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C.SENA

USE OF SPECIAL ELEVATION EQUIPMENT FOR TERRESTRIAL CAMERAS,
FOR PARTICULAR PHOTOGRAMMETRY OPERATIONS.

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LABORATORY FOR TERRESTRIAL PHOTOGRAMMETRY
POLYTECHNIC - UNIVERSITY OF TURIN

ISTITUTO DI GEODESIA, TOPOGRAFIA E FOTOGAMMETRIA DEL
POLITECNICO DI TORINO (ITALIA)

USE OF SPECIAL ELEVATION EQUIPMENT FOR TERRESTRIAL CAMERAS,
FOR PARTICULAR PHOTOGRAMMETRY OPERATIONS.

Carmelo SENA

Laboratory for terrestrial Photogrammetry
Politecnico - Università di Torino

ABSTRACT

The uses are briefly described of special elevators for photogrammetry cameras, carried out by the author in some sectors (survey of landslide areas, of archaeological zones, etc.) where notable difficulties are met for the normal photography operations.

In a preceding publication⁽¹⁾ we described the plan and the reasons for which we built a tridimensional elevator able to lift a photogrammetric camera for the maximum height of m.15, in any position inside an ideal m.7 radius sphere either for vertical or horizontal pictures or for angle shots with any inclination angle value and obviously with any convergency value.

The elevator has been constructed by "Officine Hydron" with factory in Cornaredo (Milano)

The purpose of the present publication is to describe experiments made with this equipment in case of two surveys, that is as first example the survey of the rocky crust under the "Giunone" temple in Agrigento (Sicily) and as second example, the survey of an archaeological excavation zone, near Reggio Calabria.

Besides, we present a new equipment that let us have a perfectly vertical take direction, until the height from the country plane of about m 6.

(1) C. SENA - Un elevatore tridimensionale per fotogrammetria terrestre - Litografia M & S - Torino - luglio 1979



1°) As you know, even the zone of the Agrigento temples hill has been interested by subsidence movements; great strength phenomena happened in the past with disastrous effects in the north zone of Agrigento center.

We have been interested by the "Regione Siciliana" and by the "Soprintendenza Archeologica di Agrigento" to study and realize a way to keep under control in the time the plano-altimetrical movements of a small (about 250 x 250 m) but very interesting zone first of all because the Giunone temple (fig. 1) insists on it, and because it is very near to a zone already concerned in a quite recent past in an remarkable subsidence movement.

Here we omit reporting the various and interesting considerations effected by several specialists (geologists, archaeologists, engineers, etc.) that particularly allowed the delimitation of the study zone and the individualization of interesting areas positions in order to obtain those informations of geometric characters, necessary to the zone systematic control and then to the eventual understanding of the beginning and the nature of the phenomenon itself. We obviously hope to be able after ^{wards} to spread in ^a systematic way to the whole temple hill and even to other near zones the sort of research we effected here.

The geometric informations for particular points (we speak about these operations purposely prepared) or through photogrammetric terrestrial operations reaching all the examined zones until those areas less easily accessible.

To this end, we first of all carried out the materialization of a certain number of points (n. 27) in the concerned and accessible zone.

This operation ^{done:} was already by drowning in special beton foundations (fig. 2) of the average sizes of cm 40 x 40, with deepness until cm 90, some circular alluminium plates, cm 2.5 thick, cm 16 in diameter, provided with anchorage metal purposely studied for allowing the position either of signals always very well visible in photogrammetric pictures and in topographic operations, or with special support for passive prisms for the determination of their position even making use of electro-magnetic waves diastimeters. For the photogrammetric takes of the interested zone and purposing to avoid to resort to great distances from camera to monuments, we used for the execution of photogrammetric stations a small road that skirts the interested zone.

Obviously exposures have been projected for the utilization of the elevator it would compel us, always on the supposition of the taking feasibility from the same positions, to use shotting axes with a certainly considerable inclination. We report the general data respective to the pictures operations: in this case we used the photogrammetric camera U.M.K. 10/1318 C. Zeiss Jena, deliberately modified to be supported by elevator's forks (even other photogrammetric cameras



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may be used to the elevator). U.M.K. provides with a back film, with a completely automatic shooting cycle.

It has a focal distance of mm 94.14 (for shooting distance to infinity), useful image size 120 x 160 mm .

The shooting distance from the medium plane was of m 80 and so with photograms scale 1/800.

The shooting height from the country plane (changeable) was of m 12.

We must remember some peculiarity in using elevating equipment, particularly to see how to settle the camera's orientation and therefore how to resolve the conditions to obtain stereoscopic pair satisfying the normal plotting needs either with a fixed elevator base or with a moving elevator. The elevator with fixed base in a point, may shoot from two suitable stations in the space by lifting and turning two jointed arms.

The fork at the end of the upper arm, which supports the photogrammetric camera with a mechanical device made up by two jointed parallelograms always keeps vertical its turning axis.

Besides through a flexible transmission device, made of flexible connecting rods rolled up on special pulleys, it is constantly oriented meaning that shooting axes always result parallel between them in the different positions of the fork and therefore of the camera.

A control of these situations may always be effected through the closed circuit telecamera jointed to the photogrammetric camera, with the observation of particular pieces of the interested zone.

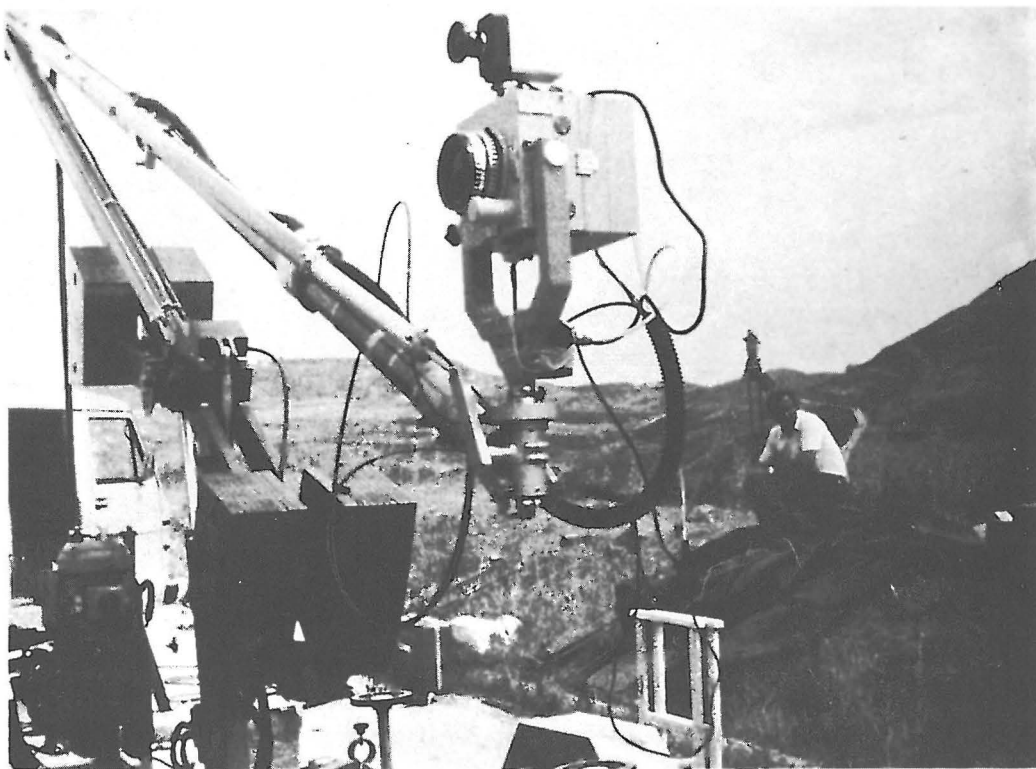
And then reaching the established station positions in the space, is effected by imposing some rotation and inclination angles of the two moving arms of the elevator, as already described in (1).

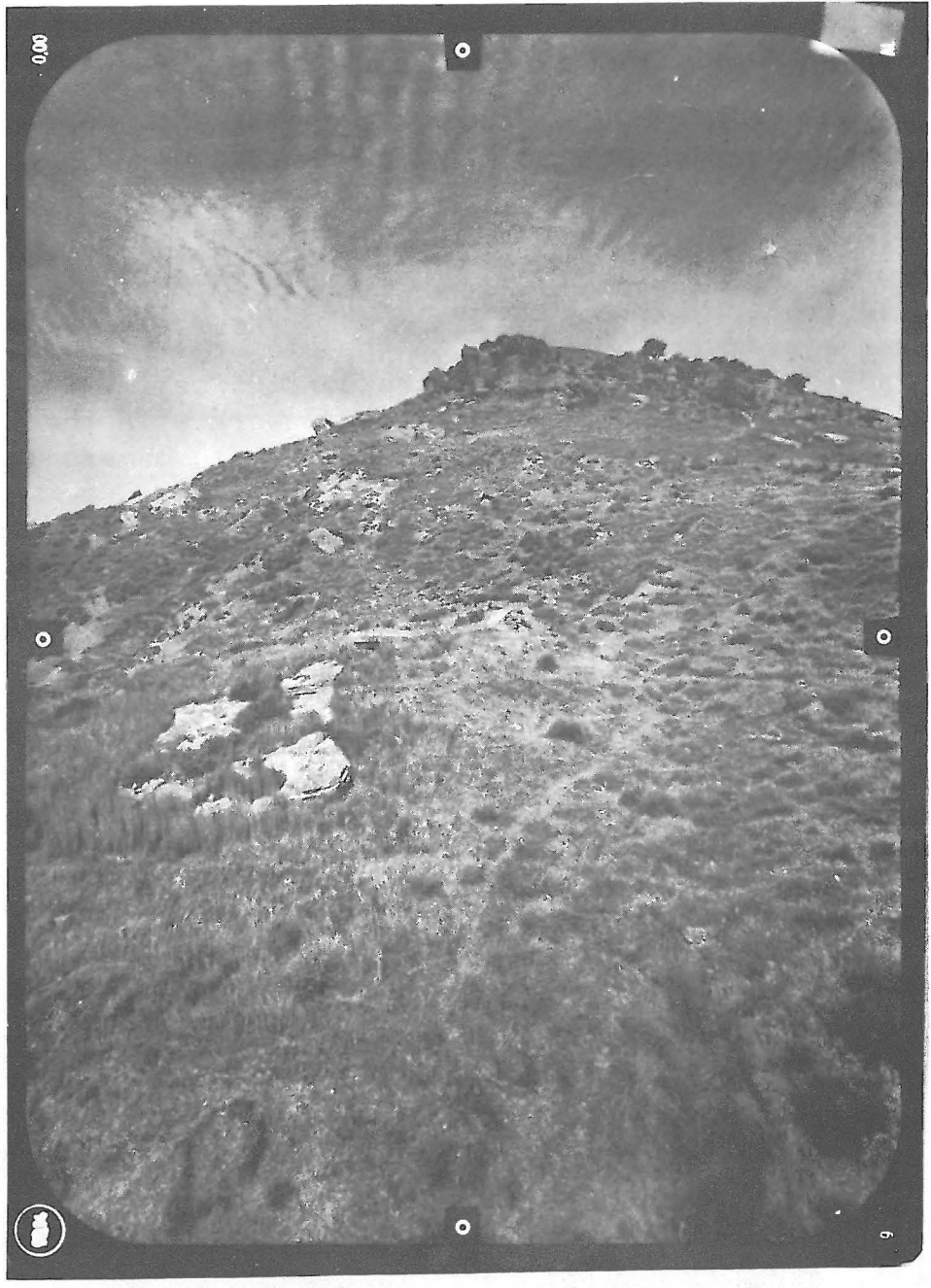
A control, in cases it asks a particular precision in camera position, may always be done with topographic methods, for example putting small reflecting surfaces in particular camera's positions and observing this one, in its movements with an electro-optical diastimeter, with measurements of azimuthal and zenithal angles.

In case that the elevator must move to reach new positions, previously studied and established in the shooting project, you need to proceed first of all as to respect the projected condition of bases placement (it is quite an easy operation); and then you make again the orientation operations with the camera in the suitable position, so that the new camera's position turns out bearable with the previous one with which it must pour.

In fig. 5 we report the example of a photogram relative to the zone in question.

2°) During works of doubling Villa S. Giovanni - Reggio Calabria railway line, a quite interesting archaeological area has been discovered just near the town of Reggio Calabria. Excavations took to a definition essentially two zones, near to each other, and of which it has been asked a survey able to give all details of emerging structures. Even about this work we report more widely in another report; here we just speak about the peculiar utilization of the elevator already described. The recourse to a survey through terrestrial photogrammetry methods is first of all justified by the necessity to obtain a very rich and exact documentation (the asked scale for survey is 1/50); besides we have problems of urgency to let the realizing railway works go on. Sizes of the two zone: one m. 40 x 50 the first and m. 10 x 10 the second. It seemed impossible to be able to use the photogrammetric equipment inside the areas. So the pictures plan has foreseen photographic stations on the outside perimeter of the two areas. Therefore the set had to work with the horizontal upper arm and with the photogrammetric camera inclined towards lower of 45° (fig. 6). The covering of the whole area asked for a high number of photographs to have the minimum of defilated details.





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The pictures operations project has, in any case, been studied in function of the plotting with the analytical instrument "Digital Stereocartograph" (D.S.) from the "Officine Galileo, Firenze!"

We report some data pertinent to the exposure operations: medium distance (along the inclined axis) m 14; base m, 6; used camera U.M.K. whose data have been previously reported. The used film was the Kodak plus-X aerographic with sensibility of 22 D.I.N., cut in sizes to be used in the camera U.M.K.

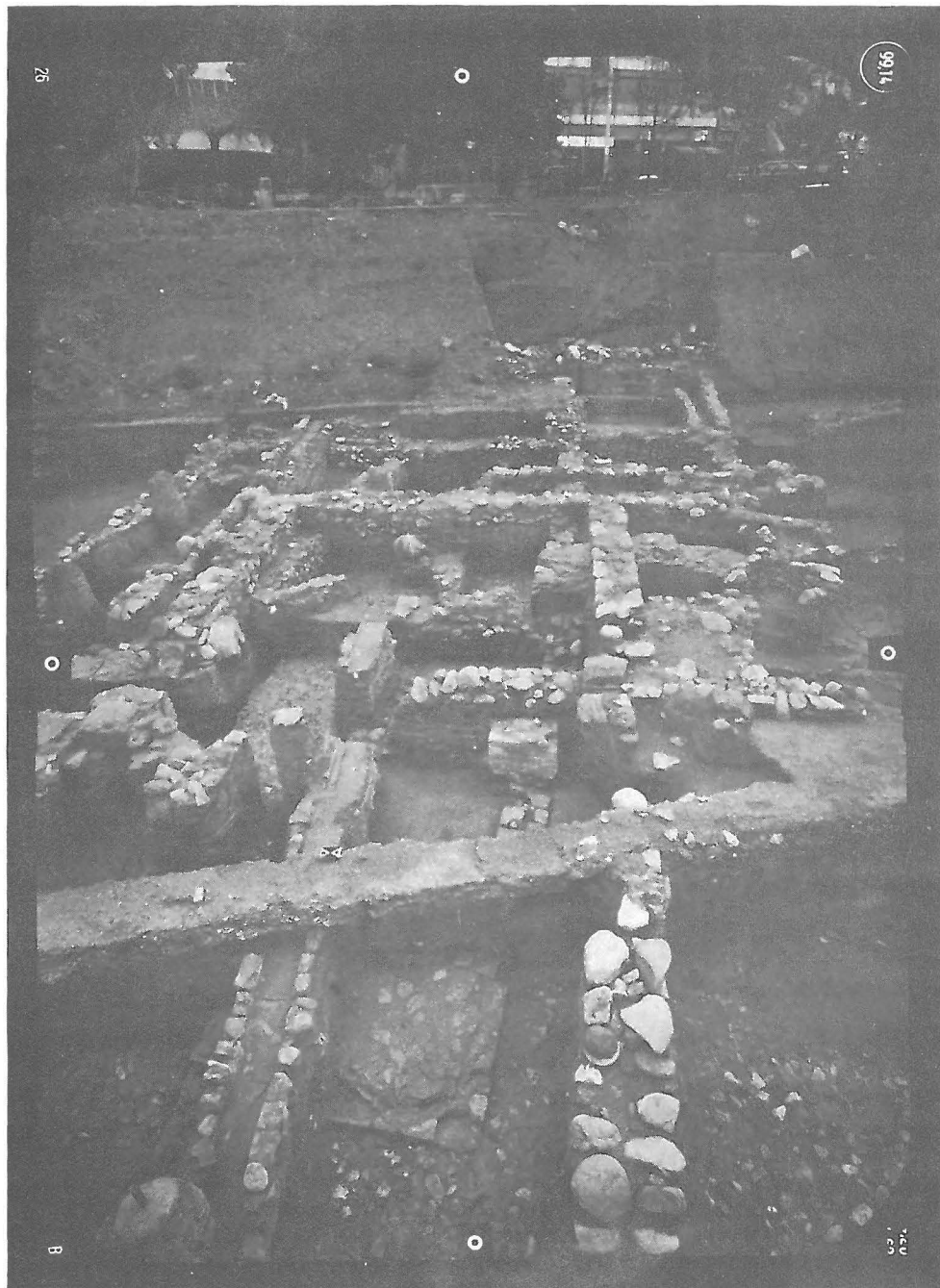
The good sensibility of the film was particularly appreciated for a great presence of wind which required small click times.

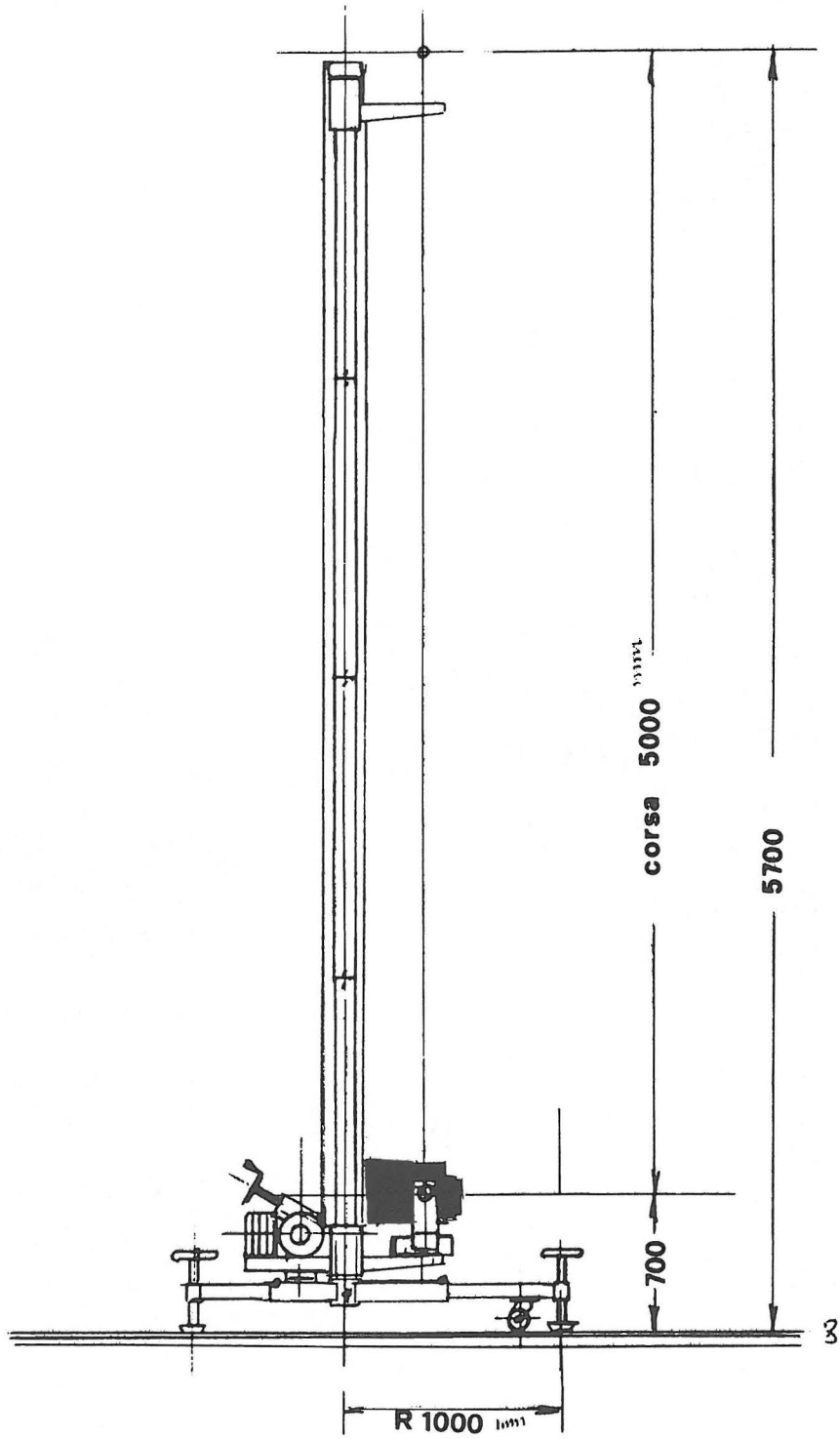
In fig. 7 we reported the example of photogram interesting the first excavating zone.

- 3°) In the end, we want to present a new special lifting equipment, easier than the previous one but of a more limited employment.

Even this equipment boîrns from the need to lift the photogrammetric camera in particular ways and to provide for very light and small sized so that it could be carried in places where the previous equipment cannot reach (fig. 8).









It is particularly born from the need to survey the columns of the Giunone Temple in Agrigento (fig. 9), restoration stage, to graphic scale 1/5, with effecting three prospects for each column, so to have the whole development. Therefore the work, extremely heavy (it takes about 9 stereoscopic models to have each column) requires the possibility to effect some pictures with particular characteristics. The instrument is made up with an adjustable tripod that acts as a base on which is connected the rigid column of 4 decomposable elements, realized with section shaped in light alloy (aluminium).

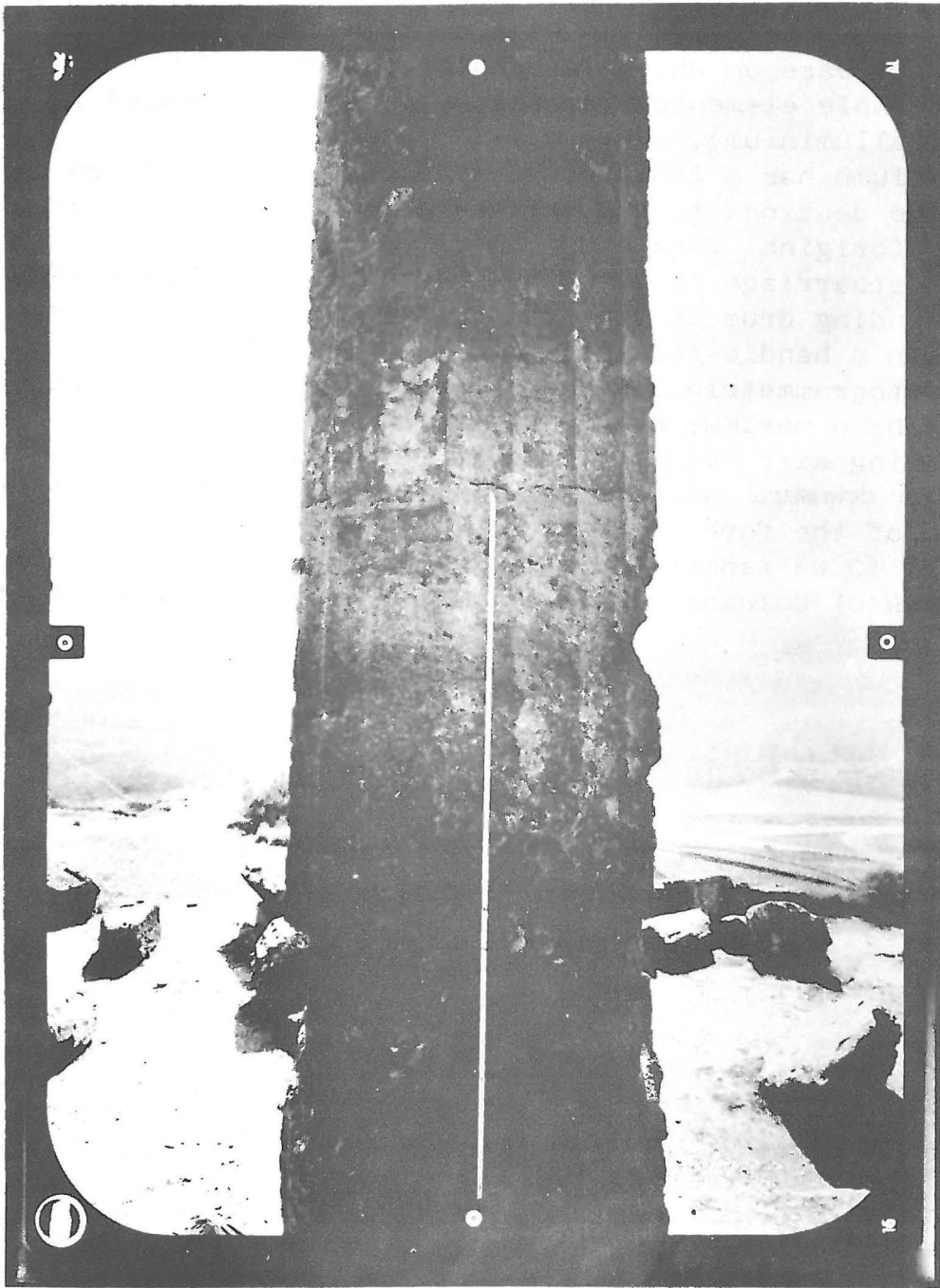
This column has a continuous guide on which slides an undercarriage destined to support the complete photogrammetric camera (original fork plus camera).

The undercarriage is raised by a mechanical device made up by a winding drum of the flexible traction element, provided with a handle-reducer.

The photogrammetric camera can reach the minimum height of 70 cm and a maximum height of 560 cm.

The taking axis may be horizontal or variously inclined to upward or downward as possibilities offered by the inclination system of the fork.

In fig. 10 we report a proof photograph interesting a column. The work of columns survey is actually in an execution stage.



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