NOTES ON THE PANTOGRAPH-CUTTER FOR CHARTS IN RELIEF

The P. RICHARME (*), S. D. G. D. Patented Process.

The Pantograph-Cutter is a new instrument by the use of which all kinds of models, more particularly plans and charts in relief and clay models of large public works, may be made with great ease and rapidity.

Up to the present it has been necessary to employ either very slow elementary methods, for instance, the superimposition of cardboard cut according to the contour lines, or industrial precision instruments, costly and also of low rate of production, like machines for drilling plaster. As a result it has never been possible for plans and charts in relief to be widely circulated.

The Pantograph-Cutter was invented during the war, in a prison camp. The first model, made of wood, and the wire-cutter system of which was rudimentary, nevertheless produced remarkable relief-work, especially of great heights such as the *Cirque de Gavarnie* (France), the Hidden Peak (Himalayas), the most remarkable being a monumental ensemble of the *Massif d'Oisans* to scale of 1 : 20 000, measuring 1.50 m. × 1.40 m. fortunately brought to France and visible in Paris ; there were also produced reliefs of countries such as the Pyrenees, Syria ; and clay models of public works such as the Ghryb dam in Algeria.

Quite recently the instrument was developed, the metallic gear improved, and an endless-wire cutter introduced, which has still further increased its output and enables spatial sketches to be made with the same facility as ordinary drawing.

The Pantograph-Cutter at last provides the easy solution of a problem ; by its use the rapid diffusion of charts and plans in relief becomes possible ; so far these had been merely laboratory or museum pieces.

It may be used with advantage :

— by teachers, for manual work and the study of geography ;

— by *Ingénieurs des Ponts et Chaussées,* in Civil Engineering, in important public works, to make models of studies or of already constructed works—(Hydraulic power, important barrages, electric, telepheric lines, autoroutes, works of art of all sorts) ;

— by geographers, geologists, prospectors ;

— by tourists, alpinists, *syndicats d'initiative,* youth associations, etc..., in a word, by all persons interested in art and in geography ;

— lastly, for all sorts of models in relief.

Because of its simplicity, the Pantograph-Cutter can be procured at a very reasonable price.

The pattern is constructed by modelling a clay mass, after a chart or plan in already existing or reconstituted height contour lines, by preliminary rough casting in the form of gradients corresponding to these contour lines, the separation of each gradient being made instantaneously by the use of a wire cutter which removes the slice of clay exterior to the gradient. The definite pattern is then obtained by smoothing the gradients with the finger or by using gouges.

DESCRIPTION AND OPERATION OF THE PANTOGRAPH-CUTTER.

The instrument consists of two parts :

A self-paralleling mechanism and a cutting tool.

1) Self-paralleling mechanism.

This mechanism provides the constant translation of the chart to the model placed side by side on a table between a tracing point S which follows the height contours of the

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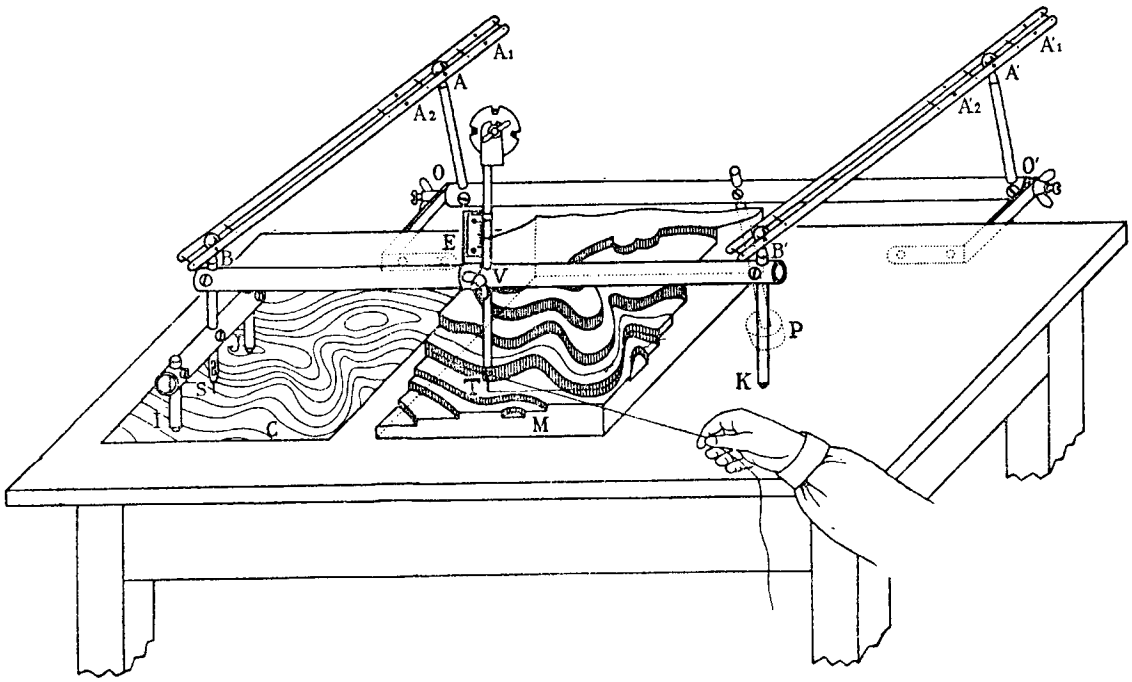
chart and a cutting tool T which acts in the clay of the model ; a scale divided for heights indicates altitudes. If necessary, an auxiliary mechanism makes it possible to produce the pattern in larger or smaller dimensions than those of the chart.



Richarme Pantograph-Cutter.

The instrument has no built-up foundation ; it is placed on any sort of a table of sufficient size, to the back part of which it is fixed by two brackets and four wooden screws. A rigid unit O O' A A', consisting of a tube O O' and two equal and parallel bars O A, O' A', pivots in two fixed points O and O' ; at A A' are two ball joints that slide to and fro along two arcs of circle with axis O O' ; the distance A A' is constant.

A traverser B B' I J K includes :

— a small tubular girder B B' ;
— a tubular bow I J ;
— three small columns I J K at the lower part of which are set three steel balls which can revolve freely and assure the sliding of the traverser in every direction ;
— two ball joints at B and B' ;
— the tracing point S ;
— the tracing tool T, which can be clamped at the desired height by means of a keying screw. The tracing tool is generally the cutter described further on or, more rarely, an accessory part (marker, scraper, tracing pricker) ;
— an elevations scale E, movable and divided as may be desired.

Two equal and parallel connecting-rods A B, A' B'.

These two connecting-rods are made fast to the small beams by a simple pressure of the fingers ; in addition to the position A A', two other positions A1 and A'1 enable the working part to be lengthened or shortened. The A A' B B' system forms a jointed parallelogram. The beams B B' can describe horizontal arcs of a circle referred to the beams A A' and the latter can move backward or forward ; the result is :

— that the point S and the part T can travel along the chart and the pattern ;
— that the segment B B', and consequently the segment S T, maintain a constant parallelism.

Lastly, a counterweight P fitted to the unit O A C' A' balances the weight of the connecting-rods A B and A' B'.

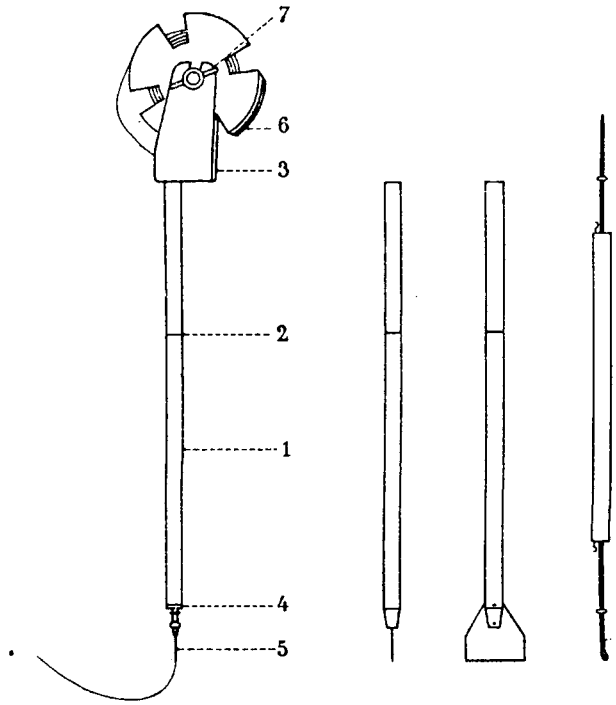
2) The cutter.

The cutter consists of :

— A tube (1) with reference mark (2), surmounted by a threaded axis and a thumb screw (7) which acts as clamp ;

— A hypodermic needle (5), clipped, fitting to the end-piece (4) fixed at the base of the tube ;

— A spool of nylon thread (6) placed on the axis and fastened by the clamp ; the thread, then the needle, runs through the tube.



The Cutter.

The instrument is manœuvred by keeping the traverser towards the tracer with the right hand and with the left hand, towards the tracing point. Only the tracing point should be watched.

When a contour line is followed on the chart, the cutting tool being secured at the corresponding height, the clamp being released, the needle penetrates into the clay of the relief to be modelled, traces a furrow corresponding to the contour line and, as the spool unwinds, the cutter thread is deposited in the hollow of the furrow. A great length of thread can thus be unwound without any impediment. The only pull which, besides, is very feeble, to which the pantograph is subjected comes from the friction of the needle in the soft clay.

When the needle issues from the pattern, after clamping it suffices to draw away, horizontalwise, the free end of the thread, on the opposite side from the slope, in order to cut a horizontal slice and obtain a gradient of the relief.

So that the cut may be perfectly horizontal, the piece of thread being pulled is generally crossed with the tightly-drawn part issuing from the needle.

Large divisions of ground are proceeded with at the same time ; first of all the principal contours are cut from top to bottom after displacing the scale by two or three millimetres towards the top, then the whole pattern is again gone over contour by contour, this time working from bottom to top, the scale having been again clamped in its place.

While cutting, any rewinding of the thread should be carefully avoided, for the clay which the thread would then trail into the needle would immediately obstruct it. When, after

cutting a few gradients, several metres of thread have been unwound, wipe it carefully with a wet rag and rewind on the spool.

Only a few minutes are required to mount and dismount the instrument ; it is carried in a long, flat case. A small type can be made for schools and a medium-size or large type for engineers.

A plaster mould is habitually taken of the model ; the clay is recuperated when the mould is run off. From this plaster mould one or several proofs may be drawn, either as small bands of paper, in "papier-mâché" or staff or even in plastic matter or moulded rubber. The samples are afterwards painted, decorated, and inscribed so as to show them to advantage.

The Pantograph-Cutter was submitted to the 68th Meeting of the *Association Française pour l'Avancement des Sciences* held at Clermont-Ferrand in July, 1949, to the Lépine Competition in 1949 and to the International Competition of Inventions where it was awarded a very high place.

Two types of the instrument are manufactured :

Large type for models 75×75×75 ;

Small type for models 40×50×50.

Supplement for enlarging or reducing mechanism large type and small type.