would obtain the weight of the atom of sulphur compared to hydrogen as the unit. The specific gravity he obtained was about 1·23—corresponding nearly, he says (p. 451) to Thénard's number, 1·23. Hence (as he believed air to be twelve times as heavy as hydrogen) he would obtain the atomic weight of sulphur as $(12 \times 1·23) - 1 = 13·76$, which number, standing half way between 14·4 as given in the first table, and 13 as given in the second, points out the origin of the first relative weight of the ultimate particle of sulphur. So from sulphurous acid he would obtain a similar number, taking the specific gravity as obtained by him (Part ii., 389) to be 2·3, and remembering that this gas contains its own bulk of oxygen (p. 391), he obtained $(2·3 - 1·12) \times 12 = 14·16$ for the atomic weight of sulphur. As, however, we do not possess the exact numbers of his specific gravity determinations, and as we do not exactly know what number he took at the time as representing the relation between the densities of air and hydrogen (in 1803 he says that the relation of 1 : 0·077 is not correct, and that $\frac{1}{20}$ is nearer the truth), it is impossible to obtain the exact numbers for sulphur as given in the first table.

In reviewing the experimental basis upon which Dalton founded his conclusions, we cannot but be struck with the clearness of perception of truth which enabled him to argue correctly from inexact experiments. In the notable case, indeed, in which Dalton announces the first instance of combination in multiple proportion (Manch. Mem. vol. i., series ii., p. 250), the whole conclusion is based upon an erroneous experimental basis. If we repeat the experiment as described by Dalton, we do not obtain the results he arrived at. Oxygen cannot as a fact be made to combine with nitric oxide in the proportions of one to two by merely varying the shape of the containing vessel; although by other means we can now effect these two acts of combination. We see, therefore, that Dalton's conclusions were correct, although in this case it appears to have been a mere chance that his experimental results rendered such a conclusion possible.

INTERNATIONAL METRIC COMMISSION AT PARIS

THE Permanent Committee of the International Metric Commission, elected from among the members at their general meeting at Paris, in 1872, has just concluded a series of meetings, the first of which was held on October 6. The Committee were directed to meet at least once a year, in order, amongst other things, to examine the progress of the work of the French Section, to whom the construction of the new standards was entrusted, with a view to the concurrence of the Committee as the executive organ of the Commission.

At their recent meetings, the Committee fully considered and discussed a detailed report of the proceedings of the French Section since the melting of the great ingot of platinum-iridium on May 13 last, from which all the new International Metric Standards are to be made (an account of which was given in NATURE, vol. x. p 130); and, generally speaking, the Committee expressed their unanimous concurrence and satisfaction at the mode in which the French Section have hitherto executed the duties entrusted to them by the Commission, and they also gave their decisions on certain points submitted to them for the guidance of the French Section in their future operations.

The first operation to which the great ingot of 250 kilogrammes of platinum-iridium was submitted, when in its rough state, and cleansed from all extraneous matter, was to have all the inequalities on its surface, that had been in contact with the lime of the calcined furnace, removed with a cold chisel. The ingot with its surface thus smoothed was found to weigh 236·330 kilogrammes. In this state it was exhibited to the Académie des Sciences at their *séance* of July 2, 1874. A portion of this large homogeneous mass of metal, when analysed by M. Henri Saint-Claire Deville, showed the proportion of iridium to be 10·29 per cent.

The ingot was next forged by M. M. Farcot under a steam hammer weighing 5,000 kilogrammes, until by successive hammerings and annealings, in a single day, it was brought to the form of a bar five centimetres square in section. By similar operators this bar, divided into convenient lengths, was afterwards further reduced to eight bars 2·5 centimetres square in section, and of a total length of 16·405 metres.

A remarkable phenomenon was observed by M. Tresca during the forging of these bars, and was communicated by him to the Académie des Sciences at their *séance* of July 9. At the moment when the hammer struck the bar, lines of light were seen to pass downwards from the edges of the hammer, and to cross each in the form of an X on each of the side surfaces of the bar. These lines continued afterwards distinctly visible in a certain light, appearing like slightly burnished marks.

The next operation was to prepare the bars for drawing into the X form, by cutting longitudinal grooves along the middle of each of the four sides of the bars by means of a planing machine. A further object of cutting these grooves was to ascertain if there were any flaws on the surface of the metal so exposed, as it was found absolutely necessary to remove any such flaws, else they would remain as blemishes on the surfaces of the bars when drawn.

The eight bars were next submitted by M. Gueldry, at the Audincourt foundry, to successive operations of drawing out and annealing, until they were accurately reduced to the X form of the Tresca section, when each was extended to a length sufficient to make three or four metre bars. The first of the grooved bars was passed through the dies no less than 220 times, and was as often subjected to annealing. It was afterwards ascertained that the rigidity of the drawn bars was but little affected by the process of annealing, their co-efficients of elasticity being found as follows:—

Before annealing	21·2085
After annealing	21·0073

Their co-efficient of expansion was also found to be but very slightly changed, and in the opposite direction, viz.—

	Co-efficient of expansion for 1° C. at mean t. 40° C.	Variation for mean t. 1° C.
Before annealing	0·00000880,2	0,84
After annealing	881,9	0,86

When divided into finished bars of the X section, 1·02 m. in length, each bar is made perfectly straight by special arrangements contrived for this purpose. Four straight edges of steel are made exactly to fit into the grooves of the X bar, and to form, when so fitted, a rectangular bar two centimetres square in section. This squared bar is then enclosed between the plane surfaces of four solid rectangular iron bars; and all being tightly compressed with iron clamps in the form of hollow squares and with iron wedges, the whole is heated in a furnace till red hot, when the clamps are further tightened and the mass of metal is left to cool. By this operation, each of the X metre bars is made perfectly straight. Up to the present time bars of the X section have been made sufficient for more than thirty metres.

The polishing of the surface of the X bars next follows. This is effected by the use of polishing powder and powdered charcoal. Particular attention is given to the polishing and subsequent burnishing of that portion of the surface of the metal on which the defining lines are to be cut. Several experiments which have been made tend to show that the best surface for cutting the lines will be obtained by the final operation of slightly impressing a stamp of highly polished steel, of the dimensions of 3 mm. by 2 mm. By this means an identical surface for receiving the defining lines may be given to every one of the new metres.

The apparatus for cutting the lines is connected with the new longitudinal comparing apparatus, carrying a microscope with its micrometer. The microscope is 0·8 m. in length and magnifies more than 200 times; and the whole apparatus is placed in the cold chamber, which has been constructed at the Conservatoire des Arts et Métiers, and can be maintained constant at the normal temperature of 0° C. The polishing of the bars, as well as the cutting of the defining lines, the position of which must necessarily be the result of the most precise comparisons with the primary standard metre, are both entrusted to M. Tresca and his son, M. Gustave Tresca.

The lines are to be cut with a diamond point. Each transverse defining line will be crossed at right angles by two longitudinal lines 0·1 mm. apart, and the portion of the transverse line so intercepted between the two lines will define the length of the metre. The width of these lines will probably be about 0·002, or at most 0·003 mm., or 3 microns (μ). This will be about one-fourth of the thickness of the defining lines of our standard yards, which are cut with a steel knife upon the polished surface of a gold stud, and are viewed through microscopes magnifying about sixty times.

Great progress has been made in the construction of the series of new thermometers, two of which are to accompany each international standard metre. These thermometers are being constructed by M. Baudin. Their length is 0·45 m., and their external diameter 5 mm. The bulbs have the same external diameter, and the two thermometers can thus be placed in the groove of the X metre bar for determining the temperature of its measuring axis during comparisons under the microscopes. The scale of the thermometers ranges from -5 to $+50°$ C., and each degree is subdivided into tenths. Every 1° corresponds with a length of about 7 mm. Four standard thermometers have been constructed for the purpose of verifying the new metre thermometers. They have an arbitrary scale from 0° to 100° C., graduated in half-millimetres by hydrofluoric acid on the glass tubes, and the value of the several graduations has been accurately determined by calibration. The length of these standard thermometers somewhat exceeds 0·50 m.

The construction of the new international kilogrammes and of the standard *mètres-à-bouts* will be deferred until the completion of the number of *mètres-à-traits* required. Meanwhile, several balances of the greatest precision have been obtained for the weighings, some of which are fitted with mirrors for observing the extent of the oscillations through a telescope by means of a vertical graduated scale fixed to the telescope and reflected in the mirror, according to the principle adopted by Gauss for observing variations of the magnetic needle.

For ascertaining the atmospheric pressure during the weighings, the standard barometer of the Conservatoire des Arts et Métiers, constructed by Fastre, is proposed to be used, by which the height of the mercury can be read to 0·01 mm. An ingenious apparatus has been constructed by M. Mendeleef, which shows the slightest variation of pressure during the process of weighing, by means of a small U-tube containing oil of petroleum. One end of this tube is closed and contains a certain volume of dry air maintained at a constant temperature, whilst the other end is open to the air. The instrument being accurately adjusted by means of a mercurial plunger connected with the bottom of the U-tube, so that the petroleum is exactly on a level on the two branches of the tube, it is found to be so extremely sensible that the slightest variation of atmospheric pressure is shown by an alteration of the level, and the amount of this alteration can be measured with the greatest precision.

It is expected that the whole series of new *mètres-à-traits* will be completed by the French Section and ready to be handed over to the Comité Permanent by October 1875, and that the construction of the new kilogrammes and *mètres-à-bouts* will also be far advanced by that date.

During their late meeting, the question of the convocation of a Diplomatic Conference at Paris with the view of providing the requisite means for enabling the committee to execute all the definite comparisons of the new metric standards, and for securing the due preservation of the new international metric prototypes and regulating their use for future comparisons, was further considered by the Committee. In pursuance of their resolution of last year upon this subject, the requisite communications were made by the French Government to the Governments of the several countries interested, and the Committee have now passed a resolution that considering the numbers of Governments who have agreed to take part in such conference, the French Government be requested to convoke it with as little delay as possible. Information has been received of the willingness of the French Government to accede to the request, and the Conference will probably be held in the spring of next year. H. W. CHISHOLM

NOTES

IT is with the greatest pleasure and with something like a sense of relief that we are able at last to announce definitely that at a Cabinet Council held last Saturday it was decided that there should be an Arctic Expedition, at the expense of Government, to sail next spring. The welcome intelligence was thus announced by Mr. Disraeli to Sir Henry Rawlinson:—"Her Majesty's Government have had under consideration the representations made by you on behalf of the Council of the Royal Geographical Society, the Council of the Royal Society, the British Association, and other eminent scientific bodies, in favour of a renewed expedition, under conduct of Government, to explore the region of the North Pole, and I have the honour to inform you that, having carefully weighed the reasons set forth in support of such an expedition, the scientific advantages to be derived from it, its chances of success, as well as the importance of encouraging that spirit of maritime enterprise which has ever distinguished the English people, her Majesty's Government have determined to lose no time in organising a suitable expedition for the purposes in view." Steps have, we believe, been already taken to carry into effect this resolution, which reflects so much credit on her Majesty's Government. Admiral M'Clintock left for Dundee on Tuesday with an engineer and shipwright, to buy two steam whalers, which will be fitted out under the tried explorer's superintendence at Portsmouth. Capt. A. H. Markham, who went to Baffin's Bay last year, will probably occupy an important post in the expedition, the route of which will, of course, be Smith's Sound. Now that the thing has been decided on, there is no doubt that it will be thoroughly well done; and now that Englishmen have once more got the chance, we may expect something like real work, if, indeed, they do not take the last step in the solution of the Arctic mystery.

WE take the following from the *Times*:—The medals in the gift of the Royal Society for the present year have been awarded by the Council as follows, and will be presented at the anniversary meeting on the 30th inst.:—The Copley Medal to Prof. Louis Pasteur, of the Academy of Science, Paris, For. Mem. R. S., for his researches on Fermentation and on Pebrine. The Rumford Medal to Mr. J. Norman Lockyer, F.R.S., for his spectroscopic researches on the sun and on the chemical elements. A Royal Medal to Prof. William Crawford Williamson, F.R.S., of Owens College, Manchester, for his contributions to zoology and palæontology, and especially for his investigations into the structure of the fossil plants of the coal-measures; and a Royal Medal to Mr. Henry Clifton Sorby, F.R.S., for his