TayloVsand Arsberger's Experiments on High-Pressure Steam.

|  |  |  |
| --- | --- | --- |
| Temperature | Taylor. | Arsberger. |
| 212° | 30∙0 | " |
| 220 | 34∙9 | ***"*** |
| 230 | 41∙5 | " |
| 232 |  | 44∙4 |
| 240 | 500 |  |
| 249 | " | 59∙1 |
| 250 | 59∙1 | " |
| 260 | 70∙1 |  |
| 270 | 82∙5 | " |
| 274 | J, | 88∙9 |
| 280 | 97\*7 | " |
| 290 | 114∙5 | " |
| 293∙4 | 1204 | ***"*** |
| 300 | 1337 | " |
| 320 | 1794 | ***99*** |
| 322 | " | 1760 |
| 372 | " | 3250 |
| 432 |  | 620∙0 |

32. We now come to the most imposing series of experiments hitherto conducted. In 1823, the government of France having resolved to legislate on the means for obtaining security in the use of steam-engines, consulted the Academy of Sciences, upon the mode of most effectually promoting the public safety, without placing useless restraints on commercial enterprise and manufacturing industry. The examination into the state of knowledge concerning the phenomena of vapour at elevated temperatures, which resulted from this application, having brought the imperfections of this part of science prominently into notice, the Academy were induced to undertake a long and laborious enquiry, not entirely free from personal danger, into the law connecting temperature with the pressure of steam. The commission consisted of the illustrious mem bent of the Academy, Baron de Prony, Arago, Girard, and Dulong ; and the results of their investigation, finish ed in 1829, are given in the tenth volume of the Memoirs of the Academy of Sciences, printed in 1831. These experiments, conducted principally by the MM. Arago and

Dulong, were on a scale of magnitude and expense suited to the munificence of the French government and the re­

sources of the Academy. The precautions adopted to ensure minute accuracy, entitle them to confidence, no less than the names of two philosophers, so well versed in experiments of a similar nature. They were carried as high as to the twenty-fourth atmosphere of pressure.

The experiments were made in one of the courts of the Observatory. Fig. 18 represents a section of the principal portions of the apparatus. The boiler *a* consists of a cylindrical body, having its axis vertical ; the two ends forming top and bottom are spherical segments, strongly riveted to the body, the whole being made of the finest plate iron. The material of the cylindrical part is half an inch thick, the top and bottom being considerably thicker. The aperture at the top, six inches in diameter, was closed by a plate of wrought iron, an inch and three-quarters thick, overlapping the hole, about two inches all round, and having on its lower surface a projecting ring, adapting it to a groove on the upper side of the top of the boiler : between these two surfaces was interposed a thick ring of lead, and the cover was then strongly screwed down by six steel bolts, the nuts of which had head-washers, so that, on screwing the whole together, the cover became hermetically closed. This experimental boiler was built in a furnace of considerable size and mass, intended to produce a temperature of the requisite constancy ; *x x* are bars upon which the fire rests ; *y* is the flue leading to the chimney.

The other parts of the apparatus connected with the boiler are *b* A, a lever, safety-valve, and weights ; *y y* (fig. 19) the thermometer scales; and *w w* reservoirs of cold water, for maintaining uniform temperatures on the vertical parts of the instruments.

During the process of proving the boiler by a hydraulic pump, the common safety-valve, when used as an instrument for measuring with precision the pressure of the fluid in the boiler, was observed to give very erroneous indications, and the necessity of a more delicate apparatus was demonstrated. The improved index of pressure, made use of in the experiments, is shown in fig. 18. For measuring the great pressures to be used, a tube of mercury, 80 feet high, would have been requisite ; but there was used, as a substitute for it, a glass tube *z z,* closed at the upper end, filled with dry atmospheric air, and having a length of only five feet seven inches, and an internal diameter of 1/5 of an inch, and of a thickness nearly equal to its diameter. It was so arranged as to furnish a convenient manometer, capable of giving the same indications, by the contraction of the contained air, as would have been given in similar circumstances, by a column of mercury of the height due to the diminished volume of the air. The graduation of this manometer, however, presented new difficulties.

These difficulties were successfully encountered by the skill and ardour of the academicians. Every one knows that it is impossible to obtain a glass tube of considerable length and magnitude which shall have a tolerably cylindrical interior ; and that there are a number of practical