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A three-axis universal clamp for re-orientation of rocks in the laboratory

MANY geologists have cause to collect rock specimens on which they make adequate markings to enable exact re-orientation in the laboratory. One of the more common methods for such re-positioning is to support the specimen on a block of modelling clay. This often becomes a tricky operation, especially with large specimens, which may cause sudden sagging of the clay and consequent loss of the desired position. Being exasperated with this technique the author designed a three-axis universal clamp, which can be quickly and accurately adjusted to hold a rock in any desired position. The device (fig. 1) can be cheaply and easily made, and by constructing it from wood and non-magnetic alloys a compass can be used near it for exact geographical re-orientation.

A hubless and spokeless aluminium alloy bicycle wheel, of 25 in. diameter and $\frac{7}{8}$ in. width, has been mounted in a composite wooden clamping block with dimensions $4\frac{1}{2}\times 5\frac{1}{4}\times 1\frac{1}{4}$ in. A hole drilled through the block and the rim of the wheel has a $\frac{1}{4}$ in. diameter bolt passing through it, about which the wheel can be rotated (A_3). Tightening of a wing nut on this bolt effectively locks the wheel to the large wooden baseplate (13×26 in.), which supports the whole device. The clamp consists of two wooden boards ($17\times 2\frac{1}{4}\times \frac{3}{8}$ in.) attached to two location blocks and arms across a diameter of the wheel. At the extremities of the arms are two bearing housings connected by a plate that passes around one half of the wheel circumference and is supported by three anchor blocks. At each bearing housing and each anchor block this plate is spaced from the wheel by a single glass 'marble' of $\frac{1}{2}$ in. diameter that runs in the groove normally occupied by the tyre and the inner tube. The clamp can thus be rotated about an axis through the centre of the wheel corresponding to the position normally occupied by the axle (A_2). The $\frac{1}{2}$ in.-diameter arms supporting the clamp can rotate within the outer bearing housings and so provide the third axis of rotation (A_1). Rotation of the specimen about A_2 can be prevented by locking screws, one of which passes through each of the bearing housings and bears on to the side of the bicycle wheel, whilst rotation about A_1 is stopped by tightening a second pair of locking screws in the same housings.

The clamp itself consists of the two wooden boards between which lie the two locating blocks each carrying a pair of rods which pass through the boards. The rods lying on the wheel diameter are of $\frac{1}{2}$ in. aluminium

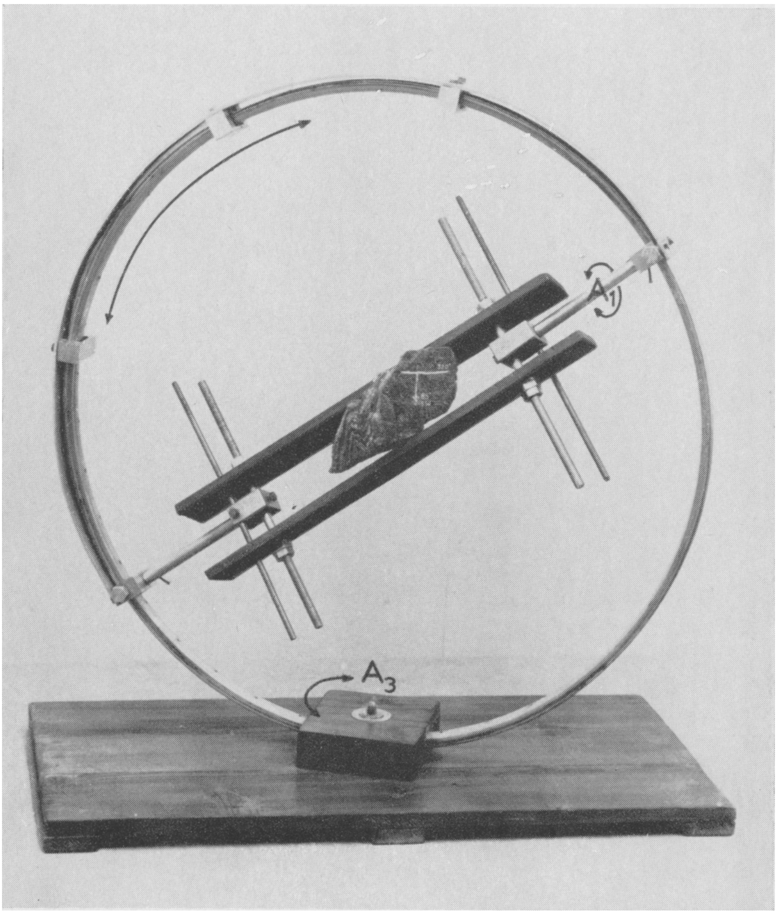

FIG. 1. The three-axis universal clamp. Axis A_2 is in the position normally occupied by the axle; the rotation directions about it are shown near the rim of the wheel.

alloy and are threaded at both ends. By tightening the nuts with a spanner the boards can securely clamp a rock specimen, but finger tightening has generally been found adequate. The offset brass rods act as guides to ensure stability of the clamp and are particularly necessary to maintain a diametric position. The clamp has a maximum opening of 10 in. and can accommodate samples 10 in. wide; specimens weighing up to 40 lb have been handled.

In use it is wise to clamp the rock with its centre of gravity approximately at the mid-point of the sphere of which this device constitutes one circular plane. Adjustment of A_2 is made first to get the horizontal location line approximately to its original position, and then both A_2 and A_1 are adjusted together to obtain an accurate horizontal position and also to get the dip arrow to its original attitude. Finally the geographical position can be regained by rotation of the wheel about A_3 to the correct compass bearing.

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Deriving the formula of a mineral from its chemical analysis

In a recent note with the above title, Gabrielle Donnay (1964) has seemingly overlooked a most useful method that is applicable to complex silicates, phosphates, sulphates, &c., even though the unit cell may be large and the chemical analysis may indicate numerous cationic and anionic components.

The basic principle of this method stems from the Bragg concept: Such structures are composed of a sea of oxygen atoms in symmetrical array, and the interstices are filled (more or less) by cations. In turn the oxygen atoms surrounding these cations give rise to Pauling's polyhedra that establish simultaneously the co-ordination numbers of the cations. One basic assumption is involved in the calculation of the structural formula by this procedure: The number of oxygens packed in one structural unit must be an integer.[1] There can be no 'holes' among the regular oxygen positions and no 'excess' (McConnell, 1958), and all symmetrical sites for oxygen must be accounted for, either by oxygen or by OH, H_2O, or halogens.