

STRENGTH OF CISTERNS AND TIE-RODS.

WEBB v. TOWNS—ARBITRATION.

THE facts of this case are shortly these:—The plaintiff, Mr. Webb, is an extensive malt distiller, carrying on business at West Ham, Essex, and employed the defendant, Mr. Towns, a back-maker, to construct for him a number of wash-backs or cisterns of very large dimensions, constructed to contain the wort or wash similar to the fermenting tuns at breweries. The plaintiff undertook to provide the iron tie-rods ready for fixing: the defendant was to fix the rods so provided, and provide and fix the timber work. One of these wash-backs (No. 8) suddenly burst in March, 1851, on which occasion the wash, valued at about 300l. was lost, and damage to the amount of 341l. 15s. 8d. was alleged to be done to the premises and plant by the accident. The inside dimensions of the back were:—length, 30 feet; breadth, 20 feet; depth, 13 feet; contents, 48,000 gallons=1,329 barrels=216 tons weight of fluid; and constructed of Denton fir, 3-in. sides, 2-in. bottom, spiked to sides, braced horizontally with three tiers of 1½-in. tie-rods, longitudinal and transverse, hooked together in the middle, with fir cleats and tie-planks; in addition to which were iron bolts passing vertically through the entire thickness of the sides, besides dog-bolts at angles.

The plaintiff's witnesses, consisting of Messrs. Curtis, the builders, and men in their employ, gave evidence that the ties were improperly placed in the back, as regards heights or distances from the bottom; that the rods, 1½ common English iron, hooked together in the manner as ordered by plaintiff, were tested by hydraulic pressure to the extent of 25 tons, without breaking. Mr. Deely, engineer, gave evidence that the tie-rods were improperly placed, and on some other points of construction. Mr. John Braithwaite, civil engineer, gave evidence to the like effect, that the iron tie-rods were sufficient for the purpose; calculated the pressure that possibly could be on the bolts or tie-rods, and found it less than one-half what the bolts ought to stand; was convinced the cause was not the bursting of the bolts, but that this was the consequence; found the back slightly put together; the tie rods were too far from the bottom, throwing too much pressure on the wood-work of the bottom, the dog-bolts too slight. He concluded that the back gave way in the first instance at the bottom, giving motion to the fluid within, and, according to the degree in which it gave way, would increase the pressure probably from 10 tons up to 40 or 50 tons, depending on the velocity of the fluid, and in his opinion was the cause of the accident. The weight on the tie-bolts could not have broken them, even to 20 tons; the breaking strength of the iron was nearer 30 than 20 tons: did not object to the tie-bolts being hooked.

Calculated pressure on side upper tier of bolts—

4 at 3½	tons each	13 tons.
4	6½	26
4	9½	39

Total tons 78

For the defendant.—His workmen and fellow-tradesmen gave evidence that the materials and workmanship were good, and the backs were constructed in the ordinary and common way—excepting as regarded the method of connecting the tie-rods together in the middle, which by the special direction and interference of plaintiff, were hooked together, instead of being connected by eye-bolts—and they likewise spoke to the bad quality of the iron (common English), which, in turning to form the hook, broke several times.

Mr. Charles Humphreys, surveyor, gave evidence.—The back was constructed in the customary way; that after the accident the side was bulged and convex on the outside, the cleats broken outwardly; that the point of the greatest convexity was in the lowest tier of tie-rods, and that the rupture of the side tore away the bottom, and that the cause of the accident was insufficiency of the tie-rods both as regards the quality of material and the method of connection, by means of hooks; that all iron loses 75 per cent. of its strength by being hooked (as shown in a series of experiments instituted especially for the purposes of this trial, by Mr. Heather, M.A. of the Royal Military Schools, with the proving machine, at the dockyard, Woolwich); that by calculation the pressure on the entire side of the vat was 70 tons; and, deducting for the duty done by the bottom and sides, there would be a pressure of 6 tons on each tie-rod, supposing it possible to insulate each rod, but the side being made rigid, it was not possible so to do; that the

tie-rods were equal to a strain of 2 tons only, and broke with 6½, as shown by experiment: that after the bursting, the pressure of the fluid on the back would rapidly diminish, and would not increase.

Mr. Heather, M.A. of the Royal Military Academy, Woolwich, by a working model proved that, if any fluid issues from an aperture in the side of a vessel, the pressure on that side is diminished, being consumed in the motion of the fluid; that the principle of hooking ties together is essentially bad, in consequence of the cross strain on the fibres of the iron, to the amount of 75 per cent. on all iron; and that the accident occurred in consequence of the insufficiency of the iron tie-rods, as regards quality and construction.

Mr. Davidson, civil engineer, gave evidence in confirmation of the above.

The inquiry lasted nine days, and the arbitrator gave his award for the defendant.

The points of this case are especially interesting as regards the common method of hooking ties together, thereby causing a loss of strength, and the wide discrepancy between the experiments performed at Woolwich Dockyard and by the ordinary testing machines of foundries.

These experiments we will give hereafter.

WORDS TO WORKMEN.*

CHATEAUBRIAND, the eminent French writer, states, in his "Posthumous Memoirs," that when at the age of seventeen, his strength and youthful buoyancy were such, that on rising from bed on early mornings, he, only half-dressed, ran headlong across field and forest, as in ecstasy and surfeit of physical power. Goethe and Klopstock were both great poets and skaters, and Christopher Wren and Titian lived to the age of ninety-two. If the phrase "a great man" is both materially and morally used in all ancient and modern languages, we may, for our present purpose, modulate it into "a healthy man—a happy man." Health and strength may appear, to many, things accidental and fortuitous; but in reality they are not. If we were to search into the life and behaviour of the healthy and strong, the sickly and the weak, we should find that the former has, in a thousand instances, acted judiciously and prudently, while the latter has done the contrary. A state of health and power always implies self-government, while the sickly and weak has been a slave to some or other tyrannical power, outward or inward. Medical statistics are deficient on that score, but the inspection of any work or poor house will convince every one that they are not the abode of corporeal beauty (?), strength, and health, but rather those of ugliness, weakness, and sickness. This gloomy calculation may be even extended to prisons, and thus one of the axioms of our modern times, that "ignorance, disease, poverty, and crime go hand in hand," becomes thoroughly evident and obvious.

The situation of working men in the northern parts of Europe is one especially unpropitious in that respect. Tired, in body and mind, by some more or less severe work, they think that they have to relax, amuse, and recreate themselves. But, strange to say, from any one occupation, employing only more or less of their muscular system, they pass to that which puts them into perfect quiet, and often exchange, to add bad to worse, the confined or even unwholesome existence in the workshop or factory, for that of the taproom or other localities of sedentation (*Sitz-Lokale*). In old Athens and Rome this never was the case: it could not be. The beauty and warmth of sun and nature drove the workmen out of the confines of thronged thoroughfares to the Piræus, the Forum, and the Seven Hills, where they found the palestra, the quoit, &c. And thus, that truly great word of one of our greatest social writers (*Michel Chevalier*) is thoroughly confirmed, that "the social life for the working men of modern Europe is yet to be sought for and created."

The rail and steamboat will do a little that way, but not far enough, until Governments and the wealthy will be forced towards the enacting of a complete code of popular amuse-

ments and gymnastics. But it will finally be the expenses of the hospitals and burials which will arouse men into action! At Paris, for some years past, every tenth person of the whole population dies in the hospital; and in Vienna, the very largest building, with its 3,000 windows, also is an hospital. After tons of paper will have been written on the subject, we will begin to understand, that it is better to spend two francs on public recreation than three on hospitals and coffins!

But the conscientious writer has not to await the completion of such tardy events: he has to anticipate and suggest more or less immediate remedy. And if Goethe says, that "to be wise means to be wise before others," we have, in this instance, to impart this quality to our readers,—at least, in general; because who can direct, where ways and means and other circumstances are so different? If we lead the young towards even merely knowing the value of health and strength, we have done our part. If any healthy person consider himself unhappy, it is, surely, a blameable self-decision. With our speedy communications all over the world, our world-enterprise, who of such requires now to pine or want? With the least amount of skill or schooling he may start life, begin the world anew in a hundred different places, in a hundred different ways. A pair of sturdy hands are, in some way or other, a draught at sight, negotiable throughout the world. Such, then, may in surety and contentment await those sanitary and senatorial enactments, which, *albeit* of the utmost urgency, rulers will enact or not, as chance may ordain. The strong, being self-governed, depends on none but himself: to the strong belongs the world—on the throne, or in the workshop.

TRACTION OF CARRIAGES UPON ROADS AND RAILWAYS.

IT matters not whether on roads or railways, by horse or steam-power, carriages, as all other machines for parallel purposes, must work with the greatest steadiness. In road carriages this necessity is duly regarded in the provision of lateral restraint, which insures safety, speed, and economy in their working.

Railways present an admirable framework of parallel bearings exclusively for carriages working with lateral steadiness; but this theory is disregarded, and an adverse system of expediency is tolerated. I cannot presume on space necessary to go through all the details of this expediency system, and, therefore, beg leave to submit one weighty comparison between road and railway results in the present practice. A road carriage of about one ton weight is of sufficient strength to carry more than double its own weight over rough roads and street pavements, with lateral steadiness and safety at any rate of speed it is capable of. A railway passenger-carriage of the narrow gauge (which on the average may not carry a greater amount of loading) will weigh about four tons; and such ponderous weights are necessary, not on account of the loading, of course, but for keeping the carriages from bounding off the rails, which, having lateral liberty, they would do if they were only of the fair proportionate weight of road carriages. So that in a moderate train of ten or twelve carriages this superfluous ballasting weight might amount to upwards of thirty tons, to enable an adverse working system to keep upon the rails at any high rates of speed; and what would he fifty or sixty miles an hour to boast of with steam power if the mechanical arrangements could guarantee safety? And when the danger of a collision might require a train to be stopped in the shortest possible distance, such superfluous weight must be a great impediment, and has caused many a serious collision, which might have been avoided by more ready control over lighter carriages.

The subject might find more scientific means from the ingenuity of others, than the plain arrangements which I have provided and presume to think so well of; and as steady traction is theoretically so indispensable, there cannot be a more legitimate experiment to any party. Lateral restraint superseding lateral oscillation, would insure certain and very great advantages.

* Translated from the German.