

THE INSTITUTION OF MECHANICAL ENGINEERS

THE Institution of Mechanical Engineers held its meeting in the Theatre of the Institution of Civil Engineers on Thursday and Friday of last week. The paper on "Triple Expansion Engines," read at the last meeting, of which we then gave an abstract, was discussed. The remainder of the papers on the programme were read and discussed.

Mr. E. P. Rathbone's paper on "Copper-Mining in the Lake Superior District" comprised a general description of the district, the method pursued in mining, and the system of ore-dressing and machinery employed. The ore employed is what is known mineralogically as "native copper." It does not occur in true fissure veins, but rather in beds, or, as they are not inaptly termed in the district, "belts," dipping at the same inclination as the "country" or rock inclosing them.

From exhaustive scientific investigations into the origin and derivation of the copper in these deposits, it appears probable that it was infiltrated into them in the form of an aqueous solution of copper, which also appears to have had a strong chemical affinity for special constituents of the rocks, thereby giving rise to a series of chemical reactions, whence resulted the precipitation of native copper in a more or less concentrated state, according to the proportion and the even distribution or otherwise of the precipitating or displacing agent present in the original rocks. In the amygdaloidal trap-rocks the displacing agent appears generally to have been less evenly distributed than in the conglomerates; in certain places the concentration of the displacing agent has been so excessive as to give rise to the formation of large masses of copper. Whether or not the precipitating action was connected with some natural process of lixiviation, influenced by terrestrial electrical currents, it is impossible to decide. In the amygdaloidal trap-rocks the vein-stone is frequently composed largely of epidote, a mineral whose presence is regarded as favourable or "kindly" to copper. Other minerals found in association with the hornblende and augitic porphyries that constitute the vein-stone proper, are quartz, calc-spar, and many varieties of the zeolite group. The commercial copper smelted from these ores being entirely free from deleterious matters, such as arsenic, bismuth, antimony, &c., is especially valuable for electrical purposes, as the conductivity of copper is reduced by the presence of foreign matter even in the minutest proportions, a trace of arsenic reducing the conductivity 20 per cent. In the manufacture of brass, again, the presence of antimony is most deleterious: one-tenth of 1 per cent. converts first-rate "best selected" into the worst possible; one-fortieth of 1 per cent. renders it unfit for anything but inferior brass; one-eighth of 1 per cent. changes "best selected" into "tough ingot"; one-tenth of 1 per cent. of either bismuth, arsenic, phosphorus, nickel, or cobalt, is sufficient to turn "best selected" into tough metal.

There are two methods pursued: "mass mining," where copper is found concentrated into masses varying in weight from a few hundred pounds up to many tons; and "stamp-rock mining," where the copper occurs in a more or less divided state, and usually pretty evenly disseminated throughout the whole vein-stone, so that its separation from the matrix or gangue can be economically effected only by stamping and by the subsequent processes ordinarily employed in mechanical ore-dressing. The more evenly the copper is distributed throughout the vein-stone, the more valuable is the latter, and hence it is that vein-stone producing only 0.75 per cent. can be worked profitably at the present low price of copper.

The object of ore-dressing is to separate as far as possible the small percentage of valuable metal occurring in the ore from the worthless matrix or gangue, and concentrating it to the highest degree of purity practicable. The main feature of the process may be said to consist in applying to copper ore the principles and the machinery already employed elsewhere in the dressing of tin and lead ores.

In the Lake Superior copper-mining the features which appear to the author most worthy of special attention are:—(1) The care with which the exploratory workings are kept in advance of the stoping. (2) The general use of machine drills, which admits of opening up the mines at a rate otherwise impracticable. This is one of the few localities where drills are employed for stoping, and it has been found that two or three times as much rock can be stoped in the same time by drill as by hand. (3) The care bestowed upon the separation of the copper from the gangue by dressing.

M. Marc Berrier-Fontaine's paper was descriptive of his portable hydraulic drilling-machine, by means of which holes are drilled in a single operation through all the superposed thicknesses of metal without stopping the drill, which insures that all the holes are quite true. By its use 25 per cent. more holes are drilled than can be drilled by stationary machines in the shops.

Mr. H. Teague's notes on the pumping-engines at the Lincoln Water-works, which the Institution visited at its summer meeting last year, are mainly of a technical character. It is interesting to learn that when in 1884 still further pumping power was required, the author, from experience gained at Grantham, Maidstone, and other places, decided to revert to the Cornish pumping-engine, as he had been convinced that the cost of coals and repairs had been reduced in some instances to as low as only one-sixth of the annual expenditure pertaining to rotatory pumping-engines previously in use there.

THE SCOTTISH METEOROLOGICAL SOCIETY

THE Journal of the Scottish Meteorological Society, which has recently been published, contains, in addition to copious tables of the meteorology of 1885, several papers of more than usual interest. Prof. Piazzi Smyth leads with a suggestive paper on hygrometric observation, based chiefly on observations made by him in the neighbourhood of Malvern in the summer of 1885, on fifteen successive days, at 9 a.m., in June, at a height of 125 feet; and subsequently for twenty successive days at the same hour but at a height of 350 feet. Scrupulous care was taken to have the dry-bulb surrounded with air as nearly as possible of the same quality as that of the free atmosphere outside, by placing a large and tall black iron chimney on the top of the Stevenson screen, according to Mr. Aitken's idea of promoting a current inside the screen; and to have the wet-bulb as perfect as possible by enveloping it in thin muslin, tightly drawn over its surface, and by securing that it was always thoroughly wet for each observation. The results gave for the lower station a mean depression of $3^{\circ}.4$ of the wet- below the dry-bulb; and $6^{\circ}.4$ for the upper station. It is probable that these results would be found to be higher than what obtained at the three or four stations in Central England nearest to Prof. Smyth's at the same dates; and without a doubt the value of the inquiry would have been enhanced if such comparisons had been made and recorded in the paper.

An important point would be gained if such inquiries led meteorologists more earnestly to consider the necessity of improving the means and methods of observing and reducing the observations of this most important element of the atmosphere, it being by its aqueous vapour that the disturbing influences at work are called into play, giving rise to winds, storms, rain, snow, hail, electric displays, and other atmospheric phenomena.

Mr. Omond, in an interesting paper on the wind and rainfall of Ben Nevis in 1885, based on the hourly observations at the Observatory, shows that the direction of wind with which most rain fell was a little to the north of west, and that the quantity diminishes round the compass in both directions from this until the driest point is reached a little to the south of east: east winds having a very low value. As regards the rate of fall with each wind during the time it lasts, north-westerly winds are the wettest and easterly and south-easterly winds the driest. Since south-easterly winds mostly occur when an anticyclone is moving off and a cyclone approaching, the fact of their dryness at the Observatory, 4406 feet high, is a valuable contribution to our knowledge of storms, since the same winds under the same conditions at lower levels are notoriously wet.

A hopeful inquiry is being carried on at the Ben Nevis Observatory by Mr. Rankin, first assistant, on rainband observations; and from the results already obtained there can be little doubt that when a complete low-level observatory, with hourly observations, has been established at Fort William, much light will be thrown on the vertical distribution of vapour in this part of Great Britain, and its important bearing on forecasting the weather. The observations for seven months are discussed, and the means show that a heavier rainband indicates with steady regularity a larger rainfall as determined by the hourly observations.

But the most important contribution of new facts in the Journal are thirty-nine pages of temperature observations made on the Firth and Lochs of the Clyde from March to November 1886, by

¹ Journal of the Scottish Meteorological Society, Third Series, No. iii. (Edinburgh and London: William Blackwood and Sons.)