

Index Kewensis Plantarum Phanerogarum. Supplementum primum. By Theophilus Durand et B. Daydon Jackson. Pp. 120. (Brussels).

ON the title-page of this, the first supplement to the "Index Kewensis," the name of Monsieur T. Durand, the director of the botanical garden at Brussels, is associated with that of Mr. Daydon Jackson, the author of the original work. Mr. Durand is mainly responsible for the new part, which deals with species and varieties which have been named during the decade 1886-1895. In order to maintain uniformity, the same arrangement is adopted as in the "Index Kewensis." Most of the new plants are tropical, and quite an appreciable addition is due entirely to Kuntze, who has upset several of the ordinarily accepted genera, though for the most part species names are unchanged. This part takes the genera as far as *Cymbidium*.

It is hardly necessary to point out the importance of keeping a standard work of this kind up to date, and the author has rendered a great service to systematic botanists in bringing out so quickly, considering the great labour involved, this additional record of plant names.

LETTERS TO THE EDITOR.

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The Misuse of Coal.

As England has taught the world how to use coal, she ought to think of teaching the world how to use coal without waste. Coal is so plentiful, so cheap; it is so much to the interest of many people that the waste should go on, and the general public, who alone can apply a remedy, are so ignorant of natural science that when, every few years, I draw attention to this subject, I feel my efforts to be hopeless. Nevertheless, you will perhaps allow me to call attention to the fact that in the very best and largest steam-engines less than 10 per cent. of the energy of coal is utilised; in many small engines only 1 per cent. The remaining energy is quite wasted.

In the electric generating station of a city like Manchester, there are engines of 12,000 horse-power, driving tram-cars and house-lights. In a line of battle ship there is more than twice this power. Two new Cunard steamers are, I understand, about to be ordered, each of which will have 48,000 horse-power. The great waste of energy inevitable in all heat engines of the world is therefore enormous.

It is known that when fuel energy is converted into the electric form directly, as in a voltaic cell, more than 90 per cent. of the fuel energy is convertible into the mechanical form, but at present contrivances to do this even in the case of gaseous fuel are too bulky and expensive to compete with heat engines. I wish once more to suggest that an organised attempt be made to convert the energy of coal into electric energy in some form of engine which shall not cost more or have greater weight than a steam-engine of the same power.

For the heating of buildings, Lord Kelvin pointed out long ago that the very law of thermodynamics which makes a heat-power engine inefficient makes it possible to obtain from one unit of energy the effect of 50 or 100 units by direct heating. I know of nothing which so well illustrates the scriptural promise of the seventy and seven fold reward of virtue as this. Discover the energy engine and you multiply your power to heat buildings from coal, seventy and seven times. But how can we make facts of this kind obvious to ordinary men—the men who are said to

be educated when they know absolutely nothing of physical science? Even with coal as cheap as it is we might appeal to its selfish users by pointing out that with the new kind of engine a ship would be able to travel ten times as far at full speed as she now can do without coaling.

The world's yearly output of coal recently was 663 million tons. Of this Britain's share was 30½ per cent. If the whole of the energy of Britain's coal for one year could be utilised and charged for at 8*d.* per Board of Trade unit, the price paid in many towns by consumers of electric energy, it would amount to 100 times our national debt. It is to be remembered that the cost of human labour when used most economically is nine times the figure here given.

Here is another fact. Scientific men know of no other store of energy available for man's use than fuel from the earth, except what we may get by the help of the tides or by wind or waterfalls. To depend upon the future discovery of some great store is to act like a spendthrift who knows of no relation whose death will give him more money and yet who goes on wasting his substance. The energy of coal is the foundation of such widespread comfort as we now observe all over the world. To put the matter in a very definite form we may say:—the cost of one Board of Trade unit of energy by the agency of human labour working most economically is seventy pence; the cost of the unit as given out by a large steam-engine in a cotton factory is one farthing; the cost per unit of the coal alone (at 8*s.* per ton) if all its energy were utilised is one one-hundredth of a penny. But when our coal supply is exhausted, when all the races of the world have fought for the waterfalls and places of high tide, the price must go back to the higher figure. The failure of our coal supply is one of the two things neglected by Mr. Wells in his "Anticipations," the recollection of which would have modified all his conclusions. When coal becomes scarce, people will wonder how it was possible for the nations to spend so much money as they all now do, and our grass-hopper weight of a national debt will seem to be an unbelievable burden. Seventy pence to a farthing is the ratio of values without and with coal even now, and the ratio ought to be ten times as great, or 2800 to 1.

In sixty years we have greatly destroyed that store of energy which is the foundation of what some of us call civilisation. In another hundred years the English hamlets of contented working folk that have become cities of luxurious people will decay again into hamlets, inhabited by a discontented, poverty-stricken population which will curse its ancestors for their prodigality. They will not curse us for using coal perhaps, but they will know how to economise coal, and so they will curse us for our ignorance. Over and over again have I called attention to the fact that we are wasting the energy-capital of all the inhabitants of the earth for all time to come. The value of human labour gives the normal value of energy, and at this rate we in England are wasting 900 times the amount of our national debt every year. I have dragged this matter into my lectures and papers with and without relevancy many times, and every one of my hearers and readers neglects its significance. Scientific men know it, but they think it useless to try to impress the ordinary citizen, so ignorant of natural science as he is and so unheeding of any kind of danger which was unknown to his forefathers. What annoys me particularly is not so much the selling of my birthright as that I should sell it for such a mere mess of pottage.

To return to my cry for a new invention. Many men have advanced the subject beyond its first principles; they know of directions in which to work with prospects of success. In the animal machine the thing is actually done; but of this machine