

of working," which is equivalent to the ratio of the initial to the final section, or, what comes to the same thing, that of the final to the original length. The minimum values assigned to this coefficient are generally three or four, and sometimes higher. Doubts as to the necessity of this, however, have been raised. Prof. Howe, in his treatise "The Metallurgy of Steel," after weighing the evidence on the subject, wrote many years ago that "cumulatively the evidence raises a presumption in favour of the view that the supposed special effect of kneading and pressure, as such, does not exist or is relatively unimportant." Prof. Tchernoff, the eminent Russian metallurgist, has gone even further, and claims to have proved that the effects of forging can be produced by heat treatment alone. In view of the great practical importance of the question, it is somewhat surprising that it has not been made the subject of decisive experiments until quite recently.

Much experimental work is, of course, carried out in metallurgical works which is never published, and from the character of the discussion on M. Charpy's paper entitled "The Influence of Hot Deformation on the Qualities of Steel," presented at the autumn meeting of the Iron and Steel Institute, it would appear that a certain amount of information on this subject is already available. Nevertheless, M. Charpy is entitled to the credit of having been the first in recent years to attempt to obtain an answer to the question with the view of publishing his results and submitting them to discussion.

M. Charpy's experiments may be classified under two heads. In the first place, he attempted to trace the actual character of the deformation when steel ingots are worked either by hot forging or hot rolling. By ingenious methods he was able to show conclusively that in the former the deformation is very far from uniform, that extremely variable local deformations are produced, and that in a given instance, where the mean coefficient of working was 4.8, the extreme values were 2.37 and 7.30. This was one of the simplest cases possible, namely, the transformation of a cylinder into one of smaller diameter; and there can be no question that in a more complicated forging the local deformation would be even more diverse. In the latter case the deformations are very much more regular, and they may be considered as practically uniform. At any rate, lines originally parallel with the axis of rolling were shown to remain rectilinear and parallel during the course of deformation.

In the second place, the author describes certain experiments, designed with great care, to determine the influence of hot working on the properties of the steel. Test pieces prepared from rolled bars, in which the coefficients of working were 1.7, 3.2, and 6.1, were subjected to tensile tests, impact-bend tests, and impact tests on notched bars. The test bars were all cut from the same parts of the ingot, and were situated at one-third of the distance between the surface and the axis so as to avoid the influence of segregation and axial porosities. The bars were quenched and annealed under exactly similar conditions. It was found that the hot rolling of the steel does not appreciably affect the tenacity or elongation either longitudinally or transversely, but that it improves the reduction of area and resistance to impact longitudinally, and considerably diminishes these values transversely. The extent of the variation depends on the quality of the steel, and is more marked the lower its purity. This is a very important result to have established, for it shows that the effects of hot mechanical work must be considered as they affect the properties of the steel both longitudinally and

transversely. The author declares that the favourable influence attributed to hot working rests solely on the fact that, in the great majority of cases, only the results of longitudinal tests have been taken into consideration, and that the conclusions arrived at have been unwarrantably extended to materials where the main stress is transverse. His conclusion is that for pieces working under transverse stresses, such as guns, longitudinal extension by hot working has undoubtedly an injurious effect, and that, so far from specifying a minimum reduction of cross-section of the original ingot, it would be much better to reduce it as little as possible. H. C. H. CARPENTER.

EDUCATION AND LIFE.

AMONG the Acts which will make memorable the closing session of the present Parliament none will be held of more momentous import than the Education Act of 1918, limited in its scope to England and Wales; or the scarcely less important measure dealing with Scottish education, which passed its third reading in the House of Commons on October 17. Both measures will have a potent effect on the future education of the two kingdoms, and be fruitful of great results for the educational and physical well-being of the children of the nation. It is therefore to be regretted that Prof. Robert Wallace, professor of agriculture in the University of Edinburgh, should have thought it well to occupy the attention of his students, on the occasion of the opening of the University session on October 8, with a denunciation of the policy of both measures, and that he has now issued and circulated the lecture as a pamphlet (Edinburgh: Oliver and Boyd, price 6d.) to Members of Parliament and the Press. Prof. Wallace is apparently persuaded that children between the ages of eight and fourteen should, for their practical instruction, participate actively in agricultural and manufacturing industry on the ground that 85 per cent. of the children of the nation must earn their living by hand-labour, and he would therefore introduce them at a tender and immature age into close intimacy with adults in field, factory, and workshop.

That is not, in the estimation of most thoughtful persons, parents, teachers, and administrators, a desirable policy to pursue in the best and permanent interests of the children and of the nation. Both measures provide not only for a fairly adequate training in literature and in science, but also for effective, practical instruction for both eye and hand, as well as for the physical health and training of the child, and that at just the period of his life when he is most susceptible of treatment and of the permanent effect of such training. Few Acts have been subjected to so large a measure of public discussion as the Education Act of 1918, or have won so general an approval. Its chief purpose, whilst providing for the general well-being of the childhood of the nation, so vital a matter in present circumstances, is to give full opportunity for those who are naturally gifted to share in the highest educational advantages which the nation can offer. Despite Prof. Wallace's strictures, it is demonstrable that the Education Act of 1870 has had a marked effect on the moral health of the nation; for whilst in 1865 70 per 10,000 of the population were convicted of crime, fewer than 30 per 10,000 were so convicted in 1913. And there is abundant testimony, some of which was cited by Mr. Fisher on the introduction of his measure, to the wonderful initiative and intelligent grasp of the young men trained in the elementary schools who, in their scores of thousands, joined the national forces

in 1914. The crux of the success of both measures lies with the teachers, who must now, whatever the cost, alike in respect of payment, prospects, and pensions, be attracted to the most vital and worthy of the national services.

THE SCOTTISH JOURNAL OF AGRICULTURE.

THE appearance of an official organ of the Board of Agriculture for Scotland marks an important development in the activity of that body, which, though created but six years ago, has already accomplished much good work in the development and guidance of agriculture and forestry north of the Border. On the educational side of its work it has co-ordinated under its ægis the agricultural colleges and other educational agencies with a success which is noted with warm approval in the report of the Agricultural Subcommittee of the Reconstruction Committee. Much useful information has also been furnished for the Scottish farmer in the annual reports and leaflets issued by the Board. Its rapidly growing activities rendered inevitable, however, the creation of some more suitable medium of publication of matters of general interest to the agricultural community, and this has been found in the new journal, of which the first three quarterly issues are now available. In appearance and general character the *Journal* is not unlike the older-established *Journal* of the English Board, but the resemblance is little more than superficial, and the design to cater for the specific needs of Scotland is clearly evident throughout.

Original articles of educational value form the most prominent feature, and are supplemented with notes on varied topics of current interest, summaries of official notices and statistics, and a useful review of recent agricultural periodical literature.

The interest aroused in practical circles in Scotland, as in other parts of the kingdom, in the subject of the costs of production of agricultural products is indicated by the inclusion of articles on this subject in each of the three issues, no fewer than four articles dealing with the cost of production of milk alone. Crop production is represented by articles on oats, potatoes, and flax. Other articles selected at random, such as the effects of the war on Scottish forestry, the improvement of hill pasture, the restocking of deer forests, farmers and income tax, rural housing, and women's institutes, illustrate the varied and interesting character of the problems discussed, and incidentally the wide scope of the activities of the Board.

The *Journal* is secure of a hearty welcome from the Scottish agricultural public, and will assuredly in due course be in considerable demand throughout far wider circles of British agriculture as a standard educational publication. C. C.

CHEMISTRY IN EDUCATION AND INDUSTRY.¹

IN the early eighties of last century the great Livery Companies of the City of London combined for the promotion of technical and scientific education in this country; by reason of their great wealth, the administrative capacity at their command, and their complete freedom from State interference, the City Companies were admirably fitted for this task. Amongst their circle they numbered many men of high scientific and technical standing, such as the late Sir Frederick Abel and Mr. George Matthey, both of

¹ From the first Streatfeild Memorial Lecture delivered at the City and Guilds Technical College, Finsbury, on October 17, by Prof. W. J. Pope, F.R.S.

whom worked nobly to ensure the success of the new movement. Without describing in more detail the scheme which was adopted, it will suffice to note that the great Livery Companies established and financed, first, the City and Guilds Technical College, and, a year or two later, the larger Central Institution at South Kensington. Both these institutions were designed with the view of popularising scientific and technical education and of counteracting to some extent the overwhelming influence of the older universities; both Oxford and Cambridge, with their glorious history and their scholastic traditions, remained very exclusive, and contributed but little at that time towards the advanced teaching in pure and applied science of which our country stood in urgent need.

We have always been accustomed to attribute importance to aristocracy of birth and family position. This attitude is probably sound; other things being equal, the son of able and influential parents is more likely than another to exhibit ability and a sense of responsibility; we find no cause to revise this opinion in the light of the record of our great families during the last four years. During recent times, however, the conclusion must have thrust itself more and more upon us all that there is another aristocracy, equal in nobility to the first, if not greater—an aristocracy of real achievement and of intellectual attainment. Promotion to this modern aristocracy is slow and painful, but is worth attaining; it can be attained by any young man who possesses the requisite physical and mental equipment. The City Fathers understood this forty or fifty years ago; they realised that one of the greatest needs of the British Empire was the proper utilisation and cultivation of every intellectual talent latent in its children; they believed it desirable that these potentialities should be directed into the wide channels opened by the advance of science and the exploitation of the scientific industries. Acting upon these convictions, they founded our two colleges.

As time went on, the municipal authorities established technical schools and similar institutions broadcast, and the initial striking success of the City and Guilds Colleges waned somewhat under the stress of competition. Although the instinct which guided the Livery Companies in their great scheme of technical instruction was sound, one cannot but think that that instinct played them false at a later date; the closing of the chemical laboratories at the Central Technical College was a real calamity to the nation, as well as a disaster to science. The country needed facilities for still more advanced education and research in applied science—needed them so urgently that the Government has had to provide them at South Kensington. An institution for this purpose established under the auspices of the City Companies could scarcely fail to become really great, whilst under Government administration it incurs some danger of becoming merely colossal.

The scheme initiated by the City and Guilds of London some forty or fifty years ago, having for its object the promotion of scientific and technical education, attracted a number of ardent teachers well known to us all, of whom F. W. Streatfeild was one. With the collaboration of this band of workers the new movement rapidly became fruitful, not only by pouring a host of well-trained workers into the scientific industries of the country, but also by the way in which its very success stimulated other public bodies to emulation, and ultimately provoked intense competition. Since, as we have had to deplore, the original scheme was not raised above this competition by a further spontaneous effort of its initiators, it is only gaining but slowly upon its initial success. At the same time,