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The second part of the present work is a compact review of the various arguments for protection. Prof. Bastable's fair statement of these arguments and his temperate tone of criticism render his work suitable for the classroom, and will encourage protectionists to give him a fair hearing. So far as we have noticed, he does not analyze the different effects of a protective tariff on production according as the Law of Diminishing Returns or the Law of Increasing Returns is operative. The English Corn Laws illustrate the former case, and the parts of our tariff protecting high-grade manufactures illustrate the latter. Many of the popular arguments for free trade, inherited as they are from the Corn Law struggle, ignore the difference. Some protectionists have a vague inkling of the difference, but do not give a correct analysis of it, and usually exaggerate its effects. In the production of commodities, where the Law of Diminishing Returns operates, any agency like a tariff which restricts the foreign sources of supply tends to increase the amount of home production; but each increment of home production is secured at an increased cost. Hence, in this case, the normal effect of the tariff would be to increase prices (the demand remaining constant) to the amount of the tariff. A tariff on wool must always increase the cost of wool to the consumer. If, however, the tariff is levied on high-grade manufactures like tools, sewing-machines, or watches, in whose production the law of Increasing Returns operates, each increment of home production, after a certain point, would be secured at a slightly diminishing cost. Hence in this case, where domestic competition is free, prices will tend to fall and will show no assignable ratio to the foreign price plus the tariff. If the Law of Increasing Returns acts sharply, as in the application of new machinery, the domestic price might fall lower than the foreign price, for the domestic article has a different and less cost of production. Until economists reckon with this analysis, and define the limits of this case, they will fail to convince protectionists of their understanding of the problem of production.

For a manufacturing country to protect its agriculture may be a far more costly process than it is for an agricultural country to protect manufacturing. Our own experience, however, during the last twenty-five years, has shown that in most cases where the Law of Increasing Returns has been effective, there has been a movement to convert the gains into monopoly profits by regulating domestic competition through Trusts or other means so as to prevent or retard a fall in prices. So far as the tariff, by diminishing foreign competition, promotes and protects this process of converting gains in production, which should have accrued to consumers, into monopoly profits, it acts directly as a tax upon the community for the benefit of the protected capitalist. In our present industrial organization monopoly profits play a great rôle. It is not possible, perhaps it would not be best, to eliminate this feature of business life which so stimulates every energy, but few would defend legislation to render this feature more pervasive. It is one of the ironies of popular government that the people so generally, at the present day, should be demanding legislation that either increases the cost of commodities or increases monopoly profits at the expense of consumers.

*A Treatise on the Mathematical Theory of Elasticity.* By A. E. H. Love, M.A., Fellow and Lecturer of St. John's College, Cam-

bridge. Volume I. Cambridge, Eng.: University Press; New York: Macmillan. 1892.

ELATERICS, or the science of elasticity, consists of a purely physical investigation (called, especially with reference to its ruder determinations, the doctrine of the strength of materials) and an elaborate mathematical theory designed to bring the fundamental facts to bear upon questions of applied mechanics; and this mathematical part might very well be called stereostatics. This name would hint at its intimate alliance with hydrodynamics. The two theories alike suppose the solution of complicated partial differential equations with boundary conditions; and the equations of many problems in the one are identical in form with those of problems in the other. They are sister studies, too, in their exceeding economical and philosophical importance. Hydrodynamics has to direct hydraulics and ship-designing; stereostatics to govern almost every operation of engineering, from the vastest erections down to the fashioning of a horse-shoe or a snaffle. The two theories are, finally, in one and the same pickle, in that nearly all the questions that are put to them are beyond the power of our mathematics satisfactorily to answer. Although a wealth of thought of all but the finest quality has long been lavished upon them in a geometrically increasing yearly outpour, so that none of the physical sciences shows greater advances than do the departments of mathematics which may be expected to aid elaterology and hydromechanics, still the practical problems we should wish to solve remain unsolved, and in all likelihood will so remain for a long time to come. Mathematicians, when they cannot solve the problem that real facts present—and this is what always happens—substitute for the real problem a simpler one, as near like the former as they can manage, and are guided by the solution of that. This is that method of abstract or analytical thought which Hegel and his countrymen obligingly teach us is mere futility. This is the style of thinking which makes English political economy so ludicrous to the superwise. They never tire of laughing at the two or three men on a desert island by the study of whose conduct political economists propose to regulate the policy of nations. Yet the contrast between such a little community and a modern State is, after all, certainly not so great as the contrast between any real, practical problem in hydrodynamics or stereostatics and the problem that the engineer succeeds in solving. The resemblance between the actual motion of water in any case and that represented in the pure hydrodynamical solution is so very slight that some study would be required to detect its existence. The contrast between the stresses in a real structure and those in an engineer's diagram are so enormous that for safety he is obliged to allow that they may amount to from five to ten times the latter. If the deriders of abstract thinking would only reflect that theories thus miserably imperfect have nevertheless sufficed to "possibilitate" (as a Spaniard would say) all the great engineering works of our age, they might, in their turn, learn something. Ships and bridges constructed after the directions of concrete historical thought would hardly be likely to prove much cheaper or much safer.

Mr. Love goes so far as to say, "The only logical way would be to use, instead of the elastic equations, others in which set is properly taken into account, and these are, unfortunately, unknown"; but this is exaggerated, for in most cases it is not merely rupture that we desire to avoid, but the passage of

the limit of elasticity. But let the reader fancy what the fairy grace of the structures of the future shall be when the theory of stereostatics shall really have been mastered! How gross and stupidly costly ours will appear in comparison, which make the gazer think only of how much money they cost, instead of singing, as those will do, the psalm of triumphant mind. Even to-day, great steps were altogether practicable could a mathematician of real genius be engaged in the task.

Mr. Love's treatise cannot fail to hasten the blessed advent of structural truth. Of late, engineers who have really understood their business have been dependent upon such works as Müller-Breslau's treatise, upon the French edition of that of Clebsch, brought out by the veteran elastician Barré de Saint-Venant, and upon the same eminent author's edition of the 'Leçons de Navier.' But now the whole subject, with the actual state of the most important of the open questions with which it is infested, is lucidly set forth in almost its most modern developments. The reader, for example, has the advantage of Betti's process of integration, though that is hardly twenty years old; but the still more recent methods of Castigliano, Mohr, Fränkel, and others we look for in vain. It must, however, be admitted that some of these are objectionable—one of them decidedly so. The latest things we have noticed in the book are a discussion published by Boussinesque in 1885, and something by Mr. Chree, who read the proofs.

Mr. Love assumes, with Green, that there are 21 independent elastic constants, and does not, with Cauchy, reduce them to 15. This is at present the assumption best supported by observation, even if it be not demonstrated by Voigt's determinations. A very fair account of the whole controversy is given. Mr. Love denies the inference of Sir William Thomson, Lord Kelvin, that because the tidal "effective" rigidity of the earth is intermediate between the rigidities of steel and glass, but nearer the former, therefore the earth's interior cannot be fluid. Certainly, the argument that because the earth does not yield much in a day or a fortnight, it would not yield to a slight force in thousands of years, never did have much force with most minds.

The notation appears to us the most stupid of all the notations, none of them very good, which have ever been proposed for the subject. The first solecism we meet with is that P, Q, R, S, T, U correspond respectively to  $e, f, g, a, b, c$ . This is truly British; and this is the general style of the whole.

*Sir Henry Maine: A Brief Memoir of His Life.* By the Right Hon. Sir M. E. Grant Duff, G.C.S.I. With some of his Indian Speeches and Minutes. Selected and edited by Whitley Stokes, D.C.L. Henry Holt & Co. 1892.

It is rather surprising that in these crowded days the memoir of even so great a man as Sir Henry Maine should be delayed for five years after his death; but we should have been willing to wait longer if it would have brought us something better than this. No one can question the good intentions of this biographer, or his capacity to estimate Maine's constructive work in India; but more than this is necessary to the writing of a successful memoir. In the case of Sir Henry Maine, it may, perhaps, be said that boyish adventures and youthful errors could not be appropriately introduced; that the interest of his personality was so exclusively intellectual as to make it indecorous to disclose the

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