

### Letters to the Editor.

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#### Pliny's Water-Mill.

A PHOTOGRAPH of a water-mill which recently reached me from Kashgar in Turkestan is reproduced in Fig. 1. It has taken me two years to secure this photograph; and, so far as I can trace, no illustration of a mill of this peculiar type has hitherto appeared in any British or American publication: though references to such



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FIG. 1.

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mills will be found in the works of a number of explorers in the Far East.

The interest of this particular mill lies in the fact that Pliny appears to have referred to water-mills of a similar type in his "Natural History" (xviii. 23). It will be noted that the water-wheel, which is undershot, does not drive mill-stones through gearing, but operates pestles by a 'trip-hammer' action. Pegs on the horizontal axle come in contact with the short ends of two pivoted levers as the axle rotates. The short ends are depressed alternately, the other ends of the levers—which carry pestles—then rising; further rotation of the axle releasing the levers so that the pestles fall by their own weight into mortars containing grain or rice.

After discussing hand-operated pestles for crushing grain, Pliny remarks: "Maiores pars Italiae ruidio utitur pilo: rotis etiam quas aqua verset obiter, et molat". This has been variously translated, but I think the following gives the sense of the words correctly: "In the greater part of Italy is used a roughened pestle, with wheels which the water turns in passing, and so it grinds". The passage is admittedly obscure, but with the knowledge that the pestle-and-mortar water-mill actually exists, I think we may reasonably infer that Pliny refers to this type.

Further evidence, albeit indirect, is afforded by the fact that mechanism precisely similar in principle, though differing in application, is described and illustrated by Heron of Alexandria in his "Pneumatics". The difference lies in the fact that Heron substitutes a wind-wheel for a water-wheel, and a piston falling

by its own weight in a cylinder for the pestle falling by its own weight into a mortar.

It is not improbable that this type of water-mill was invented before the geared mill described by Vitruvius, and developed out of the (I think) still earlier water-raising wheel used for irrigation purposes, a vague reference to which occurs so far back as Sumerian times ("Cambridge Ancient History", vol. 1, p. 461). There are two other types of water-mill without gearing; but I have been unable to find any evidence for either in the literature of antiquity. Certainly no evidence is given by Bennett and Elton, in their "History of Cornmilling", in support of their view that the horizontal water-wheel on a vertical spindle was known in Græco-Roman times; though one may reasonably suspect, from its primitive design and construction, that it was originally invented at an early stage of civilisation. I hope to give fuller details in a paper to be read before Section H of the British Association in September.

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#### Classification for Bibliography of Science—A Problem.

THE relations of bibliography to science with especial regard to classification, as brought forward in Dr. S. C. Bradford's recent articles in NATURE,<sup>1</sup> have for many years been my purposive study. I welcome the renewed and increasing interest in the problems involved. It is very regrettable, however, that these matters were not considered more wisely a quarter of a century ago. What can best be done now should indeed become a question of major

importance to scientific workers, to bibliographers, and to librarians.

Classification, affirmed to be fundamental to scientific method, has not yet been applied to scientific literature methodically and in a scientifically organised system. This should now become a first concern of the national and international organisations. The reasons for this, so well stated by Dr. Bradford, have been urged by me elsewhere on broad grounds.

The International Catalogue of Scientific Literature rejected in 1896 the classifications then proposed; and the study of the question was remitted to the Committee on organisation.<sup>2</sup> In the face of this negation on the part of the scientific workers, the International Institute of Bibliography soon after adopted an arbitrary classification devised by an American undergraduate in 1875 for the college library he was then serving. This was the famous Decimal Classification of Melvil Dewey. Its undeniable disqualification is that it is illogical and unscientific.

This system separates Science in Class 5 from Philosophy in Class 1 and places it subsequent to Social Science in Class 3, which is remote from History in Class 9. Then Philology in Class 4 it dissevers from Literature in Class 8; so all the literatures are severed from their languages. Biology and psychology, so far from being treated as distinct, fundamental sciences, are misrelated and dispersed. Biochemistry is given place neither under biology nor under chemistry, nor even in the index. These few examples of the disorder and inadequacy that pervade