meanings, is to invite obscurity and misunderstanding.

The unscientific mind may not always appreciate the requirements of classification as an important aid to scientific development. To one who is not a geologist nor an agriculturist, a clod of earth may be sufficiently described by a word of three letters. It is mud, and there is nothing more to be said about it. But the man who has learned to use his eyes (and one need not have a college education to do that) perceives that there may be fifty different kinds of mud; and the scientist who wishes to investigate the subject of soils and the rocks from which they are made, recognizes the necessity of an exact and elaborate nomenclature.

This need comes, in the first place, from the use of terms *as mere tools for facilitating analysis,* and thus favoring the development of a research. In this sense, that is to say, as provisory terms, invented by the investigator for the purpose of mapping out and arranging his work in an orderly way, it is desirable that the vocabulary shall be so full that it may seldom or never be necessary to use names with a double significance. Not all of these names will be retained eventually, but the looker-on must learn to tolerate them, at least during the incipient stage of path-finding investigation.

In the next place, entirely new branches of knowledge require the invention of whole classes of terms, constituting virtually a new language. To dissent from this position, and to require that the new thoughts shall be clothed in familiar forms, is as unreasonable as to require that the proposition of the maximum economy of material in the construction of the bee's cell shall be demonstrated without the use of the differential calculus, or that all psychological propositions shall be stated in terms of one sense, that of sight.

The final forms which shall be given to words expressing necessary and permanently useful distinctions of meaning are a matter which may well concern all scientific workers, whatever their specialties, as well as the general public. It is of course desirable that a new word shall be short, if this desideratum is compatible with intelligibility. Unfortunately, most of the short-cuts which are proposed from time to time, such as sweeping reforms of an extensive and tremendously cumbersome chemical nomenclature by substituting words of one syllable, break down under a weight of meaningless memorizing which is absolutely prohibitive. Common names of plants and animals become overloaded with so many meanings in different localities as to be equally useless. The prevalent custom of inventing names by joining Greek or Latin words of cognate import, giving to the new term a special and new significance, has the advantage that the word-coinage is, to a degree, self-explanatory, at least to one who has learned a modicum of Greek and Latin words. There is no royal road to knowledge. Scientific descriptions remain unintelligible to the lazy man who hates to use the dictionary. They are free property to all who are willing to take this trouble.

FRANK W. VERY.

ENGINEERING NOTES.

INDUSTRIAL ECONOMICS.

AN interesting and probably important fact, and one which may ultimately have a serious influence upon the relative standing, industrially, of the United States and Great Britain, is reported by English papers. It is the signature of an agreement between the employers and workmen in the machine shops of Great Britain which, on the whole, would seem entirely reasonable, while in the United States the unions have refused to enter into a similarly reasonable arrangement. The initiation of the displacement of British manufacturers from their own markets and from the markets of the world was largely due to the restriction of production and the deprivation of free workmen of the privilege of working at their trades, while, in our own country, restriction of production was almost unknown and freedom of the individual was at least not absolutely destroyed. It now looks possible that the conditions may be reversed.

The British agreement provides that the unions shall not interfere with business management, nor the employers with the proper

functions of the unions; the men may join the unions or remain free as they may choose and the employer may employ union or non-union men; piecework is approved and restriction of output specifically disapproved. No limitation of the number of apprentices is permitted. In case of disagreement regarding any question arising between the two parties, reference and arbitration will be prescribed and work shall not stop when such question arises or during the session of the committees of arbitration.

Had these principles been in force in recent years, it is hardly to be believed that the long and costly strike which finally broke up the former tyranny would have occurred or that Great Britain would have experienced, as now, competition of serious character within her own boundaries.

On the other hand, should the false principles formerly so destructive of British industries find extensive lodgment in the United States, as now seems possible, it can hardly be doubted that the experience of the older country will be repeated in our own. Restriction of production has been a cardinal principle with many associations though, fortunately, not with the most intelligent and well-managed, nor so generally and effectively as to as yet seriously impair the industrial prosperity of the nation. The future of our industrial organization may be found to depend, nevertheless, upon the intelligence, the courage and the firmness of the leaders in the unions and upon their success in the maintenance of right principles in fixing the relations of employer and employee. Freedom in bargaining, independence of the individual who chooses to be free and independent, freedom of the ambitious and industrious and skilful, within or without the union, to secure the full value of his best efforts, and entire freedom to secure maximum output in both quantity and quality are now assured the British workman, for the first time in at least two generations, and, in default of similar freedom and independence and of similar economic practice in the United States, the tables may once more be turned. The spirit of fairness and the intelligence and knowledge of economical principles displayed by the leaders of the unions of most intelligent and highly skilled workmen in the United States and the rapidity with which a good example makes its impression in this country give assurance that the progress of the country industrially is not likely to be suddenly or soon checked. When an enormous organization like, for example, the Railway Trainmen's Association, makes fair play and industrial peace a cardinal doctrine, and when their associates of the Locomotive Engineer's unions have a record of not more than two or three serious strikes in a generation, it may be fairly anticipated that reason and justice will ultimately prevail generally.

MR. MARCONI'S ACHIEVEMENT.

The month of February and particularly the 23d and 25th of February, 1902, will undoubtedly become historically recorded as the beginning of what may be known as the Marconian era. It was on the first of these dates that a message was transmitted more than a thousand miles, between a station on the coast of Cornwall and a ship at sea in the midst of the Atlantic, and it was at the second of these dates that distinct signals were repeatedly transmitted over a distance exceeding two thousand miles under similar circumstances and permanently recorded on the tape of the receiving instrument. The practicability of the system of wireless telegraphy operated by Mr. Marconi was thus confirmed as effectively for these enormous distances as it had been, long before, by constant use over shorter ranges, for months together, on the coasts of England, France and the United States.

The Marconi station at Poldhu, Cornwall, has been in use a long time, not simply for the usual work of exchanging messages with ships at sea in that neighborhood, but also in the investigation of the problem of transmission over the ocean, from shore to shore. Weeks before it had been found possible to reach the coast of Newfoundland with distinct signals and Mr. Marconi, returning to England, refitted his apparatus for a test which should be crucial. He left Southamp-

ton on the U. S. M. S. *Philadelphia* February 22d and, with a prearranged system, communicated with his operator at Poldhu, regularly, from a point 250 miles west of the Lizard until reaching mid-ocean, over a thousand miles away, the operator reported "Fine here. Thanks for message!" Thence, to a point 1,551 miles away, messages continued to be intelligible, the last, 'All in order,' indicating that the cessation was due to lack of power in the sending apparatus, not to any defect of construction or adjustment. Single signals nevertheless continued to be recognizable, and were automatically recorded on the tape, until the two operators were separated by 2,099 statute miles. The records of all these messages and signals were properly certified to by the operators and by the officers of the ship, in order that the scepticism manifested at the first announcement of Mr. Marconi's work in Newfoundland might not be given a shadow of an excuse for expression in this instance. During this experiment the messages and signals transmitted to the *Philadelphia* passed over the *Umbria,* following in her wake all the way across the Atlantic, or within easy communicating distance, without being recognized or even detected.

Mr. Marconi is now confident that he has demonstrated that the distance over which his method will prove available is only limited by the power of the sending apparatus. He is preparing to establish at Poldhu ten times as much transmitting power as was available on this occasion. It may probably be admitted as demonstrated that we may anticipate the successful transmission of messages between a ship at sea and the shore, on either hand, from the moment of her setting out on her voyage until her passengers are landed at her destination on the other side of the ocean. Then the previously unavoidable period of anxiety attending the disappearance of ship and crew and passengers, for days together, will be at an end forever. New, or temporary, or moving stations may be established at sea or on land, and a campaign may be conducted, in time of war, with perfect communication between forces and commanders however relatively situated and, with suitable codes, without enlightening the enemy, even if the fact of communication be detected by him at all.

R. H. THURSTON.

ANNUAL REPORT OF THE CONCILIUM BIBLIOGRAPHICUM.

THE general statement for 1901 has just been issued from Zürich and shows that Dr. Field's determination to carry this project through is at last beginning to meet with reward. The total number of cards published in 1896 was 3,345, and in 1901, 21,946. The total number of cards issued up to December 31, 1901, is 9,671,500. The total expenditure up to the same date is 119,015 francs, or in round numbers $23,803. The receipts up to the same date have been 92,484 francs, thus leaving outstanding amounts of upwards of 21,000 francs or something over $4,000, probably due to losses in the two first years of inauguration, which will soon be covered by the present increasing sales.

The financial standing of the present year shows a great advance over all that have preceded; the increase of subscribers has been so great that whole sets have gone out of print. The prices charged for subscriptions correspond, however, so closely to the actual cost that the increased sales have occasioned increased expenditures to nearly the same amount. It is the generosity of the Swiss Government to which in the main the Concilium owes the present improved state of its finances. While this shows the permanence of the work, it is very desirable that other countries should give similar aid and thus remove the last of the difficulties under which Dr. Field and his staff are struggling.

In consequence of the failure of an expected subsidy, the physiological part of the work has been temporarily suspended, but it is hoped that this impediment will soon be removed.

A recent report of the Swiss Society of Naturalists estimates the saving of time afforded by the great catalogue in the specific case of an investigation on the trout; the report says that in looking up the recent literature of this subject by means of the Concilium catalogues the saving of time was estimated at one half a day, but in regard to other