adjusted at such distances that, with a slit 1 cm. wide, one letter is always in sight; if 2 cm. wide, two letters; and so on. By varying the rate of rotation of the drum and the width of the slit, the time necessary for the reading of a single letter under various circumstances was obtained. Up to a certain limit, this time is *shortened* as the slit is *widened*. This fact is to be interpreted as follows: In reading these letters, two time elements are involved: 1°, that of recognizing the letter; and, 2°, that of naming it. The association between the sight of the letter and its name is so close, that the latter action is performed automatically: hence, if the letters follow one another with so great a rapidity that the first can be named while the second is being recognized, the average time for reading a single letter will evidently be shortened; and the experiments show that this power of carrying over one letter while pronouncing the preceding can be active when three, or in the case of several persons when four or five, letters were present to the eye at once.

Another series of experiments showed that it takes longer to count letters than to name them; and if the letters are counted in groups of two, or better still of three, instead of singly, the counting time is reduced.

The time necessary for reading words in different languages was also studied; and the general result is, that the maximum rapidity with which words forming sentences can be read varies directly with one's acquaintance with the language. A German read 100 German words in 18.4 sec., but 100 English words in 29.1 sec. This method offers a means of objectively testing a person's acquaintance with a foreign language. If the words are read backwards (thus eliminating the sense of the passage, and reducing the process to mere reading), the time is lengthened; but the smaller one's acquaintance with the language, the less difference in time between reading it forwards and backwards.

It seems that among those tested, women read faster than men; and Germans take longer to spell their words than English-speaking persons.

If small strips of colors are used, instead of letters, it takes almost twice as long to name the true color as it would to name a letter; and this difference in time is due to the greater difficulty in finding the proper name. In this case the association between the color and its name is a loose one. These studies will be continued in the next number of the *Studien*. J. J.

NEXT year's exhibition at South Kensington, of the products of India and the colonies, is to be the last of the sort in that locality. Liverpool is to have an exhibition of shipping and means of transport.

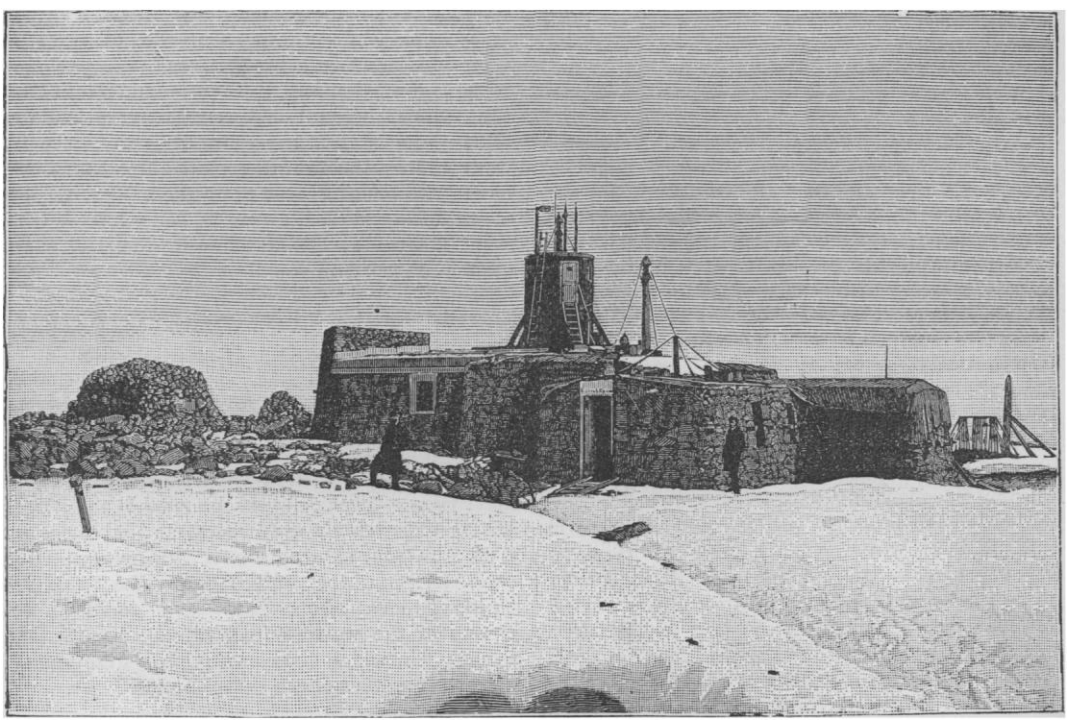
THE LAWS OF TEMPERATURE IN THE AUSTRIAN ALPS.

DR. JULIUS HANN of Vienna, editor of the Austrian meteorological journal and a leader among European meteorologists, has lately completed his detailed studies on 'Die temperaturverhältnisse der oesterreichischen alpenländer,' which are now published in three parts in the *Sitzungsberichte* of the Vienna academy of sciences. All available observations are included in the reductions, and the results are stated with great detail. As to method, attention should be emphatically called to the reduction to normal means; that is, to the mean of some definite series of years, in this case the thirty years from 1851 to 1880: thus, if a station had records from 1855 to 1884, the mean of these thirty years' observations was reduced to what it most probably would be for 1851–1880 by the use of a correction determined from neighboring stations where the records covered both periods; that is, from 1850 to 1884. Wild of Russia, and Buchan of Scotland, have employed this method for low-level stations; Hann is the first to show its applicability to mountain stations also. As to results, one of the most striking is the appearance of the *increase* of temperature upwards in the thirty years' winter mean of valley and mountain stations as a persistent climatic element. Observations of late years have shown that this inversion of temperature — extreme cold in valleys with moderate cold on mountains — was common enough in the winter during anticyclonic or high-pressure weather, but it is here first shown to be a persistent inversion characteristic of the winter mean. Hann was also the first to explain, several years ago, the peculiarities of the warm winter alpine wind known as the *föhn*, which depends directly on the unduly high temperature of the upper air in winter.

BEN NEVIS METEOROLOGICAL OBSERVATORY.

THE highest of the Scotch mountains, Ben Nevis, reaches an altitude of four thousand four hundred feet; less than five miles away, the sea stretches a long arm up the submerged portion of the great glen to Fort William. On this well-chosen summit, in the path of many a storm from the Atlantic, the Scottish meteorological society has built an observatory, here figured, for the direct study of the conditions of the upper air, which observations at their low-lying stations must leave to inference. Most of the few mountain observatories of Europe stand at a greater height than the summit of the Ben, but none of

them have the peculiarity of being immediately by the sea, and none are so frequently visited by storms. Hourly observations of the usual meteorological elements are taken by Mr. Omond, the superintendent, and his two assistants; and, if the observatory be maintained as well as it has been begun, its records must yield results of the greatest value in the study of the weather. Unfortunately, its support still depends only on general subscription. Among the generalizations thus far made for Ben Nevis by Mr. Buchan, secretary of he Scottish society, we may quote the following: are prevailingly cold, on account of the rapid loss of heat by radiation from the ground through the clear, dry air. Mountains, therefore, have a meteorology of their own, and one that is well worth studying.



BEN NEVIS METEOROLOGICAL OBSERVATORY. (*London graphic.*)

The mean velocity of the wind is greater at night than at day, this being the reverse of the variation found at low-level stations, but in accordance with the results of other mountain observatories and with theoretical deductions; diurnal variations of temperature are small, the change from warm to cold weather being very largely dependent on the passage of cyclonic storms; the temperature is abnormally high during the passage of an anticyclone, or area of high atmospheric pressure, in which the air descends from great altitudes, and is warmed by compression; this, like the variation of the wind, being the reverse of what obtains at lower levels, where anticyclones

THE ORIGIN OF MEDIAEVAL UNIVERSITIES.

AN important contribution to the history of higher education has been made in Germany by the publication of a work[1] on 'The mediaeval universities prior to 1400.' Its author is *unterarchivar* of the papal see, P. Heinrich Denifle, and he has brought the thorough methods of research which are characteristic of the Germans to the discussion of the ample stores of information which are to be found in the archives of Rome, Florence, Paris, Leipzig, Munich, Erlangen, and other ancient seats of learning. The volume before us includes more than eight hundred pages, but it is only one-third of the proposed work. It discusses the origin of the universities in the middle ages; and their organization and constitution are to be considered

[1] *Die universitäten des mittelalters bis* 1400. Von P. HEINRICH DENIFLE. Band i. Berlin, *Weidmann*, 1885.