present was estimated by the number of spots developing on the leaves of *N. glutinosa*), after passage of paper pulp the number of spots was 407 per leaf; after 0·8μ membrane, the number was 220; after 0·49μ, 38; after 0·25μ it was 6, and after 0·1μ or less, there were no spots. It may be necessary to remove this clogging material before passage of the membranes, and experiments are in progress for this purpose.

With all qualifications made, the results obtained are of interest and significance. As is the case with animal viruses, we find that the plant viruses differ greatly in size among themselves. The virus of tobacco mosaic (Johnson No. 1) passes the 0·51μ membrane, though in reduced quantity (only 4 plants infected out of 8), and passes the 0·154μ easily. The virus of yellow tobacco mosaic (Johnson No. 6) is of the same size, passing 0·051μ (2 plants positive of 8). Aucuba mosaic virus passes 0·120μ and 0·112μ but does not pass 0·10μ, 0·06μ, or 0·051μ. The virus of a *Hyoscyamus* disease found by Dr. Marion Hamilton passes 0·30μ but not 0·234μ or any smaller membrane: and this is a point of some interest since (as she shows in a paper now in the press) this virus does not pass through a L.3. Pasteur-Chamberland porcelain candle, although its pore size is about 2·5μ.

By Elford's method of calculation, these figures would indicate a particle size of 15μμ for the tobacco and yellow mosaic viruses, about 40-50μμ for aucuba mosaic, and 150μμ for the *Hyoscyamus* virus. The value found for tobacco mosaic comes midway between Duggar's estimate of 30-40mμ and the recent estimate of 5mμ by Waugh and Vinson.

It is possible by the use of these membranes to separate two viruses occurring together in nature in the same plant. Dr. Hamilton's *Hyoscyamus* virus was passed through a series of membranes. It passed 0·64μ and 0·30μ with characters unchanged; after passage through 0·234μ, 0·209μ, and 0·120μ the disease produced was of different type, and further investigation has shown that the virus passing the smaller membranes is entirely different in its properties from the other larger virus it accompanied, and it is possible to separate the two by other methods than filtration.

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Constitution of Tantalum and Niobium

THESE two elements of the vanadium group have properties very unfavourable to mass-spectrum analysis and all attempts previously reported have been completely unsuccessful. I have now been able to obtain their mass lines, owing to the kindness of Dr. P. Kronenberg of Berlin, who has prepared for me specimens of the pentafluorides. These solids are slightly volatile but their great chemical activity makes them troublesome to deal with. If, however, they are volatilised in the discharge tube itself, it is possible to obtain, at least intermittently, a discharge which contains the metallic ions. Under these conditions the data are not complete, but one result is beyond doubt, and this is, that notwithstanding their fractional chemical atomic weights, both elements are essentially simple.

Tantalum, which was investigated first, gave a strong line at 181 followed by a diminishing series 200, 219 ... due to TaF, TaF_2 ... Neither the expected isotope 183 nor any other could be detected even to one-fiftieth of the main line. The packing fraction of tantalum was estimated from the position of the line 200 among the mercury group to be −4. Owing to certain experimental difficulties, this is only to be regarded as a rough provisional value, but it eliminates any possibility of an abnormally high mass. Correcting to the chemical scale, this value gives

Atomic weight of tantalum = 180·89 ± 0·07.

Niobium behaved in exactly the same way, giving a single line at 93 and fluorides at 102, 121 ... It has not been possible to measure the packing fraction of niobium with accuracy, but direct comparison of the line 93 with line 85 (SiF_3) suggests a large negative value, about −8. This gives on the chemical scale

Atomic weight of niobium = 92·90 ± 0·05.

The atomic weights of these elements given by chemical methods have always been regarded as unsatisfactory, and these results suggest that the present international values, 181·4 and 93·3, are considerably too high.

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Vibrations in Solid Rods

IN connexion with the study of vibrating metal rods, a method of investigation has been devised which promises to lead to a number of new and interesting results. The experiment consists in tapping

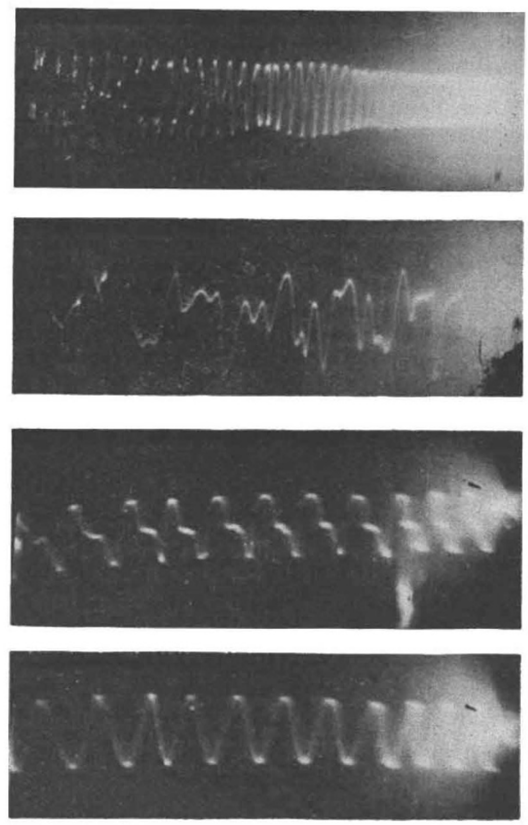

FIG. 1.

a rod at one end with a small hammer, and then making visible the train of waves which occur as a result of the impact. This is accomplished in the following manner.

To the end of the rod opposite that which is tapped is cemented a piece of piezo-electric crystal, for example, quartz or tourmaline, which converts the vibrations at that point to an alternating voltage.