to us of any royalty thereon in accordance with the provisions of the act of April 30, 1926 (ch. 460, 45 Stat. L. 467).

This invention relates to improvements in the photogrammetric instrument known as the recto-blique plotter, which is used in connection with the making of maps from aerial photographs, in accordance with the trimetrogon system. The latter has been developed for the purpose of making planimetric maps of extensive areas in a rapid and economical manner.

The chief function of the recto-blique apparatus as a whole is to translate oblique photographs to vertical photographs. The trimetrogon system comprises the taking of three photographs simultaneously by the use of three cameras mounted in an airplane, one directed vertically downward, the other two at 60 degree angles, in divergent relation, one on each side of the vertical camera. The axes of the oblique cameras form a 120 degree angle to produce a horizon-to-horizon composite when joined with the vertical photograph. The axes of the oblique cameras, however, result in the photographs, in a convergence of lines proceeding from the plumb point of the vertical. For example, parallel lines such as roads or field lines when photographed at an angle appear to converge at a point beyond the horizon. In order to make a map from this type of oblique photograph, it is necessary to rectify these convergences to the true directions on a horizontal plane.

In addition to the foregoing, regard must be given, in utilizing the photographs, to the "tilt" of the airplane, that is, its transverse wave or dip along the wing line, occurring during flight and obviously resulting in certain disalignments of the photographs being taken. The photographs must be rectified as to these details also and the present invention is specifically concerned with correcting the disalignments mentioned. That is to say, a principal object of the invention is to provide more accurate means for setting the amount or degree of tilt.

Another object is to provide means for more accurately forming paper templates used in the process of map making.

Another object is to make a simultaneous setting of angle and paper distortion along with the correct displacement or "tilt," on paper template as constructed on the recto-blique machine.

These and other objects are attained by the means herein and disclosed in the accompanying drawings, in which

Fig. 1 is a perspective view of a recto-blique machine or plotter comprising the means of the present invention.

Fig. 2 is a top plan view of that portion of the table or top member of the recto-blique plotter with which the invention is associated, parts of the recto-blique apparatus being omitted for the sake of clarifying the disclosure.

Fig. 3 is a view on line 3—3 of Fig. 2.

In detail, and with reference to the drawing, the invention is adapted to form part of a recto-blique plotter comprising a table member 6 mounted on a sloping frame 7 for disposing the former at a convenient working angle. The apparatus seen associated with top 6 at the left hand side of Fig. 1 is set forth in co-pending patent application Serial No. 212,617 and is not primarily involved in the present disclosure since it concerns means for determining the "tip"—that is, longitudinal deflections—of the airplane taking the photographs utilized in the operation of the recto-blique plotter. It will be understood, however, that in the making of paper templates, the apparatus on both sides of table 6 is utilized.

It is however the apparatus seen adjacent the center and associated with the right hand side of table 6 that is concerned in the instant disclosure.

This apparatus preferably comprises a support plate 8 suitably secured to the bottom face of table member 6 and adapted to support the various elements positioned centrally and at the right side of the table member. The latter, adjacent the center at the bottom is rectangul arly slotted as at 9, for receiving a stud 10, projecting upwardly from a slide block 11. This block, as seen in Fig. 3, is T-shaped in cross section and is slidably supported on a pair of guide strips 12 and 13 bordering the slot 9 on the bottom face of table 6. Seid strips are secured to support plate 8 by screws 14. A threaded shaft 15 passes through slide block 11 in threaded relation therewith. At its inner and outer ends, the shaft is rotatably supported in bearing blocks or bushings 16 and 17 secured to support plate 8. A knurled wheel 18 is provided on the projecting outer extremity of shaft 16 for turning the latter to actuate the slide block and stud 10 inwardly and outwardly of slot 9.

Adjacent the right side of table member 6, the support plate 8 has secured thereto, as at 19, a pair of grooved guide rails 20 and 21 for slidably supporting a slide bar 22, T-shaped in cross section. The forward end of this bar has secured thereto a block 23, as at 24. On the top surface of table 6, a rigid plate 25 is positioned, having its outer end secured, as by screws 26, to the top of
The inner end of plate 25 has projecting upwardly thereof a pin 27, for a purpose to be described.

To the left of the elements just referred to, the support plate 8 has fastened thereto as at 25, a support bracket 29 which has pivoted thereon as at 30 an elongated arm 31. The left end of this arm is slotted as at 32 for slidably receiving a bolt 33 extending into the bottom of slide block 11. A washer 34 may be positioned between the arm 31 and said block.

The opposite or right end of arm 31 is similarly slotted as at 35 for slidably receiving a bolt 35 (Fig. 3) passing into the bottom of slide bar 22.

It will now be clear that when hand wheel 19 is turned, the threaded shaft 9 advances or retracts slide block 11, thereby actuating pivot arm 31. The latter, by virtue of its connection at 36 with slide bar 22, moves the latter forwardly or backwardly, whereby the end block 21 and the plate 25 secured thereto, are similarly actuated.

The table 6 has associated therewith a pair of pivotally connected template members 37 and 38, used in the rectoblique procedure. Member or arm 38 at its lower end 39 is, in accordance with known construction, provided with a small opening which, in the present invention is utilized for receiving the pin 27 on plate 25. When the plate is actuated in the manner already described, the arm 38 is thereby moved to a predetermined angular position in accordance with a rectoblique computation or usage.

The arm 42 which is of transparent material to permit viewing of points on the underlying photograph, is attached to a pin 43, which, in turn, is secured to the bar 41 and projects through a slot 45 in arm 42 to provide for sliding movement. The lower end of the arm 42 is attached by a pin 48 to a slide block 49 movable in a slot 50 in the table member.

With reference to the slide block 11 and its stud 10 which projects up through slot 9 into the plane of the top surface of table 6, it may now be pointed out that data strips 60 (Fig. 1) containing line indications for degrees (or related material), are positioned alongside the slot 9 and the top of said stud is provided with a transverse hairline adapted to register with the selected data line by actuation of the wheel 19. The template members 33–37 are thus simultaneously actuated to a line and predetermined adjustment.

As already indicated, the purpose of the rectoblique plotter is to make a paper template which is representative of two opposed oblique photographs on a horizontal plane. As was indicated previously, this operation involves the use of the device disclosed in co-pending patent application Serial No. 212,817, the operation of which is coupled with that of the present invention for making of templates more accurately and on a production basis. The present invention is concerned with the correction of tilt as affecting the X-axis of the photograph. In use, a section of paper of desired length, with center line drawn, is placed over template pin 27 on the inscribed center line, midway of the template ends. The template member or drawing bar 38 is adjusted for placing the small opening at the lower end 39 of the bar on the pin 27. The drawing bar is then oriented so that the center line on the paper coincides with the edge of bar 38. The handwheel 19 is now adjusted for moving the indicator stud 10 into such position that the hairline on the indicator is placed opposite the correct tilt figure shown on the data or scale strip 40. The adjustment thus made is to conform with the pre-determined tilt figures placed on the photograph. The latter is not shown herein but is placed on the disc seen at the left-hand side of Figure 1 which, together with related procedure, is disclosed in the co-pending application previously mentioned. This disc is rotatably mounted in the table 6. However, it will be noted in Figure 1 herein that longitudinally slidable horizontal bar 41 at the upper edge of table top 6 couples the upper end of template member 31 and the upper end of the strip at the left-hand side of Figure 1, extending transversely of the disc member there shown.

This horizontal bar 41 is now moved so that the center line of the said vertical bar overlying the disc at the left of Figure 1 lies over the desired point on the photograph positioned on the disc. This results in placing in the template or drawing bar 38 in a radial position relative to pin 27 so that a line may be drawn by pencil on the paper or template sheet, thus giving a radial or graphic representation of an angle similar to or representative of the same angle on the photograph. This angle is converted from an oblique plane to a horizontal one on the paper sheet or template. The same procedure is carried out for any number of points of selection on the photograph.

Modifications will be suggested by the means herein disclosed, but these are believed to be comprised within the spirit and scope of the invention.

What is claimed is:

A rectoblique plotter, a table member having a slot with a visible scale adjacent thereto, a threaded shaft rotatably mounted beneath the slot and means for rotating the shaft, an indicator projecting into the slot and mounted for actuation by said shaft into a preselected relation with the scale, a template member movably mounted on the table member, a plate slidably positioned on the table member and pivotally connected with the template member, a bar slidably mounted beneath the table member, means rigidly connecting the plate and bar for effecting actuation of the plate by movement of the bar, and an arm pivotally mounted on the table member and having one end movably connected with said indicator and the other end movably connected with said bar whereby the template member may be adjusted in accordance with actuation of the indicator to a preselected position relative to the scale.

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