months when the temperature was high. One of them occurred on the Lancashire and Yorkshire Railway in the summer of last year when the temperature was 50° to 60° above freezing. I could enumerate others in which the winter frosts had nothing to do with the fractures which ensued."

After referring to some other experiments, Sir W. Fairbairn proceeded: "The danger arising from broken tires does not, according to my opinion, arise so much from changes of temperature *as from the practice of heating them to a dull red heat, and shrinking them on to the rim of the wheels*. This, I believe, is the general practice, and the unequal, and in some cases, the severe strains to which they are subject, has a direct tendency to break the tires. To show how easily this may be effected, let us suppose that a tire, two feet six inches or three feet diameter, is shrunk on to a wheel one-tenth of an inch larger than the tire, it then follows that the tire in cooling must be elongated to that extent, with a strain equivalent to the force of the shrinkage, and calculated to produce that amount of molecular disturbance. It may be more or it may be less, but supposing the strain to be one-half or three-fourths of that which would break the tire, it then follows that the constant action of its irregular motion on the rails must ultimately lead to fracture.* I am not surprised that this should be the case, as most, if not the whole, of railway tires, excepting those on engines and tenders, are not turned, but selected by hand, heated and shrunk upon the wheels with every degree of tension, as suits the convenience of the workman. So long as this process is pursued the public will be exposed to the risk of broken tires. What is required in this description of manufacture is, that the rim of the wheel and the inside of the tire should be *turned to a standard gauge*, accurately calculated to give the required amount of tightness with a larger margin of strength, and this done we should attain greatly increased security to the public, and a great saving in wear and tear—to say nothing of the large sums expended by companies in the shape of compensation for injuries and loss of life."

Here, then, is another potential triumph for more scientific accuracy and more hope for travellers.

SCIENTIFIC SERIALS

Poggendorff's Annalen der Physik und Chemie, 1870, *No.* 9.—The contents of this number are:—(1.) "Calorimetric Researches," by R. Bunsen. In the first part of this paper Prof. Bunsen describes the construction and method of using a new calorimeter, in which quantities of heat are measured by the amount of ice at 0° which they are capable of converting into water at the same temperature. The quantity of ice melted is in its turn indicated by the resulting diminution of volume, as shown by the movement of a mercury-column in a graduated capillary tube communicating with the vessel in which the ice is contained. In order to convert the results obtained by this method into absolute heat-units, it is necessary, either that the motion of the mercury-column produced by a known quantity of heat should be ascertained, or that the specific gravity of ice at 0° and its latent heat of fusion should be known. The first of these quantities was found by observing the effect produced by a given weight of boiling water, and the second by a process which may be described as consisting in the application of the principle of the weight-thermometer to measure the change of volume which water undergoes on freezing. From these data the third of the quantities mentioned, or the latent heat of fusion of ice, is readily calculated. Of the numerical results, given in the paper, we will quote only the following:—

Specific gravity of ice at 0° C	0·91674
Latent heat of fusion of ice	80·025
Specific heat of indium	0·0570
Specific heat of calcium	0·1704

* From long-continued action under strain, it has been proved that it is only a question of time when rupture takes place, as repeated increased and diminished changes with the same load ultimately leads to fracture.

One special advantage of this method of calorimetry is that it allows good results to be obtained with very small quantities of material; for instance, for specific heat determinations, from 0·3 gramme to, at the most, 4 grammes is sufficient. (2.) "On the relations between the crystalline form and chemical constitution of some organic compounds," by P. Groth. (3.) "Experimental and theoretical investigation of the figures of Equilibrium of a liquid mass without weight" (Eighth series), by J. Plateau. A translation of this paper, which relates to the conditions of the ready production and of the persistency of liquid films, to the superficial tension of liquids, and to their superficial viscosity, was printed in the *Philosophical Magazine* vol. xxxviii. p. 445 [1869.] (4.) "On the Absorption of Light," by Paul Glan. Among other results, the author finds that the absorbing power of a substance, when it is employed in solutions of different degrees of concentration, increases in a greater ratio than the concentration; also, that the absorbing power of a body in solution is affected by the nature of the medium in which it is dissolved. The experimental results are followed by a mathematical discussion of the mechanism of the absorption of light. (5.) "Additional researches into the behaviour of Vapours in relation to the Laws of Mariotte and Gay-Lussac," by Dr. Hermann Herwig. This paper has reference to an earlier one published in vol. cxxxvii. of *Poggendorff's Annalen*. The author finds that, when the pressure upon a vapour at a given temperature is diminished so far that the vapour obeys Mariotte's law, that is to say, so far that the product of the pressure into the corresponding volume becomes constant, this product bears to the similar product, when the pressure is great enough to cause the vapour to be saturated at the same temperature, a constant ratio which is proportional to the square root of the absolute temperature. In the present paper it is shown that ethylic bromide and carbonic sulphide conform to this law. (6.) "Some analogous Theorems in Photometry and in the Laws of Attraction," by Wilhelm von Bezold. The mathematical law of the inverse square of the distance applying equally to the illumination produced by a luminous point, and to the force exerted by an attracting particle, it follows that the mathematical expressions by which photometrical relations are expressed, will also admit of an interpretation in relation to the action of attracting particles. In this paper the double interpretation of the same formula is pointed out in several important cases. For example:—The author shows that the photometrical analogue of an equipotential surface drawn about several attracting particles, is a surface so placed, relatively to luminous points, whose luminosity is proportional to the masses of the particles, that the illumination of each element of the surface is greater than that of any other element passing through the same point. (7.) "On the Luminosity of Phosphorus," by W. Müller. The author finds that phosphorus vapour is not luminous in the absence of free oxygen; that it is not luminous at ordinary atmospheric temperatures when in contact with pure oxygen of atmospheric pressure, but that it becomes luminous, and at the same time absorbs oxygen, when the pressure is diminished to a certain amount, depending on the temperature, the necessary reduction of pressure being greater when the temperature is lower; and that phosphorus which has been for some time in contact with certain vapours, (notably hydrocarbons), is deprived by them of the property of becoming luminous on the admission of air, although air, mixed with the same vapours, is not thereby deprived of the power of exciting (temporary) luminosity in phosphorus. (8.) "On the Superoxides that can be prepared by Electrolysis," by W. Wernicke. (9.) "On a mechanical theorem applicable to Heat," by R. Clausius. (10) "On the Spectra of negative Electrodes, and of long-used Geissler'sTubes," by Prof. Edm. Reitlinger and Prof. Moriz Kuhn. (11.) "On the Meissner Lignite modified by contact with Basalt," by Dr. A. von Lasaulx. (12.) "On the analysis of Silicates," by E. Ludwig. Refers chiefly to the precautions required for the accurate separation of silica and alumina. (13.) "On the absorption-spectrum of liquid peroxide of Nitrogen," by August Kundt. On comparing the absorption-spectra of liquid and gaseous peroxide of nitrogen, the author found that the ill-defined black bands in the spectrum of the former coincided in position with strongly-marked groups of lines in the spectrum of the latter. (14.) "On the work done by Gases in Motion, or remarks on the paper so entitled," by Dr. A. Kurz. This is a reply to a criticism by Dr. Boltzman (noticed in NATURE, vol. ii. p. 364) of a previous paper by the author.

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