

wastes a large part of the heat which it transmits to the working charge; transmitting it through the cylinder-wall too late in the stroke to be of much service, or even so late as to be absolutely lost by passage into the cylinder during the period of exhaust, instead of, as necessary for best results, early in the induction period. Both in using the steam-jacket and in superheating, the reduction of the waste by initial condensation fails to give commensurate gain in work performed by the unit weight of steam. In one instance, for example, a reduction of initial condensation by ten per cent. only gave increase of work to the extent of two and a-half per cent. In another instance a reduction of wastes by twelve per cent. gave a gain of work of only three per cent. The action of superheated steam is more favorable, and the gain in work done and increased efficiency amounts to more nearly one-half the percentage of reduction of wastes by initial condensation.

The steam was condensed in a surface-condenser. The mean quantity of steam condensed per hour and per square meter was 13 kgs. The mean quantity of heat abstracted per kg. of steam was 567.7 calories. The mean quantity of heat traversing the condensing surfaces was 7,402 calories per hour and per square meter. The cylinder-heads transmitted nearly twice this quantity from their jackets into the cylinder, and the cylindrical jacket of the cylinder proper about one-fifth as much as the transmission into the condenser.

'Cylinder condensation,' during the brief period of its action on this engine, occurred at the enormous rate of 494,600 calories per hour and per square meter—seventy times as rapidly as in the surface condenser—and illustrates the most rapid transfer of heat known to the engineer or the man of science. Mon. Dwelshauvers is probably the first to measure this figure with any degree of accuracy, though Cotteril, long ago, gave us the general facts and approximate computations.

A very important and, to the experimenter, an unexpected, development was, as stated by him, the following: "With steam superheated to 166° C. at its entrance into the engine, and with saturated steam at 155° C. stagnant in the jackets, the use of the jacket gave an economy

of 20 per cent. and over by reducing the initial condensation."*

The fact is now incontestable and it is easily seen that, so long as the action of the superheated steam is not such as to completely extinguish initial condensation by bringing the temperature of the cylinder wall fully up to that of the saturated boiler steam, the jacket may still find opportunity to reinforce the action of the superheated steam by doing some work in the interval between the instant of closing of the induction valve and that of its reopening in the succeeding cycle.

These contributions to our knowledge of the interior workings of heat and steam in the engine will undoubtedly be received as among the most important yet placed on record in the history of the experimental investigation of the steam-engine, and M. Dwelshauvers-Dery, through these researches, as an earnest and worthy disciple and successor to Hirn, will earn an enviable distinction. R. H. THURSTON.

CORNELL UNIVERSITY.

Prehistoric Man and Beast. By REV. H. N. HUTCHINSON, B. A., etc. Illustrated. D. Appleton & Co. 1897. pp. 298.

Mr. Hutchinson, already known to the readers of general literature by his works, 'Extinct Monsters,' etc., has endeavored, in the present volume, to present, in equally popular style, some of the latest results of geology and archaeology with regard to primitive man.

He distinctly disclaims writing for special students in either of these branches, and also offers himself solely as an interpreter of the opinions of others, and 'not as a Brahmin.' Nevertheless, he espouses very warmly, and claims as quite decided, various opinions which the 'specialist,' if he is fair-minded, considers still undetermined. For example, he heads one chapter 'The Myth of the Great Ice Sheet,' and assumes as incontrovertible Sir Henry Ho-worth's contention that the ice sheet of glacial

*This fact was asserted by the writer some years ago and was challenged by various authorities, including M. Dwelshauvers, who has since given us these facts and has frankly reversed his position. *Vide Manual of the Steam Engine* (R. H. T.), Vol. I.; Secs. 145, 153, pp. 598, 697; and *Trans. A. S. M. E.*, Nov., 1889; *Journal Franklin Inst.*, Dec., 1889.

times did not exist; which is very far from securing unanimous consent among geologists.

In the same manner Mr. Hutchinson knows a great deal more about the antiquity of man than most geologists. He knows that the human species is at the most not more than 25,000 years old. Surely he has with him in that calculation the decided minority of scientific students. To most, such a period seems quite inadequate to account for known facts in human history, apart from geologic questions.

His book has ten quite pretty full-page fanciful illustrations, designed by Cecil Alden, of the *Illustrated London News*. They represent a courtship of a warrior of the bronze age, the building of Stonehenge by the dwarfs, etc. The dozen chapters into which his subject is divided take up the cave-dwellers and reindeer hunters of the stone age, the 'myth' of the great ice sheet, changes of climate, the antiquity of man, the men of the bronze age, the dwarfs and the stone monuments, as dolmens, etc.

In the line of popularizing science these chapters are moderately meritorious. The leading English works have been consulted, and especial respect is paid to such as do not oppose received and conventional opinions, or do so the least. Their writers are preferred by the author as the correct exponents of modern research. He makes considerable business out of the seeming contradictions of testimony and the disagreements of specialists, when the facts do not suit him (*e. g.*, the Spy Man and the Pithecanthropus). His reports, therefore, while apparently judicial in tone, are not really so in spirit. They are probably tinged by his avocation, as is almost inevitably the case.

D. G. BRINTON.

UNIVERSITY OF PENNSYLVANIA.

Chemistry for Beginners. By EDWARD HART, Ph.D. Third Edition. Revised and greatly enlarged. With 62 Illustrations and 2 plates. Easton, Pa., Chemical Publishing Company. 1896. Small square 8vo. 245 pages. Price, \$1.50.

In text-books of elementary chemistry we have one of the most prolific fields of scientific literature, and, so far from deprecating this fact, each new book is to be welcomed as a contribu-

tion toward the solution of the difficult problem how best to teach chemistry to beginners. This problem is as yet far from solution; still, comparing the text-books of to-day with those of twenty, or even ten years back, it is apparent that a distinct advance has been made. This at least may be considered settled, that a prominent place must be given to experimentation on the part of the student. What shall be the relative order of theory and description and the order of the elements in descriptive chemistry is as far as ever from a final word, nor will the latter point, in the opinion of the writer, be settled until a natural order dependent on the periodic system is reached. As regards the former point, it must be kept in mind that there are two classes of beginners—those studying in secondary schools and those of maturer minds in colleges; a method of treatment suitable for one would quite possibly not be best suited for the other.

The book before us is from the pen of an experienced teacher, and of this it gives abundant internal evidence, and while written for beginners in colleges is equally well suited for use in high schools and academies. Ostensibly a third edition, it is so completely revised and so much enlarged that it is virtually a new book. The order of treatment is as follows: Introduction on 'rusting' of metals, oxygen, hydrogen, water (with potability, purification, etc.), constitution of matter, atmosphere, compounds of nitrogen, carbon and its compounds, halogens, sulfur, silicon, boron, phosphorus, arsenic, the metals, the carbon compounds (sixty-six pages on organic chemistry).

The theoretical portion of the subject is taken up from time to time, under appropriate compounds or elements. While the elements are considered, for the most part in the usual groups, little or no regard is paid to the periodic law in their arrangement. Equations for reactions are very sparingly used, and the word valence seems not to occur at all, although graphic formulæ are used, especially in the portion on organic chemistry.

The strong feature of the book is in experimentation. Over two hundred experiments are described, and it would be difficult to find a book containing as many pertinent, well selected,