reality of the reversal. The atomic weight periodic table contains, however, at least three reversals (the high weights of A, Co and Te), so that it is not impossible that the atomic dimension table also contains some.

The dimensional source of the isomorphism of Na and Ca (and of K and Ba) as urged in the writer's previous articles, is less evident when the new values for these elements are used. However, the values for the alkaline earth metals are very imperfectly known, and moreover, the ability to vary 10% in radius which is evidently possessed by many of the elements (some indeed appearing to vary as much as 35%) would enable even the listed dimensions of Na and Ca to overlap. Other instances of cross-column isomorphism with valence dissimilarity show closer dimension similarity: for example, Mg/Al, Ca/Yt, Ti/Cb, V/Mo, Zn/Ga, Ge/As, Sn/Sb, P/S, and Sb/Te.

SUMMARY—In this paper new atomic radius and volume data are calculated and tabulated in a form which it is hoped may prove useful to mineralogists working on isomorphism as a phenomenon connected with atomic dimensions. For deriving radii from compounds, the radius of oxygen is taken to be 0.65, following Bragg; but the value for chlorine is based on silver and silver chloride, and comes out as 1.35. Average values are given for the radii, and for the volumes on the spherical basis, of most of the elements, and the bearing of the data on certain peculiar cases of isomorphism is discussed.

A SIMPLE ROTATION APPARATUS

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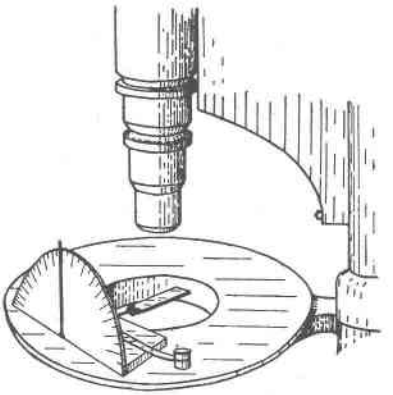
Numerous types of rotation apparatus for the measurement of axial angles and the determination of the angles between faces on small crystals have been devised for microscopic work. All such devices, however, add in varying amounts to the cost of microscopic equipment. Therefore, it is assumed that users of microscopes might be interested in a very simple rotation apparatus that can be quickly constructed for a negligible cost and will give fairly accurate results.

This device, shown in the accompanying sketch, may be easily clamped to the stage of any microscope and as easily removed. It consists of a base of wood 2 cm. wide, 4.5 cm. long and 4 mm.

thick to one side of which is tacked a graduated semicircle with a radius of 2.25 cm. The base has a small groove cut on the lower side just large enough to hold a small stiff wire which acts as a rotation arm. The wire is held in the groove by means of fine thread passed through four small holes drilled in the base, two on each side of the groove. One end of the arm is bent to fit the semicircle and acts as a pointer for reading angles. A thin strip of cover glass, not over 1.5 mm. in width, is fused to the other end of the wire and serves to hold the object under examination. Glasses may be quickly fused to the wire with a carefully directed blowpipe flame. One method is to set the apparatus with the arm



Sketch showing the rotation apparatus in position for use

in place and pointer vertical on a small mineralogist's anvil and place one end of a small glass strip on the tip of the arm. Then, with the application of a fine, well directed flame one end of the strip may be melted and will stick to the wire when cool. It is a matter of importance that the width of the glass strips be limited to about 1.5 mm. for it is inconvenient to work with objectives having short focal lengths when the glasses are wider. Such pieces may be cut from ordinary cover glasses with a diamond pointer commonly used for marking microscopic slides or may be broken at random, those of the proper size being saved.

The fragment or small crystal to be studied is placed on the glass and held in place with a small drop of oil or Canada balsam dissolved in xylol. The tension in the liquid is sufficient to hold the fragment on the glass even when it is rotated to a vertical position. The rotation is accomplished by moving the pointer.

In test measurements of 2 E for muscovite the average of five readings agreed within a degree with the value obtained with a universal apparatus. Muscovite, however, provides unusually good material for such measurements. The apparatus, it seems, may nevertheless be relied upon to give angles that are within 2 or 3 degrees of the correct values in all cases where a good image may be secured in the microscope. Axial angles with 2 E as high as 120° have been measured successfully. The results secured, however, depend largely upon the nature of the material. The measurements of axial angles for fragments mounted in liquids should be corrected for the effect of the mounting medium. This correction is usually small and may be overlooked in ordinary work or may be rendered unnecessary if one end of a fragment under investigation is fastened to the glass with a small amount of viscous Canada balsam and the observation is made on the opposite end in air alone. No correction need be made if an oil is used with an index of refraction equal to β.

PROCEEDINGS OF SOCIETIES

PHILADELPHIA MINERALOGICAL SOCIETY

Academy of Natural Sciences, May 8, 1924

A stated meeting of the Philadelphia Mineralogical Society was held on the above date with the president, Mr. Vaux, in the chair. Twenty-two members and five visitors were present. Upon favorable recommendation of the council, the following were elected active members: Messrs. J. Carroll Moerk, Thomas J. Lewis, and Harold Rosen. Mr. Boyle proposed the following for active membership: Messrs. J. H. Boyle and Herbert Haas.

Mr. Morrell G. Biernbaum addressed the society on *Gemstones, Real and Otherwise.* Data were given regarding the dispersion and refractivity of the principal gemstones. Commercial stones were classified as real, imitations (chiefly glass), "doctored" (doublets and triplets), substitutes, synthetic, and reconstructed. The manufacture and composition of the latter were described, followed by a list of trade names of many gems.

Mr. Samuel G. Gordon presented a paper on *The Composition of Thomsonite.* The formula ratios of over seventy analyses were calculated and plotted. The results were interpreted as indicating that thomsonite represents mixed crystals of calciothomsonite: $CaO \cdot Al_2O_3 \cdot 2SiO_2 \cdot 3H_2O$, and a soda compound: $Na_2O \cdot Al_2O_3 \cdot 3SiO_2 \cdot H_2O$, which is natrolite with but one molecule of water. The latter can enter into the mixed crystals only to the extent of about 50%. Any intermediate compound would have the formula: $n(CaO+Na_2O) \cdot n(Al_2O_3) \cdot 2n+1(SiO_2) \cdot 3n-2(H_2O)$, where n is the sum of the formula ratios of CaO and Na_2O the latter being considered as 1.