PHOTOGRAMMETRY AND THE PRESENT-DAY TOPOGRAPHICAL REQUIREMENTS

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(Translated from the Italian).

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Before taking up the subject of the restitution apparatus I should like to be permitted to review briefly the photogrammetric apparatus and the taking of aerial photographs.

The photographic apparatuses are nearly always of the automatic type fitted either for plates or films.

The objective should, as far as possible, be free from distortion; and nowadays it is almost always perfect in this respect.

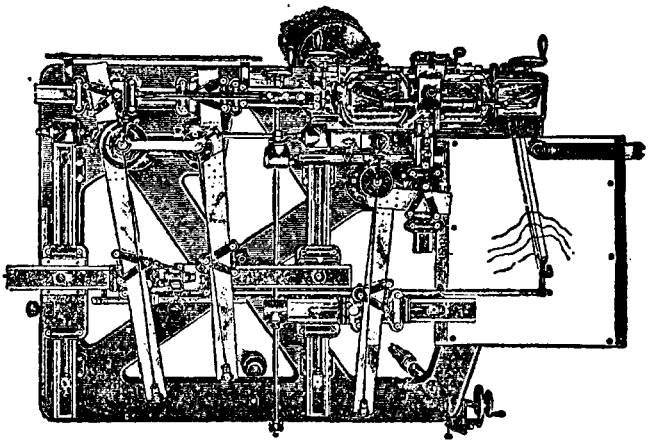

FIG. 1

OREL-ZEISS *Stereo cartograph C/3.*

In the automatic machines the opening of the obturator and the changing of the plates are performed by a device which is specially regulated, such that the shifts succeed each other at constant predetermined intervals. The chambers are either single or multiple — the latter permit the photographing of large areas of the terrain at each exposure and find their most frequent application in the small scale surveys, as we shall see further on.

In Italy we have two types of machines: the single type constructed by NISTRI, with plates or film (Fig. 2); and those manufactured by SANTONI, double, of which an interesting recent model has a capacity of 400 plates contained in the magazine without frame (Fig. 3).

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For the projection one cannot make use of the same objectives as those in the camera, because, in order to obtain clear images at short distances it would be necessary to move the plates away from the objective, whereas the distance between the plate and the objective of the projector must be maintained exactly the same as that comprised between the same elements in the camera, in order to obtain correct restitution. This is therefore accomplished by the use of objectives for restitution having a somewhat smaller focal length than the objectives used in the camera. In the photo-cartograph

of NISTRI the camera objectives have a focal distance of 20 cm., while the restitution objectives have a focal length of about 18 cm., and the image of the plates is formed at a distance of about 2 m.

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In order to locate exactly the points of intersection of the luminous rays, we may make use either of the principle of stereoscopic vision, of anaglyphs or of eclipses; the last procedure consists in projecting the two photographs alternately. In the NISTRI photo-cartograph, which makes use of the eclipse principle, two semi-disks revolve alternately in front of the objective in such a manner that while one objective is uncovered, the other is covered and *vice versa*. The speed of rotation of the disks is chosen such that one always sees the image of one plate; in which case, if the homologous rays meet at the screen, the point determined by their intersection remains fixed on this screen; if not, it jumps alternately from one position to the other, corresponding to the intersections of the two rays with the screen.

Fig. 4 shows the NISTRI photo-cartograph. In this the projector group is completely separated from the restitution group, which consists essentially of a rectangular coordinatorgraph in space. The model is turned through 90° in such a manner that the horizontal plane becomes the vertical plane. The restitution is accomplished by means of a screen of which the centre, marked by the small cross, may occupy any position whatever within the space of the coordinatorgraph; its movements are transmitted to the work-table by means of gear-wheels and pinions.

The eight small screens which are shown on Fig. 4 serve to re-establish the external orientation of the photograms; they are mounted on articulated arms which may make oither large or small movements, and are so arranged that they can occupy, in the epace of the restitution apparatus, the different trigonometric points of the terrain. In sorder to determine the external orientation of the photograms, the projectors may be

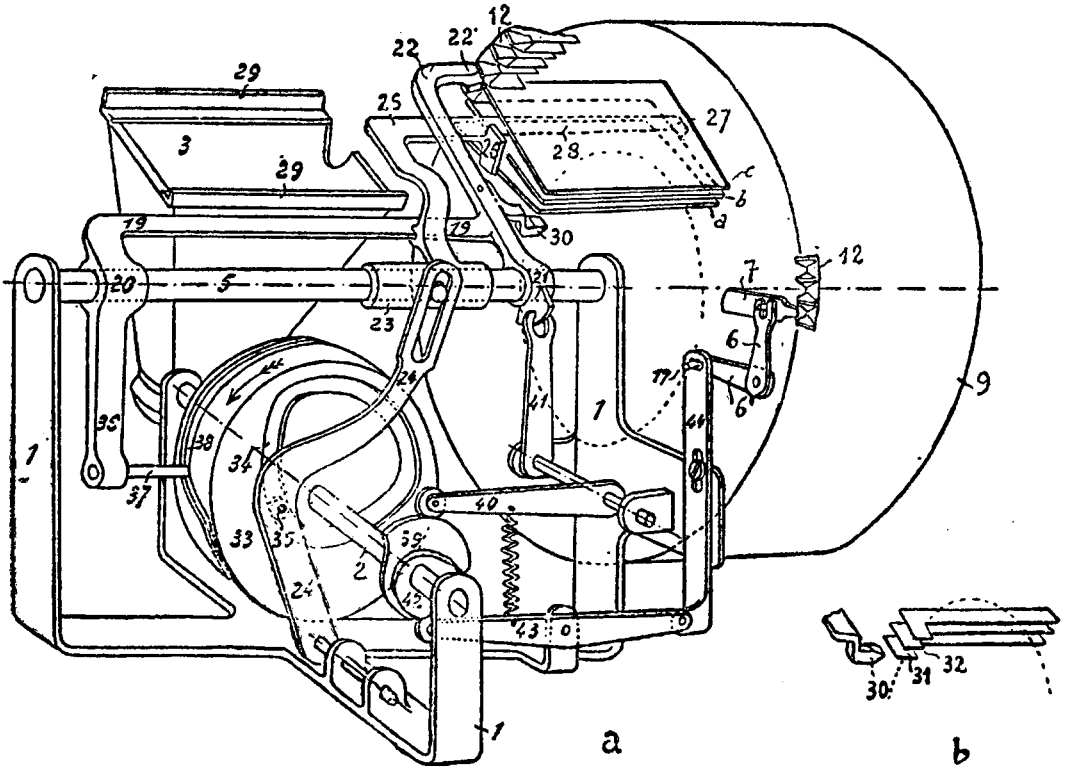

FIG. 3.
SANTONI *aerophotogrammetric machine.*

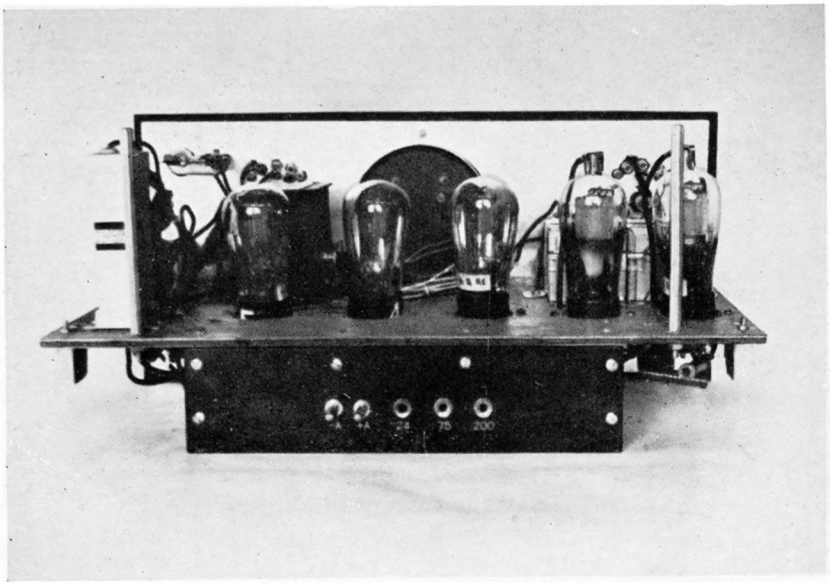

FIG. 10

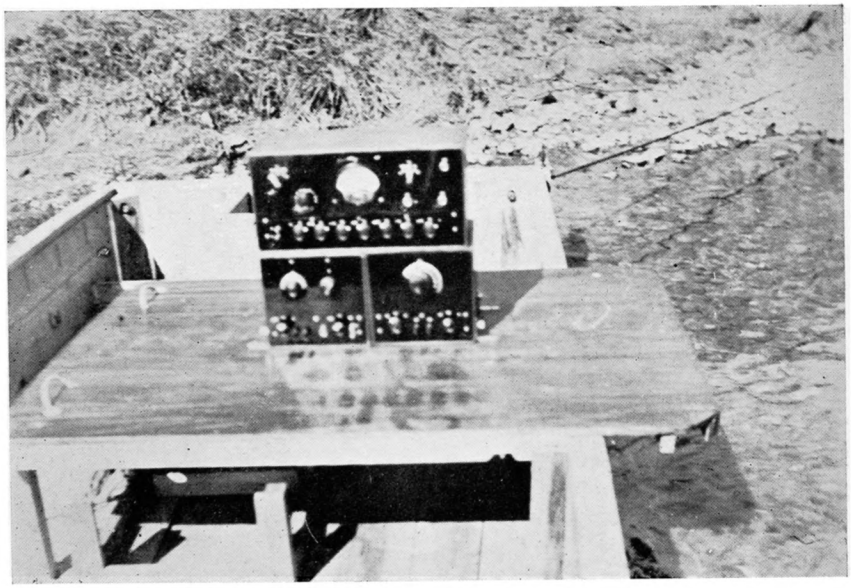

FIG. 14

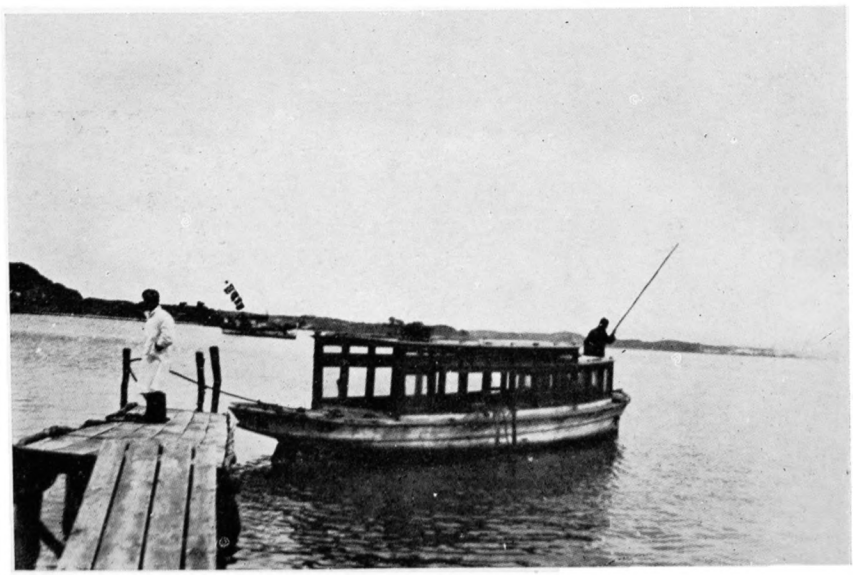

FIG. 16

moved in an appropriate manner until the points of the model correspond to the points of the base coincident with the centres of the screens.

We cannot go into details of the construction of the stereoscopic instruments of the SANTONI stereocartograph type (Fig. 5) with mechanical projection; and the photostereograph of NISTRI (Fig. 6).

For small scale work, NISTRI has manufactured the multiple photocartograph (Fig. 7) based on the principle of double projection, which is much simpler than the usual photocartograph.

The most recent apparatus is the SANTONI stereosimplex, a stereoscopic apparatus with mechanical projection very much reduced and simplified as compared with the stereocartograph.

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NISTRI has recently manufactured a special stereoscopic tracer equipped with a type of movable stereoscope which rests upon the photographs. It is connected with the pencil by means of a pantograph. By means of this instrument, one can trace the curves of equal altitude with much greater accuracy than by inspection.

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