1881; that is to say, at periods of three and three and a half months later. Then again the minimum movement B, B′, and B″ which occurred at Zanzibar in the month of May, 1881, did not appear at Bombay and Belgaum until the month of November of the same year; that is to say, after an interval of six months. Again, the maximum movement C, C′, and C″ occurred at Zanzibar in the month of September, 1881, but not at Belgaum until January, 1882, and at Bombay until February, 1882; that is to say, until after intervals of four and five months respectively. Again, on examining the minimum D, D′, and D″, which is divisible into two minor minima, the first of these minor movements appears at Zanzibar in the month of November, 1881, but at Belgaum between the month of April and May, and at Bombay in the month of April, 1882; that is to say, after intervals of five and a half and five months respectively. Lastly, the second minor movement of the minimum D, D′, and D″ occurred at Zanzibar in the month of February, 1882, and at Belgaum and Bombay in July of the same year; that is, after an interval of five months.

These facts may be presented briefly and concisely thus:—

TABLE II.

	An interval of		An interval of
From A'' to A' ...	3 months	From A'' to A ...	3·5 months
,, B'' to B' ...	6 ,,	,, B'' to B ...	6 ,,
,, C'' to C' ...	4 ,,	,, C'' to C ...	5 ,,
,, D''_1 to D'_1 ...	5·5 ,,	,, D''_1 to D_1 ...	5 ,,
,, D''_2 to D'_2 ...	5 ,,	,, D''_2 to D_2 ...	5 ,,
Average from Zanzibar to Belgaum	4 7 ,,	From Zanzibar to Bombay	4·9 ,,

In the case before us, then, it does appear to be matter of fact that there are movements taking place at the two stations, Belgaum and Bombay, similar in character to movements which have taken place at Zanzibar on an average about five months previously. And assuming that the same course of events will occur in the future, it may be expected that from the month of August to the month of December, 1882, the abnormal variations of the barometer at Bombay and Belgaum will in a general way follow the same course as was taken by the variations at Zanzibar during the months of April, May, June, and July; that is to say, an upward movement.

This prediction might be considered fairly reliable to within about a month one way or the other, were there no modifying conditions. But the curves are seen at a glance to present most decided departures from absolute parallelism; there are movements at Zanzibar which do not reappear at the eastern stations, whilst the eastern stations experience movements which do not appear to have been previously experienced at Zanzibar. Moreover, the rate of transmission of movements from Zanzibar to the west of India has been shown to vary from three to six months. And further, the movements at the eastern stations are sometimes much less or much greater than those which took place at the western station. Evidently, then, there is some influence which tends to produce irregularities in the eastward transmission of the abnormal movements; and this influence must be discovered and its occurrence foreseen and allowed for before the Zanzibar curve could be used for the purpose of predicting the nature of the movements at Belgaum and Bombay, and, as a consequence, the nature of the seasons in Western India.

A second inspection of the curves seems to indicate that not only are there abnormal movements which travel from the western station to the eastern ones, but there are also variations which are felt at all the three stations simultaneously. Thus in the months of July, 1880, June, 1881, and January, 1882, there are simultaneous upward bends of the curves at all the three stations. And again in the months of May, August, and November, 1881, there are simultaneous downward movements at all the three stations. These simultaneous movements are especially observable if the unsmoothed monthly abnormals (the thin dotted lines) be referred to instead of the smoothed curve (the thick continuous line). They are then seen to be exceedingly numerous—so numerous, indeed, that they may well be supposed to frequently mask the non-simultaneous or travelling movements, and cause those movements apparently to present many irregularities. The following table shows concisely the times when upward and downward movements have taken place at all the three stations simultaneously:—

TABLE III.—*At Zanzibar, Belgaum, and Bombay simultaneous Barometric Abnormal Movements*

Occurred in an upward direction in	Occurred in a downward direction in	Cannot be easily traced in
June 1880	May 1880	February 1880
[1] July ,,	November ,,	March ,,
October ,,	January 1881	April ,,
December ,,	March ,,	August ,,
February 1881	[1] May ,,	September ,,
[1] June ,,	[1] August ,,	April 1881
[1] September ,,	October ,,	July ,,
December ,,	[1] November ,,	March 1882
[1] January 1882	[1] February 1882	April ,,
	September ,,	May ,,
		June ,,
		July ,,
		August ,,

Thus out of thirty-two months there were nineteen in which it can be seen that simultaneous movements occurred at the three stations; and out of these nineteen months there were eight in which the movements were very distinct. In the remaining eleven months out of the nineteen the movements were not so prominent or well marked, but were always distinct enough to be readily recognised, and it does not seem unreasonable to suppose that the influence of such movements may have been felt in some if not all of those months in which they cannot be easily traced; that in fact the simultaneous movements may have been so small as to show themselves only in an excessive or deficient movement, upward or downward as the case may have been, of the curve which represents the non-simultaneous or travelling movements. In any case eight of these movements appear to be sufficiently distinct to disallow of doubt; and considering that Zanzibar is about 2500 miles distant from Belgaum, the fact seems to be interesting.

A. N. PEARSON,
Acg. Meteorological Reporter for
Bombay, January 10 Western India

(*To be continued.*)

[1] In these months the movements are very distinct.

THE INSTITUTION OF MECHANICAL ENGINEERS IN BELGIUM

THE Institution of Mechanical Engineers has this year held its summer meeting in Belgium—the first time that it has crossed the Channel, except on the two occasions of the exhibitions in Paris. The reception was organised by the Association of Engineers from Liége University (Honorary Secretary, M. Édouard de Laveleye), and was of the most cordial character. The great works of Belgium were thrown open without reserve, and numerous excursions were organised to visit them. Amongst those specially to be noticed are the colossal establishment of the Cockerill Society at Seraing, the great iron and steel works at Ougrée and Sclessin, the vast zinc works of the Vieille Montagne Company, the cloth factories at Verviers, and the splendid collieries of Mariemont, probably the finest examples of colliery plant in the world. Space forbids our entering into a description of these works, and we shall confine ourselves to the papers read, so far as these possess more than a technical interest.

The proceedings opened on Monday evening, July 23, with a reception by the Mayor of Liége, after which the president, Mr. Percy Westmacott, delivered an interesting and suggestive address. After speaking of the great modern extension of Belgian industries, and of the debt which the world owes to the inventive skill of the engineer for providing those processes on which all trades are dependent for cheap and rapid production, he went on to develop his special theme, namely, the advantage of High Speed and its connection with high workmanship. The following extracts are well worth quoting:—

"The keen and continual attention bestowed upon the work to be done, and the means of doing it, has led engineers in general to regard speed of production as one of the first elements of success. There is indeed a proverb, 'more haste, less speed;' but this, though true of human labour, which ceases to be accurate when forced beyond a certain rate, does not hold good of mechanical processes. Generally it may be said that rapidity of working not only reduces cost but improves the result, and also confers great benefits from the way in which it brings out and perfects the highest qualities of the engineer. To be able to do a thing leisurely and quietly simply requires the rudest materials and the rudest workmanship; but if work is to be done quickly, or the appliances made to move quickly, the case alters. Mechanical energy increases as the square of the speed; and so it may be said that the mental energy and skill required to carry on work increase also at something like the square of the speed with which that work is performed. The materials used must be far stronger and far finer; everything must be well proportioned and balanced; there must be the most perfect arrangement in each structure and in every part of a structure, and the most perfect workmanship in the fitting of those parts together; and thus we may almost reverse the proverb, and say of mechanical processes, 'The higher the speed, the better the work.'

"The torpedo boat is an excellent example of the advance towards high speeds, and shows what can be accomplished by studying lightness and strength in combination. In running at 22½ knots an hour, an engine with cylinders of 16-inch stroke will make 480 revolutions per minute, which gives 1280 feet per minute for piston speed; and it is remarked that engines running at that high rate work much more smoothly than at slower speeds, and that the difficulty of lubrication diminishes as the speed increases: doubtless the experiments on friction which are now being conducted by this Institution will throw light upon this subject.

"An important experiment on high speed in light vessels, which will doubtless be watched with much interest, is now being carried out. Mr. Loftus Perkins is building a steel vessel with a screw at each end: she is 150 feet long; her boiler pressure will be about 800 lbs. per square inch, and she has a four-cylinder compound condensing engine of 800 h.p. working on to a single crank, and making from 400 to 500 revolutions per minute. When this vessel is laden with 300 passengers, her total weight will not much exceed 150 tons. Should this experiment be successful, it will materially advance the solution of the problem, how to put the largest possible amount of propelling power into a vessel, and so to drive her at the highest possible speed.

"Again, in touching upon speeds, the mind naturally reverts to railway travelling. Here, however, it would seem as if for the present we had reached a maximum. It is surprising how soon the speed of the locomotive was brought up to something approaching its present limit. George Stephenson was laughed at in 1825 for maintaining that trains would be drawn by a locomotive at twelve miles an hour, but the 'Rocket' herself attained a speed of twenty-nine miles an hour at the Rainhill competition in 1829, and long afterwards ran four miles in four and a half minutes. In 1834 the average speed of trains on the Liverpool and Manchester Railway was twenty miles an hour; in 1838 it was twenty-five miles an hour. But by 1840 there were engines on the Great Western Railway capable of running fifty miles an hour with a train and eighty miles an hour without. In 1841 we find Stephenson himself ranged on the side of caution, and suggesting that forty miles an hour should be the highest regular speed for trains. In 1851 Mr. Crampton, who had already in 1849 inaugurated the express service of the Continent on the Northern Railway of France, conveyed a train twenty miles in nineteen minutes, four miles in the journey being at the rate of seventy-five miles an hour. Thus, it is a remarkable fact that the highest speed at which locomotives run in ordinary practice scarcely seems to have been raised during the last thirty years; on the other hand, the weight of the trains has been perhaps doubled.

"What are the causes which have tended to prevent any improvement in this particular? In the first place it may be said that the permanent way would suffer seriously by further increase in speed; but this could surely be overcome in time by improving the permanent way itself, which also remains very much in the same condition and of the same construction as it was twenty-five years ago. Again, it may be said that the running at a higher speed would require more powerful engines, and hence that trains now worked by a single engine would require two, or would have to be split up into two trains at a great increase in running expenses. This, however, assumes that it is not possible so to improve the engine that it shall be able to exert a considerably higher power without an inadmissible increase in weight. By utilising a larger part of the total weight of the engine as adhesion weight it would be easy to obtain the amount of adhesion required for the increased tractive force; and for this purpose Mr. Webb's compound locomotive (to be described by the author in a paper he has prepared for this meeting) which enables the number of driving wheels to be increased without the use of coupling-rods, appears to merit articular attention.

"Another point in which improvement may possibly arise in the future should be noticed. On the Russian railways, where both coal and wood are dear, the burning of petroleum has now taken a practical form. Our member, Mr. Thomas Urquhart, has been very successful in this direction, and is now running locomotives regularly which use only petroleum refuse, and which show a marked economy over coal or wood. To test the point he prepared three locomotives of exactly the same type, and started them on successive days under exactly similar conditions of weather, train, and section of road. The trips were made both ways, and the results per verst, including fuel required in lighting up, were as follows:—

	Copecks.
Anthracite, 52·9 Russian lbs., cost	26·35
Wood, 0·0107 cubic sashin, cost	23·54
Petroleum refuse, 27·36 Russian lbs., cost ...	11·64

"There is thus in this instance an economy of at least 50 per cent. on the side of petroleum, the boiler pressure being from 120 lbs. to 130 lbs. and the gross load over 400 tons. At the same time the weight of fuel used, as against coal, is diminished by about 50 per cent., which is a most important item.

"Although petroleum is scarcely a product of Western Europe, we have to notice on the other hand the progress which has lately been made in the extraction of oil as a waste product from coal, &c. Mr. Jameson has extracted as much as nine gallons per ton from mere shale. It is suggested that markets for such oil will be difficult to find; but it seems allowable to hazard the idea that we may hereafter see our locomotives, even in England, running with oil fuel, which would be at once much lighter and much more easily renewed than the coal which is used at present, and get rid of the intolerable nuisance of smoke and dirt. There might in fact be an oil tank and a water tank side by side at every stopping station, and the engine would replenish her store of fuel at the same time as her store of water.

"Another point in which speed and perfection of workmanship have gone hand in hand is the important industry connected with textile fabrics. When Arkwright first brought his inventive mind and mechanical skill to bear upon this subject, the tools he had to work with were rude compared with the tools of the present day, and could not produce the accurate work now attainable; and therefore the speed at which he was able to drive his spindles was not remarkable. But our member, Mr. John Dodd, of Messrs. Platt Bros., informs me that the average speed of mule spindles at Oldham, in new mills with new machinery, and spinning No. 32 yarn from American cotton, is about 8500 revolutions per minute; whilst speeds as high as 9500 or even 10,000 revolutions have been attained. When we consider the delicate nature of the material under treatment, the disastrous result of the slightest hitch or unevenness in working, and the perfection of mechanism required to bring up a multitude of spindles to such a speed from that of the comparatively slow main shaft of the mill, we may give every credit to the constructive skill which has achieved such a result. In woollen mills (of which we hope to see some excellent examples at Verviers on Thursday next) the speed is 4000 revolutions per minute. The progress made here has not been so great, mainly, in Mr. Dodd's opinion, from wood being still adhered to as the material for the bobbins. Here therefore is a case where improved material may yet produce improved speeds; but with cotton Mr. Dodd considers that the extreme possibilities as to speed have been very nearly attained. The limit however is imposed by the feebleness of the material, not by any lack of skill or enterprise on the part of the engineer. 'If higher speeds were required,' says Mr. Dodd, and I fully believe him, 'we could make spindles which would be equal to the demand.'

"The construction of modern artillery, and with still greater justice the methods of employing it, may properly be brought under the scope of this address. I doubt whether of late years any mechanical appliances or arrangements have given greater impetus to skilful work and to the improvement of materials, especially of steel. Twenty-five years ago the largest piece of ordnance in use was a gun weighing 4¾ tons, firing with a maximum charge of about 15½ lbs. of powder a ball of 66 lbs., and made of cast-iron, a treacherous material for such purposes. We have now guns built up on well understood mechanical principles, of the most trustworthy and suitable material known, weighing 100 tons and firing with charges of 772 lbs. of powder shells of 2000 lbs. Already considerable experience has been obtained with guns of this weight. No fewer than fourteen have been issued from the Elswick Works, and several more are in the course of construction.

"Perhaps the most interesting feature in these formidable pieces of ordnance is the ease, rapidity, and noiselessness with which they are worked. It is of course impossible that such ponderous pieces could be brought into practical use without the aid of some mechanical appliances; but it is scarcely an exaggeration to say that nothing can work with greater precision and ease and be better under control than the hydraulic machinery employed for opening and closing the breech of the gun, ramming home the charge, elevating or depressing, running in or out, and training with accuracy on a given object. Two men working levers perform all these operations, and they, together with the machinery, are under complete protection from an enemy's fire.

"The projectile when fired has an energy imparted to it equal to nearly 48,450 foot tons, yet the gun is under such entire control that its recoil, due to this enormous force, is completely absorbed in a distance little exceeding three feet, without undue strain to any part of the mechanism. When it is remembered that the internal dimensions of the costly turrets in which guns of this size are ordinarily mounted depend mainly upon the space allowed for recoil, it is clear that it is of very great importance to reduce this space to a minimum.

"The fact which lies at the basis of these results is of course this, that the attainment of a high speed requires a more perfect machine, and with a more perfect machine more perfect work is turned out.

"In conclusion, it should be remembered that high speed, especially the speed of rotation, is almost necessary to give perfect accuracy and steadiness to motion, as in the case of an ordinary spinning top, of a gyroscope, and again of the ingenious centrifugal machines now in use for separating cream, &c. The speeds which we find in Nature are beyond all conception high, and her operations under those speeds are absolutely true and perfect. We cannot hope to vie with Nature even to an infinitesimal fraction of her powers of speed and accuracy; but in this, as in many other great lessons taught by her, we see the direction in which we must travel in our efforts towards the perfection of work.

"Finally, it is unfortunately a necessity that nations should still provide themselves with materials for war; and engineers have to devote their minds to the perfecting of such materials. It does not seem impossible that projectiles may be gradually developed, of such precision and devastating power as to make the existence of life within a certain range well nigh impossible. Were this accomplished, it is clear that nations would hesitate more and more before rushing into a war so destructive; and even if they did so, its rapid termination would unquestionably go far to diminish the various miseries which war always brings in its train. Hence it may not unfairly be said that the attention and skill given to the arts of war is really our best warrant for the continuance of peace."

On the next morning the papers read were on the "History of the Coal and Iron Industries in the Liége District," by M. Edouard de Laveleye, and on the "Manufacture of Zinc in Belgium," by M. St. Paul de Sinçay. The first of these was generally of an historical character, giving many interesting details as to the development of collieries and ironworks in Belgium. A claim was put in on behalf of Belgium for two most important discoveries in the metallurgy of iron, namely, the blast furnace and the cementation process. With regard to the present position of coal-working in this district, it was observed that all the difficulties which generally beset the mining of coal have to be encountered in their severest form. The chief of them—fire-damp—is nowhere so destructive, though its effects have been to a great extent obviated by the introduction of the Davy lamp and afterwards the improved safety-lamp of Mueseler. This lamp will resist a current of air of 15 feet per second, and has also the great property of self-extinguishment. In the recent disaster at L'Agrappe, which cost the lives of more than 100 miners, a sudden escape of gas issued from the shaft and burnt for several hours like an enormous gas-burner; but there was no explosion inside the mine, the 220 Mueseler lamps which were underground at the time having all been extinguished. Similar escapes of gas have taken place on other occasions and in enormous volume, without having previously given any indication of their appearance. Science appears to be powerless to prevent these disasters.

The second paper gave a sketch of the manufacture of zinc, which is a special trade in Belgium. Little was said as to the details of metallurgy, but it appears that the Belgian process, invented by Dony, of Liége, in 1810, is superseding all others, even in England. The difficulty and loss in reduction are, however, very great, and the labour is described as harder even than that of the puddler.

The third paper, by M. Mélin, was on "The Manufacture of Sugar from Beetroot," and formed a complete and exhaustive monograph on a manufacture of which but little is known in England. We regret that we can only give the briefest possible sketch of the processes. The beetroot, of which the cultivation was fully described, contains about 95 per cent. of juice in weight, and 5 per cent. of cellulose. These 95 parts of juice contain 10 parts of sugar, 2 of solid matter, and 83 of water. In manufacturing, the special point to be considered is the percentage of sugar, together with the purity of the juice. The manufacture is carried on in the winter only, and the beetroots are piled in silos until they are required for use. They are then washed, and are now ready for the extraction of the juice. For this purpose two systems are employed. On the first or hydraulic system, the roots are immersed in powerful rasping machines, and so reduced to pulp. This pulp is collected in sacks, which are piled up one upon the other between the table and the pressure head of a hydraulic press. The press is started, and acts with a pressure of about 450 lbs. per square inch on the pile of sacks, squeezing the juice through them. The dry pulp is used for feeding cattle, and is of considerable value. On the second or diffusion system the beetroots are cut up by a cutting machine into small slices called *cossettes*. These are placed in cylindrical vessels with an opening at the top for charging, and another at the bottom for emptying. These vessels are filled with water, and the result is that a current of endosmosis takes place from the water towards the juice in the cells, and a current of exosmosis from the juice towards the water. These currents go on until equilibrium is produced; and if fresh water is substituted they begin afresh. In this way the whole of the sugar contained in the cells is gradually drawn out. On the other hand, the water passes from the more exhausted to the less exhausted cells, and thus gradually increases in richness. A number of such vessels are used, forming what is called a diffusion battery; but in each of them the process going on is the enriching of the juice on the one hand and the impoverishing of the slices on the other. The slices are finally pressed in order to remove the residue of juice, but this is never effected so completely as by the hydraulic method.

The next process is that of defecation, which consists in adding milk of lime to the juice, in order to neutralise the organic acids which are precipitated, and also to decompose the salts of potassium, sodium, and ammonia. The result is that the dark brown juice becomes perfectly clear and of an amber colour. The scum which floats on the top, and which contains much juice, is passed through filtering presses, and the dried cake is sold as manure. After defecation the juice is filtered, twice at least, through animal charcoal under a sufficient pressure. It is then evaporated and transformed into syrup in a series of three vertical vessels, of which the first communicates with the second, the second with the third, and the third with a condenser. Steam is admitted to the first, and passes through to the last; and, owing to the partial vacuum produced by means of the condenser, causes an evaporation of the juice in all three. The next process is that of boiling this group, so as to allow the sugar to crystallise. This goes on within cast-iron vessels under a high vacuum, and heated by steam at high pressure circulating through worms. After a certain amount of evaporation, crystallisation begins in the form of an immense number of small grains of sugar. To develop these grains syrup is pumped in at regular intervals and with great care, so that the crystals may grow steadily and may be large, regular, and hard. Finally the crystals are dried by ceasing to supply syrup and introducing a current of steam. After eight to ten hours the sugar is removed from the boilers, and placed in vertical turbines running at 1000 revolutions per minute. Under the action of centrifugal force the boiled mass is spread upon the outsides of these turbines, which are perforated, and the syrup passes through the holes, while the sugar remains behind. This sugar is cooled, and is called sugar No. 1. The syrup is boiled over again so as to obtain a second sugar called No. 2, and by a similar process a sugar No. 3 is obtained. The time of crystallisation, however, increases greatly, and for syrup No. 3 it is as much as six months. The final residue is molasses, which contains a large proportion of sugar that cannot be reduced by boiling. It is sold to make alcohol, or subjected to osmosis, by which the salts contained are drawn off and replaced by water; the sugar is then revivified and rendered capable of being crystalised. The paper concluded by giving careful analyses of the juice and of the products in all the stages of manufacture.

The next paper read was "On the Application of Electricity to the Working of Coal-Mines," by Mr. A. C. Bagot. The writer described a system of electric signals replacing the old system of signalling from the bottom to the top of the shaft by a gong worked by means of a wire. Galvanised iron telegraph wire was found to form the best communication, and the most suitable batteries to be 12-cell Leclanché. The system used for signalling in underground haulage planes, which are frequently the scene of accidents, was also described. Electricity had also been applied to signal the indications of an anemometer placed in the return air-way up to the engine-room at the surface. By an arrangement of clockwork and revolving tape, the engineer obtains an automatic and continuous record of the speed of the main air current at any part of the mine. Lastly the telephone might be applied with advantage for hearing the action of the pump-valves in the pumping shaft, without having to send the sinkers down.

Electricity may, however, be brought to bear for other purposes in mines, such as illumination and transmission of power. For lighting the pit bank, powerful arc lamps are found very serviceable, and the ordinary staff of a colliery, after a week's instruction, is capable of maintaining the appliances in operation. Alternating high-tension machines are very unadvisable on account of the likelihood of accident, and the Edison low-tension machine is said to be the best that can be used. At Risca Colliery a cable is taken down the pit from a dynamo at the surface, and is connected with a series of Crompton incandescent lamps at the bottom. These give an excellent light, and greatly facilitate the work of the men about the bottom of the shaft. But Mr. Bagot's opinion is strongly against the use of electric lamps in the working stalls and faces; partly because such lamps do not, like safety-lamps, indicate the approach of gas, partly because the line-wires may easily be broken, and partly because the hewer requires to be constantly shifting his light. With regard to the transmission of power by an electric tramway, as now in use at Zankerode, the writer holds that small locomotives worked by steam or compressed air are at present far more economical; so that the question of electric haulage need not in his opinion be considered at present.

These latter opinions did not pass without challenge. M. Tresca, who was present, pointed out that there was another form of electric transmission, viz. by a fixed cable with a dynamo at each end. Where work had to be done at some special part of a colliery, especially on an emergency, he believed that this would be found a handy and economical system. At the mines of La Perronière power was thus conveyed to a distance of 500 metres, and with a useful effect of about 30 per cent. This, in spite of over-bold statements to the contrary, was about the utmost which at present could be obtained in practice. The various sources of loss in such transmission were enumerated as follows:—First getting up the speed from that of the motor engine to that of the generator; secondly, loss within the generator itself; thirdly, loss in transmission along the cable; fourthly, loss within the receiver; fifthly, loss in slowing down the speed of the receiver to that of the main shaft. These defects were all now fully recognised, and might gradually, he hoped, be overcome. With regard to the amount of power which could thus be transmitted, the well-known experiments of M. Deprez showed 5 to 6 h.p. But within the last week he had succeeded in transmitting 31 h.p. from a Gramme machine to a great distance. The facility of installation was a great advantage in this system of transmission. It was far superior to that by an electric locomotive, as to which at present he had little to say; but on the whole he was more firm than ever in the view that a negative conclusion with regard to the electrical transmission of power was at any rate premature.

The next paper was by Mr. Webb, of Crewe, upon "Compound Locomotive Engines." It described the system devised by him, and now carried out in several engines running upon the London and North-Western Railway.

The last paper read at Liége was on the St. Gothard Railway, by Herr Wendelstein of Lucerne. This paper gave an interesting description of the works of the railway, and of the Brandt hydraulic drill, which was used with great success for one of the spiral tunnels. It then passed on to the question of ventilation, which was very fully gone into. Tables were given of the temperature in the great tunnel during and after construction, together with an account of the observations made on the ventilation both of that tunnel and of the spiral tunnels. The subject is as interesting from a scientific as it is important from a practical point of view, the result being that artificial measures of ventilation, the necessity for which was fully discussed, are found to be wholly needless. We regret that space does not allow us to reproduce this part of the paper.

During a subsequent visit of the Institution to Antwerp, a paper was read by M. Royers, describing the great harbour works which are now being constructed at that city, especially the long quay wall which is being built far out in the river by a special system of floating cofferdam designed by Mr. Hersent. In addition to these papers a large number of notices of the various works to be visited, &c., had been prepared and were distributed at the meeting. We understand that copies of any of these, or of the papers above mentioned, may be obtained on application to the Secretary, 10, Victoria Chambers, Westminster, S.W.

GEOGRAPHICAL NOTES

In the *Transactions of the Berlin Geographical Society* (May-June) is an interesting paper by Herr Arthur Krause on South-eastern Alaska, or that strip of coast stretching from Mount Elias to Fort Simpson, comprehending about 120 miles breadth of continent, and the numerous islands lying alongside of it. Herr A. Krause passed the winter of 1882 with his brother at a factory to the north of the Lynn Canal, making short tours the following spring into the interior, as far as the Yukon district, and Herr Krause's paper is the result of his observations. The lower course of the Yukon River, as far as Fort Yukon, has been traced and astronomically observed by Raymond in his "Reconnaissance of the Yukon River, 1871." Its upper course and sources, on the other hand, have only seldom been visited by people of the Hudson's Bay Company and by gold seekers. The most important head stream is the Polly River, which springs from France's Lake on the west of the Rocky Mountains. From the south the Polly receives a powerful current, figuring in certain maps as the Lewis River. A northern offshoot of the Lynn channel cuts so deeply into the interior that in two short days' marches you can pass thence to the Yukon river. To the north of the Lynn Channel is the varied district of Chileat, forming the watershed between the coast and the Yukon river, and parting two distinct zones of flora and fauna. The Chileat district, like the whole of the west coast, is mountainous, and its peaks condensing the vapour driven by western winds from the warmer region of the sea, the whole western tract is distinguished by its violent falls of rain in summer and snow in winter, as also by its abundance of glaciers. Glacier Bay, to the west of the entrance of the Lynn Channel, is quite filled with ice in consequence of vast glaciers falling into it. All the valleys, too, along the coast abound in glaciers. As soon, however, as the watershed and the slope towards Yukon river are reached, the glaciers disappear. With this change also appears a corresponding change in vegetable and animal forms. The low banks and islands along the coast are covered with poplars, alders, willows, and thickets. Higher up on the slopes you meet a thick belt of pine. A few green trees of diminutive size, birch, maple, and mountain ash, may be observed, but these are mostly interwoven in the enormous thick underwoods of the pine forests. In some lower-lying spots an almost tropical luxuriance of vegetation surprises the traveller. On the inland side of the watershed the whole physiognomy of vegetation is in striking contrast with that on the sea side—is barer, drier, and lighter. Instructive particulars are also given by Herr Krause regarding the fur and fishing trades of this region.

In the *Bulletin of the Italian Geographical Society* for July is a paper giving a historic survey of the Harar district, Somaliland, by the Rev. P. Taurin Cahague. Great interest attaches to this place since Frederick Müller has shown that it forms a distinct ethnologic enclave allied to