

Letters to the Editor.

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The Influence of Science.

THE ingenious letter under the above heading, on page 180 of NATURE of August 5, by that industrious astronomer of Stonyhurst College, Father Cortie, S.J., seems to require some brief notice because of the singular character of the statements made in it. We are asked to believe that Copernicus's "heliocentric doctrine was freely taught, even in ecclesiastical colleges, until Galileo interested himself as a champion of the system"; in spite of the admission that after this "truculent and hot-headed controversialist" had endeavoured to get the Church to realise that the doctrine was not really antagonistic to Scripture when reasonably interpreted, and after the offended Pope had brought the matter before the Holy Office, that authority determined that "the Copernican system was false and absurd philosophically." And we are also asked to believe that the outcome was merely that Galileo had as a penance "to recite certain prayers, and was sent to a beautiful villa at Arcetri"; the implication being that there was really no punishment, and that there was no call for anxiety or distress on the part of either him or his daughter throughout the proceedings.

Yet some of us have learnt from extant documents that Galileo was made to recant, to abjure and curse the theory of the earth's motion, and to promise to denounce to the Inquisitor any one suspected of similar heresy.

Some rather definite pressure must have been brought to bear upon the old man in order to secure this damning retraction—a retraction which the younger and more energetic Bruno a few years previously had contumaciously refused to make. Perhaps, however, it may be contended that in Bruno's case also the Cardinals "proceeded with all the gentleness and moderation which were compatible with judicial forms!" If so, it is a comfort to us scientific heretics of to-day that judicial forms have by this time lost some of their virulence and the Holy Office some of its power. The flail of orthodoxy is still wielded in high places, by searchers out of scientific heresy; but the penalties inflicted are no longer ecclesiastical, and—*pace* Father Cortie—are less severe.

On second thoughts it occurs to me that the letter may be intended humorously, in preparation for the suggestion that the Church and the Aristotelian professors had some inkling or precognition of the theory of relativity. Father Cortie summarises "the only proofs that were brought forward" for the heliocentric doctrine; and doubtless the court concluded, as modern self-elected authorities do in an analogous case, that "there is no evidence" for any modification of conservative tradition.

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Action of Cutting Tools.

IN NATURE of July 22, p. 118, there is an interesting description by Prof. E. G. Coker of experiments in which the strains and stresses of a transparent material (celluloid) in the neighbourhood of the edge

of a cutting tool were made apparent by polarised light.

It ought to be noticed that the word "cutting" as applied to tools used for metal work (and hard substances), though generally in use, is incorrect, the actual action of such tools being to cause shearing.

Cutting and shearing differ in that in the former the part removed by the tool is merely bent, while in the latter it is at the moment of formation exposed to

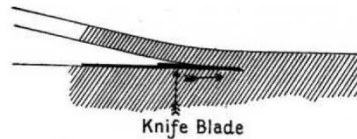


FIG. 1.—Cutting action of knife.

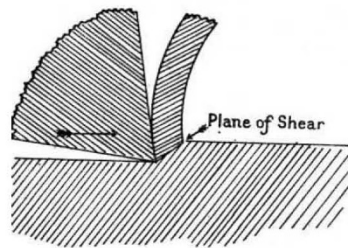


FIG. 2.—Shearing action of tool.

intense local shearing sufficient to cause permanent set or fracture throughout its whole thickness. This is illustrated in Figs. 1 and 2.

In connexion with this subject I may refer to a paper of my own (Proc. Roy. Soc., 1882), which, so far as I know, is the only place where the distinction has been made. There are very few tools and very few materials which lend themselves to true "cutting" (*e.g.* thin-bladed tools and soft substances like animal tissues), and in any attempt to "cut" hard materials the tool is soon brought up by the frictional grip of

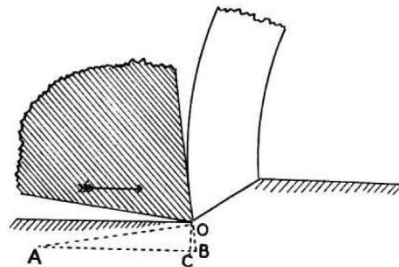


FIG. 3.—OA, normal force on face of tool; BO, frictional force on face of tool; OC, component of OA tending to make the tool "dig"; CO, component of BO tending to make the tool lift.

the material on the blade. In tools for hard materials (*i.e.* shearing tools) the friction of the shearing on the face of the tool is the chief factor in the determination of the angle at which the tool-face should be presented to the work. Any angle will cause the requisite shear, but unless the friction on the face balances the inward component of the force due to its slope, the tool will either tend to "dig" or to retreat from the material being operated on (see Fig. 3).

Thus for soft copper or aluminium, for example, where the coefficient of friction is large, the angle should be more acute than for brass, where the friction is much smaller.

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