

## ·GROMA': THE ANCIENT LAND-SURVEYING INSTRUMENT.

By F. TANDY (FROM NOTES SUPPLIED BY DR. MATTEO DELLA CORTE).

It was in the seventeenth century that erudite students first began to discuss this ancient instrument—mainly by seeking light from classical literary sources—in order to understand the nature of the material and in what manner the 'arpenter's' (land-surveyor) measuring apparatus was constructed.

By its means, the ancient Roman geometricians executed their solemn inaugural ceremonies of defining the limitations of towns and colonies as well as the common measurements of agricultural or other land.

The only literary sources available, however, contained confused or obscure notes and the text was invariably inexplicit, as, for instance, in the publication known as *Grammatici Veteres*. The various publications did not contain even an elementary description of a geodetical Roman instrument such as the 'groma.'

The information available in the beginning of the nineteenth century, although somewhat of a less indeterminate and uncertain character, was, however, much extended when the new Greek text of Heron of Alexandria was brought to light for the first time. He was the author of many military and engineering works and a great mathematician who lived in the first century A.D.

In his dissertation *περὶ διόπτρας* Heron censoriously criticises the 'groma' which Roman geometricians were accustomed to use and by mathematical demonstration indicated the errors which were introduced in its application, as compared with the more perfect instrument the 'dioptra' of the Greeks. The last instrument was the forerunner of the theodolite as used by modern engineers.

It is due, however, to the clever interpretation of the critical remarks of Heron made by G. B. Venturi, the great Italian master of physical science, that all the obscure questions relating to the 'groma' received their first consistent elucidation. Still further illumination was

brought to bear upon the subject by the discovery of a tombstone found in 1852 at Ivrea, the ancient Eporedia in Piedmont, Italy.

This tombstone denotes the burial-place of the Roman 'arpenter' and *ensor* L. Albutius Faustus. In the *mémoire* written by Dr. Matteo della Corte of Pompei, to whom reference will be made later, a reproduction is given of the funeral inscription and symbolic figures thereon. The upper part of the stone exhibits the former in engraved letters, but below there is in relief a representation of the 'groma' clearly indicating the instrument of which the *ensor* Albutius made use. The sculptor represents the apparatus as consisting of two principal parts, (*a*) a vertical cylindrical staff which could be driven into the ground, and (*b*) a large cross supported horizontally by the staff. From each arm of the cross a thread carrying a weight was suspended. Two of the weights hanging from two arms are clearly shown in the reproduction referred to.

When the ancient 'arpenter' was surveying, he threw his sights through the two pairs of threads diagonally opposing each other, and as the arms were arranged exactly at right angles he was able to project similar angles upon the ground. The act of delineating right angles upon the land under survey was and is still the fundamental procedure and basis upon which geometrical practice relies.

The study of the 'groma' and the questions concerned therewith has been undertaken by students of physics and archaeologists of all nations, but G. B. Rossi and E. Legnazzi were the two brilliant Italian masters who established the fact that the machine, to be complete and whole, required a third element in its composition. A transition or moving element was necessary between the staff or main support and the cross; that is to say, a 'projecting beak-piece,' the so-called *umbilicus soli* mentioned by the 'grammatici veteres' in their early works.

It is worthy to note that, in the relief representing the instrument on the tombstone of Albutius, such a component was missing, but this is probably due to the fact that, from a symbolic point of view, it was not essential to the purposes of a memorial. This important item was mentioned, however, by the ancient *ensores*, and it was

a necessary adjunct required by the technical conditions implied in its practical application. In fact, without it the operator or user would have been prevented from throwing his sights through a pair of diagonal threads because of the interposition of the staff.

The foregoing represents the position of affairs and state of knowledge upon the subject until quite recently, when Dr. della Corte, the well-known excavator of Pompei, found amongst an enormous mass of various material and debris a number of very valuable bronze and iron objects which he was fortunately able to recognise and to associate with the ancient 'groma.' This was due to his previous brilliant studies and discussions which enabled him quickly to establish all the elements of the 'groma' and, finally, to place his knowledge in the possession of archaeologists.

Students are referred to the *mémoire* drawn up by Dr. della Corte, entitled 'Groma' and published by the Accademia Regia dei Lincei in *Monumenti Antiche*, vol. xxviii (1922) and for this short summary readers are indebted to the author, who has kindly given permission to bring under notice his most interesting discovery.

The illustrations contained in the *mémoire* show the eleven ancient bronze and iron objects in their original condition as found at Pompei, but the wood-work is missing. Subject to this loss, the reconstruction of the entire apparatus becomes possible. At the time of the discovery all the component parts consisting of tubes, cylinders, weights and iron-work were associated with portions of the wood sections which connected the various parts, and the fibres were well preserved by the oxide of the containing metal. The pieces have been carefully studied and skilfully described, their separate functions being clearly interpreted and indicated in the numerous figures given.

Comparison between the reconstructed instrument and the relief upon the tombstone above referred to points to exact conformity between the symbolic representation and the group of objects found in Pompei. The former represents a staff, the cross and the weights. The latter consists of an iron plate fitted with a wooden cross, the staff with its two bronze ends and four weights.

The most important feature of the Pompeian discovery consists in the fact that it permits of the authentic reconstruction of the third principal element of the machine, that is the 'projecting beak-piece'; and this facilitates the re-assembly, in the most consistent and practical manner, of the various ancient fragments which have been found. Nothing is now missing which is essential to the construction of a proper and complete facsimile of the original.

The illustration which accompanies the *mémoire* therefore furnishes a wonderful reproduction of the apparatus according to classical description and modern conception.

It indicates that, by means of the two articulating bronze supports, the cross turns upon the end cylinder of the 'projecting beak-piece' in the same manner as it did two thousand years ago, and, similarly, the supporting beak rotates upon the upper end of the reconstructed 'staff.'

By these means, geometrical sights were rendered practicable in all directions and in line with or between the weighted threads when the instrument was placed in the ground.

The 'groma,' which originally weighed about 15 kilogrammes, could be dismembered into three pieces, the cross, beak-piece and staff, to facilitate its transport when measuring land.

The author includes a chapter illustrating the universal application to the various units employed in the ancient world and shews that the Pompeian 'groma' is the only authentic and original model.

This collection of bronzes therefore constitutes a very precious *unicum* which substantially enriches the collections of the Naples National Museum.

Dr. della Corte subsequently deals with many other technical objects and utensils found in the shop, which was recognised as that of the Pompeian 'arpenter.' The articles discovered include the bronze or iron terminations of the 'ten feet metrical canes' (decempedal) and of the 'signal sticks' (*metae signa*); the Roman foot-measure, bent into two halves as in the case of the modern two-foot rule; two compasses and a 'style' for writing notes upon a waxed tablet.

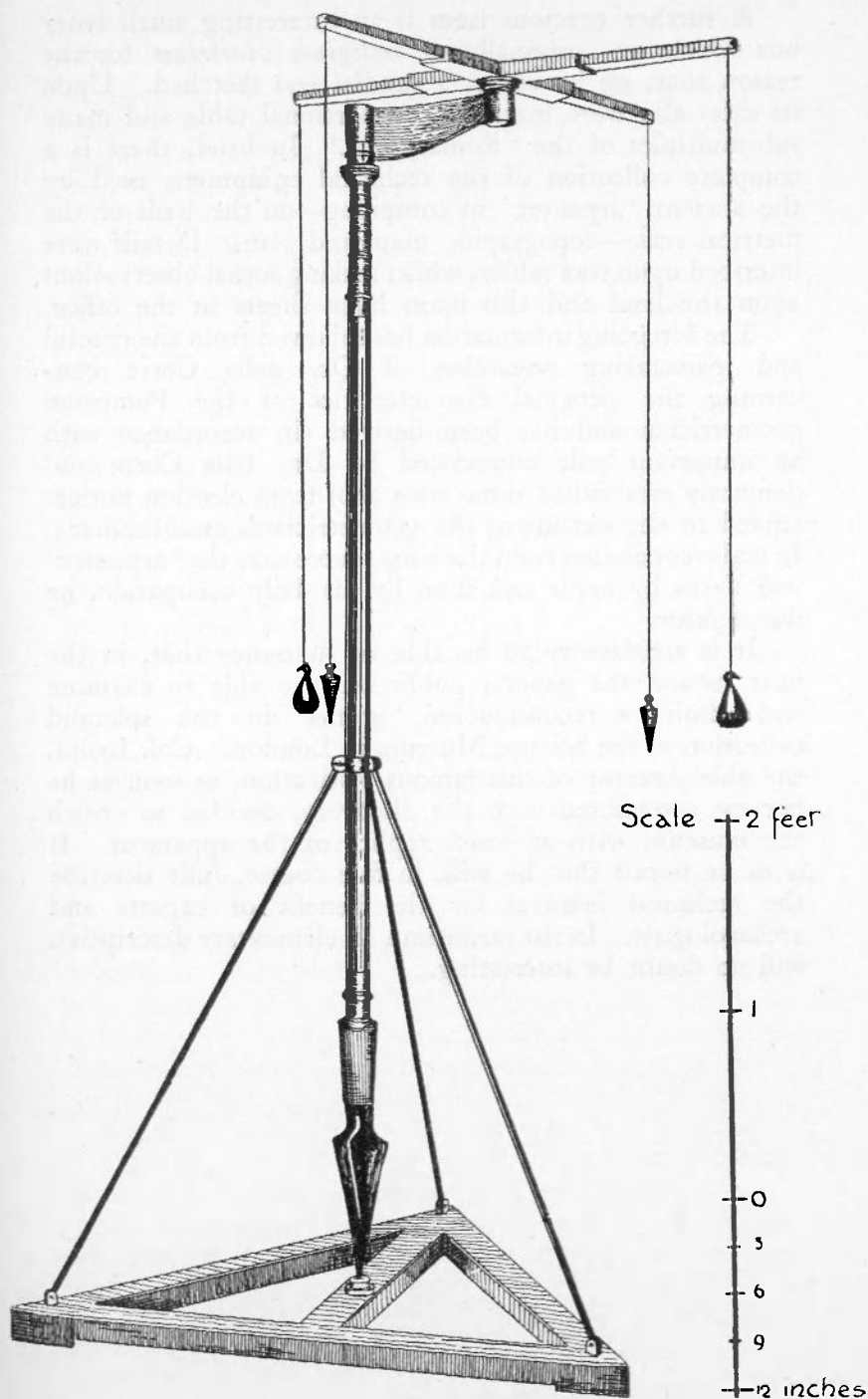


FIG. I.

A further precious item is an interesting small ivory box which was originally an *orologium viatorium* for the reason that, on its cover, a sundial was sketched. Upon its sides also were marked a proportional table and many sub-multiples of the 'Roman foot.' In brief, there is a complete collection of the technical equipment used by the ancient 'arpenter' in compiling—on the basis of the metrical scale—topographic maps and plans. Details were inscribed upon wax tablets whilst making actual observations upon the land and also upon linen sheets in the office.

The foregoing information has followed from the careful and painstaking researches of Dr. della Corte concerning the personal characteristics of the Pompeian geometrician and has been derived (in accordance with an important rule enunciated by Dr. della Corte and definitely established some time ago) from election notices affixed to the outside of the geometrician's establishment. It is also concluded from the same source that the 'arpenter' was Verus by name and that, by his daily occupation, he was a *faber*.

It is satisfactory to be able to announce that, in the near future, the general public will be able to examine and admire a reconstructed 'groma' in the splendid collection of the Science Museum in London. Col. Lyons, the able director of this famous institution, as soon as he became acquainted with the discovery, decided to enrich the museum with an exact replica of the apparatus. It is to be hoped that he will, in due course, fully describe the technical features for the benefit of experts and archaeologists. In the meantime, an elementary description will no doubt be interesting.