

when the boiler is under steam and the engine at rest, as at any other time.

It is almost impossible to trace any connection between the withdrawal of a portion of steam from a boiler and the consequent explosion of the latter. Could it be proved that the gauge either rose or fell perceptibly, the case might be different; but the hand seldom moves instantaneously at least. The only remarkable phenomenon is, the sudden rise in the water in the glass gauge; and this rise, from its character, would seem to denote a dilation of the whole body of fluid, not a mere foaming or priming, for the gauge shows a rise of "solid water" invariably, and not foam, when the boiler is properly full. It is not likely that either of these explosions will be found to present any unusual phenomena; but the lesson which this conveys is not the less instructive. Inspection, and careful inspection alone, can secure safety; and the sooner steam-engine proprietors become convinced of the truth of this proposition, the better for the entire community." *

The *London Engineer* says: "Nearly all of the large number of boiler explosions, the causes of which are annually investigated by the engineers of the Manchester and Midland boiler associations, are clearly found to have occurred in consequence of either internal or external corrosion. In the case of locomotives—and they are now exploding sufficiently often to cause considerable anxiety—furring along a seam of rivets, or rather under the line of an overlap, is found to be the malady. In many boilers, especially on those lines where the hydraulic test is regularly applied, 'furrows' are discovered in time to prevent an explosion."

From the *American Artizan*:—"It is now generally understood that nearly every explosion of a steam boiler is the result of its own weakness. This may be owing either to originally defective material or construction, or to its original strength having been impaired by, or overheating of some of its parts; but the most prolific of all causes of explosion is corrosion. The best preventives are, therefore, a thorough examination and test of the boiler when new, a frequent and thorough periodical inspection after it has been in operation, and a searching investigation into and published report on the cause of every explosion which occurs."

Steam-Boiler Assurance Company.

From the *London Engineer*:—"In the report of this association for 1864, we find the following information:

The total number of inspections, 23,849. Principal defects: fracture of plates and angle iron, 484; corrosion, 861; safety-valves out of order or overloaded, 507; pressure gauges out of order, 297; water gauges out of order, 364. Explosions, 43; and the number of deaths from explosions, 74. Iron works, mines and foundries furnishing the greatest proportion. Not a single explosion in a cotton mill is reported for 1864.

For 1865, the number of explosions is equal to the whole of those recorded for the three preceding years."

* We have seen a boiler give way without an explosion. The wasted portion in the bottom gave out, and the water ran gushing into the ash-hole.

The Midland Boiler Assurance Association.

"This association now has 1,839 boilers under either inspection or assurance, a rather larger number being under assurance than inspection. The association has been four years in existence, and it is only this year that Mr. E. B. Martin, the chief engineer, has had to report the explosion of a boiler under assurance. Even in this case the inspector had previously pointed out the defective condition of the boiler. No less than 7,172 inspections were made last year (1865), including 390 internal examinations, and 340 examinations of the interior of the flues. Mr. Martin has the care of some of the most dangerous boilers in the kingdom, judging from ordinary experience: 604 are in collieries, and 1,027 in iron works, and of the whole number no less than 1,495 are fired externally. The fact that among all this vast number of boilers not one life has been lost in four years, and that but one explosion has taken place, and that of a boiler of which the defects had already been pointed out, argues well for the care and diligence with which the inspection is carried out. It is also satisfactory to know that the association is paying regular dividends of ten per cent. per annum to its shareholders."

From the *Scientific American*:—"Not many months ago a law was passed, requiring all persons in charge of steam-boilers to have a certificate of competency from commissioners appointed to decide upon their fitness for their situations. In most instances, probably, this law has been complied with; in some others it has been wholly disregarded; in precisely how many, we have no means of ascertaining. Accident, however, has revealed one case at least where the person employed as engineer had no legal proof of his capacity, and, as the issue has proved, no mechanical fitness either: he blew himself up, with half-a-dozen others.

We shall not make unfounded charges, or be entangled in any assertion which we cannot prove; and we say that although this is the only case that we know of as being directly contrary to the provisions of the law for such cases made and provided, we can refer to countless instances where men have received testimonials of efficiency for engineering qualities which they did not possess: the five dollars of their employer bought them a character at second hand. Now, such a state of things may or may not be all right; it depends solely on the light in which they are scrutinized.

Engineering is a profession; it is not a trade, strictly speaking. It is not comprised in opening and shutting valves, or in scientific flirts with an oil-can, or in impertinence and vulgarity in demeanor when asked a civil question by an 'outsider.' It requires the closest attention, and both mental and physical labour, in order that the best possible results may be obtained. Whoever does less than to devote all his energies to his profession, robs his employer and cheats the world of science of discoveries which he might have made had he used the faculties nature gave him. Admitting engineering to be a science, and not a handicraft, we must then look for a high class of men to fill the situations—posts of honor and trust—which it opens out to the trade at large. No calling can be more productive of good results in respect to mental training, than the one under discussion.