printed below by permission of the authors, presents the results in a convenient form, but a study of the report itself is necessary to appreciate the value of the experiments upon which the conclusions are based.

Records have been kept during the last twelve years of the behaviour of apple trees when pruned to different extents. The trees were chiefly dwarf trees on the paradise stock, and the main series of experiments were made on three varieties, possessing very different habits of growth. Measurements of the height of the trees, the spread of the branches, and the diameter of the stems led to the conclusion that the less the tree was pruned the larger did it become, and this conclusion has now been confirmed by lifting more than half the trees and ascertaining their weight. At the end of twelve years (the trees then being fifteen years old), those which had not been pruned at all were 20 per cent. heavier than those which had been moderately pruned, whilst those which had been hard-pruned were 16 per cent. lighter. The difference in weight between the unpruned and moderately pruned trees was too great to be accounted for by the weight of wood removed in the pruning, so that pruning not only does not increase the actual size of a tree, but it results in less new wood being formed.

These results were further established by pruning to different extents similar branches on the same tree. The less the pruning done the greater was the number, length, and weight of the new shoots formed, and the greater, also, was the increase in girth of the original branch.

From every point of view, therefore, the pruning of a healthy, growing tree seems to be inimical to wood-formation.

It is as regards the crops, however, that a reduction of pruning shows to greatest advantage. With the dwarf apple trees, the crops during the first five years were more than twice as great from the unpruned trees as from the moderately pruned ones, and more than three times as great as from the hard-pruned ones; in the second period of five years the differences were still greater, and in the twelfth year (when, however, one variety only was in bearing) the unpruned trees yielded nearly three times as much as the moderately pruned ones, and the hard-pruned trees had practically no crop at all. Similar results were obtained during the past season with trees of fifty-three and eighty varieties on the crab and paradise stocks respectively, the crops from moderately and hard-pruned trees being in the proportion of three to one in both cases. There was no appreciable difference in the size of the fruit from trees pruned to different extents, so that the values of the crops were proportional to the weights. The trees, however, were not allowed to overbear, the fruits being thinned to two to the truss.

Confirmatory evidence of the antagonism of pruning to fruiting was obtained by counting the fruit-buds formed on similar branches of the same tree, which had been cut back to different extents.

All these results refer to healthy trees which are still young enough to be growing vigorously. With a tree which is older, and has attained maturity, the results are somewhat different, not as regards fruiting, but as regards branch-formation. With a tree of this age, branch-formation, under natural conditions, has ceased, but if it be pruned new branches are formed to supply those removed, but they are formed only at the expense of the fruit. Most of the dwarf apple trees (now fifteen years old) used in these experiments seem to have reached this stage; hard pruning in their case now results in an increase of the new wood formed, though the reverse was the case when they were younger, but the crops are still reduced by the pruning, and even more so than in former years.

What applies to a tree which has passed the age of active growth, and has reached maturity, applies also to a tree which has become stunted, or has had its growth arrested by root-injury, as, for instance, when it has been transplanted. The deficiency of vigour of a freshly planted tree is shown by the small size of the leaves and the tendency to form fruit-buds instead of wood. The correction for fruiting is, as has been shown, hard pruning, and it is, therefore, most important that freshly planted trees should be cut back hard so as to prevent precocious fruiting, which would generally result in permanent stunting. To delay this cutting back until the end of the first season would appear to be a very wrong procedure. It has been found that with trees which were not cut back the size of the leaf was, on the average, 24 per cent. less, and the new wood formed 45 per cent. less, than with similar trees which were cut back; such vigour as the tree possessed went to form fruit-buds, which, when the cutting back was eventually performed, were removed altogether, or suppressed in favour of growth. A year's growth is practically lost by thus deferring the cutting back, and the ultimate result was found to be that the trees thus treated continued to form wood in subsequent years, whilst those which had been cut back at once were fruiting; so that the crop borne by them during the first ten years was only one-third of that borne by the latter.

Experiments on apples, pears, and plums show that the date of cutting back a freshly planted tree is immaterial so long as it is done before growth begins, that is, before about the middle of April. If delayed until the middle of July, the season's growth is much reduced, and the tree will probably suffer in subsequent years. This point was investigated more fully in the corresponding case of the hard cutting back, or lopping, of older trees (plums), which had become slightly stunted. The operation increased the amount of new wood formed by the tree, and the results were the same so long as the lopping was done during the dormant season. Lopping towards the end of May resulted in less growth during the year, but this was more than compensated by an additional growth during the succeeding season. It is doubtful, however, whether anything is really gained by anticipating the autumn lopping (as is sometimes possible), and doing it in the preceding early summer, for it was found that the trees thus treated did not appear to be so healthy in foliage as those which were cut back subsequently. This was especially so where the cutting back was postponed until July, for trees cut back then made very little growth during the remainder of that season, and were deficient in growth in the following season as well.

Apart from the cutting back of freshly planted trees, the present results are emphatic in showing that the less pruning is done the better. But this does not imply that no pruning at all should be done. The removal of branches which cross or rub each other, as well as that of any unripened wood, is evidently desirable, and no doubt a certain amount of pruning, in order to obtain a compact and shapely tree, should be done during the first few years after planting. But a tree which is growing freely, and is properly tended in other respects, will require very little pruning to keep it in shape. With precocious or weak-growing varieties more pruning will be necessary, and more is required with standards than with dwarfs, for in the former case it is very desirable that a compact head and strong stem should be obtained before any heavy crops are borne.

STANDARDS AND EXACT MEASUREMENT.

THE inaugural address delivered by Dr. R. T. Glazebrook, president of the Institution of Electrical Engineers—the full text of which is published in the current number of the Journal of the society (vol. xxxviii., No. 181, p. 4)—is likely to be remembered as one which stands apart among the various addresses which have been delivered in past years, owing to the fact that the subject treated is so rarely discussed or dealt with in ordinary engineering papers.

The subject in question, that of standards and exact measurement, is one which does not appeal to all, but is of special interest at the present time, when so much has been done of late by the Engineering Standards Committee to bring about more efficient work and more uniform results in the various branches of engineering. Dr. Glazebrook, in opening his address, gave a brief account of the history of standardisation from the first report of the Electrical Standards Committee of the British Association in 1862 down to the present day. This first

early report summed up the entire connection between the various units as follows:—

"A battery or rheomotor of unit electromotive force will generate a current of unit strength in a circuit of unit resistance and in the unit of time will convey a unit quantity of electricity through the circuit and do a unit of work or its equivalent."

Mr. Duddell's report on the proceedings at the St. Louis Conference brought up the question of electrical standards in its present-day phase. Mr. Duddell referred to two important resolutions passed at St. Louis, and the question of giving effect to these was considered. Since then matters have progressed considerably, and a conference was held at Charlottenburg at which representatives from America, Austria, Belgium, France, Germany, and Great Britain were present, and the following resolution was adopted:—

"In view of the fact that the laws of different countries in relation to electrical units are not in complete agreement, the conference holds it desirable that an official conference should be held in the course of a year with the object of bringing about this agreement."

The result of the above resolution is that a future conference will be held this year in London, when the question of the fundamental electric units will be brought up. Only two electrical units will be chosen as fundamental ones, and these will in all probability be the international ohm, defined by the resistance of a column of mercury, and the international ampere, defined by the deposition of silver.

The international volt will depend on the above two definitions. Experiments have been going on in all countries since October last to determine with extreme accuracy the quantity of silver deposited in a given time and the best method of constructing practical standards having a resistance of one ohm, and these results will be considered at the conference to be held in London this autumn, when we may hope that definitions of the international ohm and ampere will be finally settled.

Not only is it necessary that the fundamental units of electrical science should be the same throughout the world, but the conviction has grown stronger that the extension of this principle would be of enormous assistance to the welfare of nations in general, and consequently international standardisation has become of the greatest importance.

At the St. Louis Congress two years ago Colonel Crompton introduced this question, with the result that it was unanimously agreed that the cooperation of the technical societies should be secured in order that the questions of the standardisation of the nomenclature and ratings of electrical apparatus and machinery might be thoroughly discussed. The Institution of Electrical Engineers appointed an executive committee for this purpose, and practically all the civilised nations of the world cooperated.

In this way the International Electrotechnical Commission was formed, and the central offices are for the present in London, at the offices of the Institution of Electrical Engineers.

The task before the commission is a large one, as the nomenclature alone will probably occupy its attention for a considerable period if one may judge by the labour entailed in the work of the electrical committees of the Engineering Standards Committee, which have been sitting lately.

Standardisation has its dangers as well as its advantages, and it is in the avoidance of the one and the utilisation of the other that the great difficulty attendant on the work of such a commission will consist. It is to be hoped that a happy mean may be found, which, while reducing the number of types of machinery which the responsible consumer or the consulting engineer can order, will not stultify the inventive faculties of engineers towards future developments.

Dr. Glazebrook further gives details of the reports of the Engineering Standards Committee on the various sections of engineering work on which it has already reported, the reading of which is of the greatest interest. The work appears to have been done in a way that is thorough and complete, and every endeavour has been made throughout to increase the facilities for obtaining greater output per machine and to reduce the multiplication of patterns.

It is gratifying to know that the work is already bearing fruit, and the recommendations have been adopted by the Government Departments, Lloyd's Registry, the British Corporation, and several other registry societies in regard to ship and boiler specifications. With regard to rails, the Railway Engineers' Association are adopting the standards, and with but few exceptions every new tramway system in this country and many in the colonies which are under construction are being provided with these standard rails. It is estimated that the saving to the British manufacturer by standardisation of iron and steel sections alone will amount to some millions sterling, and we do not think that this figure is exaggerated when we take into consideration the fact that the frequent changing of the rolls to produce in small quantities the many "special" sizes asked for would be done away with.

Although dealing with an infinitesimal part of this vast subject, the address opens out a most important question which will have to be considered, not only by the various branches of the engineering profession, but by every Government that has the welfare of its nation in view. Dr. Glazebrook is to be heartily thanked for the clearness with which he has dealt with his subject, and there is no doubt that his presidential address to the Institution of Electrical Engineers will long be remembered by those who were fortunate enough to hear it. J. L. M.

THE INFLUENCE OF PARASITES ON THEIR HOSTS.

SCIENCE of February 8 contains the report of an interesting and suggestive address on this subject delivered by Prof. H. B. Ward before the Section of Biology of the American Association for the Advancement of Science at the New York meeting held in December last. (For other presidential addresses see NATURE of February 7, p. 352.)

After certain preliminary remarks, Prof. Ward mentioned that some parasites, such as the distome Heterophyes, found in the intestine of Egyptian fellahin, seem to have no appreciable effect on their hosts. The African eye-worm (*Filaria loa*), except when it actually enters the sclerotic of the eye, affords another instance. Many encysted worms likewise come under the same category.

As a rule, single parasites leave no lasting effects on their hosts; it is rather the multiplication of parasites which should be dreaded. The most serious effects occur when this multiplication takes place within the host. On the other hand, when multiplication takes place during successive generations in other hosts, it is unlikely that the parasites, when in the proper stage, will reach the original host in sufficient numbers to cause serious mischief. The real danger lies in a multiple infection through the numerical increase which such a species often undergoes in the intermediate host, or within a limited external area, so that by the intake of a single object a swarm may be introduced.

As a rule, the harm caused by a parasite bears some proportion to its size as compared with that of its host; when, however, parasites occupy positions in connective tissue or between muscular fibres they may be relatively harmless, no matter what their size.

Some parasites cause harm in a mechanical manner, by blocking, for instance, natural passages, or, as in the case of the Egyptian blood-fluke, by the ova entering the capillaries, when serious trouble is bound to ensue. Embryos, in the case of filariæ, may likewise infest the lymphatic vessels, to the great detriment of their host.

The migrations of parasites, as when *Ascaris lumbricoides* passes along the natural gangways from the intestine to the liver, may also cause serious harm, as abscess of the latter organ. But parasites do not always confine themselves to such natural lines of movement; they may drive