THE

Scientific American.

MUNN & COMPANY, Editors & Proprietors.

PUBLISHED WEEKLY AT

NO. 37 PARK ROW (PARK BUILDING), NEW YORK.

O. D. MUNN, S. H. WALES, A. E. BEACH.

☞ Messrs. Sampson Low, Son & Co., Booksellers, 47 Ludgate Hill, London, England, are the Agents to receive European subscriptions or advertisements for the SCIENTIFIC AMERICAN. Orders sent to them will be promptly attended to.

VOL. X. NO. 15..[NEW SERIES.].....*Twentieth Year.*

NEW YORK, SATURDAY, APRIL 9, 1864.

Contents:

(Illustrations are indicated by an Asterisk.)

FAULTY CONSTRUCTION OF STEAM BOILERS.

It is palpable to the close professional observer of the manner in which steam boilers are generally constructed, that there is not only great need of reform in the actual workmanship, but that a large proportion of the accidents arising from the use of steam can be traced directly to faulty construction. It is a truism that "the strength of any structure is exactly that of the weakest part;" but who can say where the weakest part of a steam boiler *is*, as they are ordinarily made? Take a simple cylinder boiler, for instance: the sheets are run through the rolls and bent to the proper radius; when the riveting gang get to work, they close up the rivets with great rapidity, but when the holes come out of line with each other, the drift pin is resorted to, and the sheets are literally stretched until the rivets can be inserted; when the drift pin is knocked out, the sheet goes back to its place, and there is already, without a pound of steam pressure, strain enough to cut the rivets off. Repeat this performance through twenty or thirty feet, the length of an ordinary cylinder boiler, and who can say where the weakest point of the structure is? Suppose such a boiler to be made of silk, for instance, or any flexible material, what shape would it be in? It would be full of puckers, folds, seams, and gathers, and represent most accurately the various trials to which that most abused of all modern engineering apparatuses—the boiler—is exposed.

The case is aggravated, not benefited, when we construct a square boiler, for this shape seems, by general consent, to have been adopted for marine service. When the angles or flanges of the sheets are not broken by the flange turners, they are cracked out by the drift pin of the riveting gang, and it ought to be made a capital offense to have such a tool on the premises of any boiler-works. New boilers burst under the most mysterious circumstances; old boilers are patched and then burst; and we are told gravely that "putting new cloth into old garments" is the solution of the trouble. On each occasion the Coroner examines a host of "experts," who proceed to declare that "the iron was burnt," "the water low," "the stays insufficient," "the water changed into explosive gases," &c.; but it never occurs to these worthies that the actual strength of the boilers was in many cases unknown, and that the boilers may have been at the bursting point for days, weeks, or months, until at length it gave way.

It may be argued against this view of the matter that, if hydrostatic pressure is applied, it makes no difference where the strain comes, for the boiler is, as we have admitted, just as strong as the weakest point. It must be borne in mind, however, that it is natural or only reasonable to infer, in theory at all events, that every square inch of the boiler sustains an equal strain; with faulty construction this is impossible, for there may be, as we have shown, almost a rending force without a pound of steam in the boiler. It is ridiculous to suppose that safety is secured by *neat-looking* rivet heads, handsomely calked seams, and extra heavy iron; the best materials and the finest workmanship in other respects are of no use so long as rivet-holes shut past each other so much that some rivets we once took from a boiler were offset nearly half their diameters. Holes will come out of truth with the utmost care, especially in such hap-hazard work as punching is generally made; and when they do so, the only safe way is to rivet all the true holes first, rim all the faulty ones to one size and then put rivets in that fit, just as a machinist turns bolts to fit true holes in a bed-plate or cylinder. This method is no doubt costly, and will never be adopted, but it has the merit of common sense if no other. There is a great deal of carelessness in caulking seams also; for when the chipper chamfers the edge of the plate, the lower side of his chisel bears on the sheet and leaves a furrow, not very deep, it is true, but sufficient to cut through the skin of the iron, which is the strongest part. Neither are the braces properly set, for some draw all one way while others don't draw or hold at all, and are perfectly loose; thus a portion do all the work, and the rest are idle, they impart no strength and are an element of weakness, for the engineer relies upon them when they are doing no good. We are confident that a great deal of attention can profitably be given to the mere workmanship of steam boilers; they are not tanks or receptacles for boiling water, but great magazines wherein a tremendous power is stored, the safe custody of which is of paramount importance to all in the vicinity.

WASTE.

There must be, of necessity, a per-centage of loss in all the material transactions of every day life, whether these be carried on in the workshop, the counting-room, the kitchen or the laboratory; but this inevitable waste can be so far reduced by good management that it amounts to but little in the course of the year. Recent observation has convinced us that the loss in large workshops must be considerable, for in a great majority of cases we have seen materials lying about under foot—bolts, nuts, washers, kicking around in the mud out in the yard, new work exposed to injury from the elements, tools misplaced, essential articles, or tools necessary to the perfection of certain parts of the work at great distances from each other, and an infinite number of abuses which, although small of themselves, when summed up, make a grand total lost at the end of the year. As the thirty-second part of an inch too little on one piece of a steam engine, a sixty-fourth on another, and as much on still another will result in great derangement of the functions of the machine, so infinitessimal waste, continually occurring, is the representative of hundreds of dollars for which there has been no return. No matter what the nature of the trade or manufacture, it is very certain that a material reduction of the expenses of every department can be made by careful attention to the minor matters, and these remarks are made with the hope that all interested will give them attention.

A NEW METHOD OF LOCOMOTION.

On the fifth of October, 1861, we published an illustration of the enlarged pipe, for the transmission of letters and parcels, which was then being laid down for experiment, in London. This tube is of cast-iron, flat at the bottom, and arched above, in the form of a railroad tunnel. It is 2 feet 6 inches wide and 2 feet 9 inches high, and is furnished with a pair of low rails, on which a light wrought-iron car runs through it. The car is propelled by the pressure of the atmosphere; the air being exhausted from before it by a powerful fan at the further end of the tube. A pressure of from 4 to 6 ounces to the inch is obtained, and this gives a speed of about thirty miles an hour. This tube was laid down from one of the railway stations to the Post-office—a distance of about a third of a mile—for the transmission of the mail bags, and has been constantly employed in this service for more than a year.

By the last number of the London *Engineer*, we see that the success of this exeriment has been so complete as to cause a vigorous effort to be made to apply it to the conveyance of passengers. The *Engineer* says that applications have been made to Parliament by two companies ready to invest their money, for authority to lay down pipes for the conveyance of passengers between different parts of the city, and that engineers are ready to risk their reputations on the success of the undertaking. The *Engineer* also remarks as follows:—

"If a mail truck can be, as it is, whisked at the rate of thirty miles an hour, through a 4½-feet pneumatic tube, it needs no great amount of proof to show that it could be made to run equally well through a tube twice the diameter, or four times the sectional area. Now the mail trucks of the Pneumatic Despatch Company have been working regularly and satisfactorily through their tubes for many months, and although this system of communication is unseen by the multitude it is as much an established fact as railways themselves. Many persons, too, have made the journey in these trucks through the tubes, and it is clear enough that the result would be the same were the trucks filled with mail bags or with human beings. There has been no interruption of the postal traffic in the pneumatic tubes, no collisions, explosions or accidents occasioned by running off the line. The air is being constantly changed, and, as those who have gone through the tubes at the highest speeds well know, the interior is pure and sweet. Yet there is an undefined dread of the pneumatic system, arising simply from the ignorance of those who know nothing of its working. A country correspondent of ours, some time ago, wrote that it was 'of course wholly out of the question to expect passengers to commit themselves to carriages in a pneumatic tube.' On the contrary, passengers will go, even from the motive of idle curiosity, wherever they are assured of safety and comfort, and it is demonstrable that both may be secured in a higher degree in a pneumatic tube than upon any railway in existence."

We published an estimate, some time since, that passengers might be conveyed by this method at a speed of 4 miles per minute, or 240 miles an hour; and the *Engineer* gave an estimate of 6 miles per minute. Most persons naturally shrink at first thought from the idea of being blown through a tube, and, therefore, the scheme is generally regarded as impracticable; but it seems to be moving forward with steady steps towards its accomplishment.

WATER AND STEAM COCKS.

The origin of the invention of these simple appliances is very obscure. As far back as the time of Humphrey Potter, the lazy boy who made the valves of the steam engine self-acting, we find mention of them; and, for aught we know to the contrary, there may be some covered up in the Pyramids of Egypt at this day. The essential principle of the appliance is the same as it always was; and there are few material alterations in the outward form and general construction. The practical work to be accomplished by a cock is to form an absolutely air-tight partition which can be converted into a free passage between certain pipes or parts of an engine. The mechanical difficulties which prevent the accomplishment of this object (for comparatively few cocks are really tight and in good working order) are want of proportion, lightness of important parts, the absence of proper fixtures to retain the plugs or keys of large cocks in their places, and defective workmanship in making the plug tight on its seat. There is comparatively little difficulty in making the plugs of lesser cocks (or "faucets," as they are termed when of a small size) tight; as the great thickness of metal, compared with the diameter of the plug, prevents springing of the casting when it is bored. As the diameter of the shell increases, the difficulty of making the cock tight is augmented, and we believe there are few or none made with keys over five inches in diameter of opening. The costly nature of the work, and the difficulties before mentioned, render larger sizes impracticable, and the globe valve is very generally used in

their place for all purposes ; in time the valve may supplant the cock altogether. When the shell of a cock is bored out in the lathe it is not round and can hardly be made so ; because, as the tool crosses the opening, it strikes on the opposite edge and springs; this also occurs in leaving the solid metal so that inaccuracy is inevitable, unless a great expenditure of time be made in running many light cuts through the work. The same observation is true of the key, the thin sides spring under the tool, so that when the plug is put in the shell there is always a great deal of work to be done in making the two fit. Not only this, but even when ground in tightly and put in its place the pressure on the key forces its thin sides in, or springs it enough to allow fluids to find the way past. And it is, therefore, for these reasons that the cock may be considered nearly an obsolete contrivance for the object it is intended to effect. The usual method of grinding in cock plugs is to have them first turned true as possible in the lathe and afterwards scrape and file the parts which bear the hardest, so that a uniform surface is obtained, powdered glass is then applied mixed with oil, which cuts the highest points down and makes the junction of the two perfect. Small faucets are usually tried with the mouth to ascertain if they are air-tight. This is done by simply placing the open side between the lips, exhausting the little air contained within by inhaling the breath and placing the tongue over the orifice before the faucet is taken out of the mouth. If air be admitted by opening the mouth and the faucet still adheres to the tongue it is tight. If it parts readily from the member alluded to, it is leaky. Larger faucets do not admit of this; they must be placed on end, and be tried with water.

CAPT. ERICSSON'S WROUGHT-IRON GUN.

At the works of C. H. Delamater, foot of 13th street, North River, are to be seen the several parts of one of Capt. Ericsson's wrought-iron guns, such as are to be used in arming the *Dictator* and *Puritan*. First is the massive core, forged from the best charcoal iron at Bridgewater, Mass. The diameter of the bore is 13 inches, and the walls of the core are 8 inches thick at the breech; the form being cylindrical about half way up the chase, whence there is a gentle taper to the muzzle.

In another part of the works is a pile of hoops for strengthening the gun at the breech. These are cut from iron plates three-eighths of an inch in thickness, and have a radial depth of 9 inches, giving a total thickness to the walls of 17 inches—4 inches greater than the caliber. The core is to be turned upon the outside, and the hoops are to be forced on by a hydraulic press. These thin hoops will be bounded at the breech and at the upper end of the reinforce on the chase by thick hoops several inches in axial length. The trunnions are forged upon a massive hoop which surrounds the thin hoops of the reinforce. The gun is not to be rifled, but will be used for spherical shot and shell. The solid shot will weigh 276 lbs., and the shell 216 lbs. The gun is expected to bear a regular service charge of at least 50 lbs.

Verification of Olive Oil.

A most interesting paper was recently read at the Society of Arts (London) by Charles Tomlinson, Esq., "On the Verification of Olive Oil by means of its Cohesion Figure." The author of this paper has introduced a new mode of detecting the adulteration of oils, more especially olive oil. It consists simply of depositing a drop of oil on the surface of perfectly clean water, in a chemically clean glass of four inches in diameter at the mouth. Every oil will in the course of half a minute expand, and if pure will, so to speak, write its own name on the water,—that is, it will assume a shape and color that a practical eye could easily detect whether it was pure or a mixture. Mr. Tomlinson stated that "When a drop of pure olive oil is placed on the surface of water, it spreads out slowly into a large disc with a raised edge. The cohesion of the oil soon begins to re-assert itself; the film retreats upon itself; the raised edge at first shows symptoms of the returning force of cohesion; a number of dots appear at the edge, like beads strung upon a thread, the spaces between the beads open, and the edge becomes deeply serrated; separate portions of the film gather themselves up simultaneously, leaving polygonal spaces, bounded by strings of beads or bosses, and filled with an exceedingly minute dew or spray, which requires a sharp eye to detect. All these changes occupy about 35 seconds."

Terrible Calamity at Sheffield.

At a little before midnight, on Friday last, one of those terrific disasters to which nearly all the great towns in the north of England are more or less exposed happened at Sheffield. The great reservoir of the Sheffield Water Company—a reservoir nearly 100 acres in extent, and which held more than a million cubic feet of water—suddenly burst its embankment and swept with the fury of another Deluge down the narrow gorge formed by the Loxley and Stannington hills into Sheffield itself. Almost before warning could be given, the volume of waters began rushing headlong down the valley, sweeping farms and houses, forges and factories, like chaff before it. Never, probably, before has an accident of the same kind occurred so ruinous in its wholesale destruction of property, so lamentably fatal in the loss of human life. Whatever the sudden and tremendous flood could reach it seems to have destroyed, and, calculating only by the number of houses swept away and the persons missing who were known to have been in them on that fatal night, there is every reason to fear that the lives sacrificed by this awful calamity will not be less than 200, if they do not unfortunately exceed even that number. Of the damage done to property it is impossible at this early date to form even a conjecture. The devastation in this respect is unparalleled. A large, populous, and thriving district has been almost obliterated from the earth, scarce more than traces of the houses and factories that once stood there now remaining. The Don, owing to late heavy rains, was unusually high, and the additional water thrown into it has laid hundreds of acres under water, and inflicted incalculable injury to the growing crops. Of the destructive character of the flood there were abundant evidences on every hand. Timber in large quantities, ped-posts, feather-beds, tables, clocks, and various kinds of household furniture passed down, and several carcasses of cattle also.

Large numbers of people have lined the river's banks all the day; but it is now evident that the greatest volume of water has passed by, and further damage here is not apprehended. The water is very thickly impregnated with mud—a proof that it must have swept with terrific violence over the land adjoining the river. Fish—pike in particular—have been left in large quantities on land from which the water has subsided.

Every additional inquiry made into the circumstances of this appalling calamity shows that it has been more disastrous than was at first anticipated. It is now estimated that the loss of life will exceed 250, and that the value of the property destroyed exceeds half a million. From Bradfield, where the reservoir burst, down the course of the rivers for twelve or fourteen miles the country is laid waste. The reservoir covered an area of seventy-six acres, and would hold 114,000,000 cubic feet of water. The embankment, which crossed the end of the valley, was an enormous erection, with an average height of eighty-five feet, and forty feet in thickness. It was three hundred yards long. Between Matlock and Hillsborough, a distance of four miles, the greatest loss of life has been caused. Within this tract, whole rows of houses have been swept entirely away, in three of which alone there were 25 lives lost. In the opposite row the whole of the inhabitants were drowned, and scarcely any of their bodies have been discovered. The flood seems to have swept off everything before it, from the confluence of the Loxley and the Revelin to the Don. Between Wardsend and Sheffield on the Don, the bodies were seen lying in the mills and the mud and ruins. There were fourteen in one place, ten in another, and thirteen in a third. At Neepsend 900 acres of gardens were devastated, and whole families were swept away. An official report just received states that one hundred and fifty-six dead bodies have been already recovered; seventy have been identified. Large numbers are not yet found. Bodies have been discovered as far down the river as Doncaster. Along the banks of the river, between that town and Sheffield, the scene of the inundation was visited by vast crowds on Sunday; the police and a strong military guard acted for the maintenance of order and the security of property. A movement for a general subscription was immediately commenced, and a meeting will be held to-morrow. The inhabitants of the submerged districts have lost everything, and an appeal for instant help will be made; hundreds have nothing left of their property but their night-dresses. The inquests were opened on Saturday night, and then adjourned for ten days. There were then ninety bodies in the workhouse, and the coroner said he had been informed there had been nearly 200 found. He referred to a statement, which is generally made and believed, that in consequence of the dangerous state of the reservoir, warning was sent to the inhabitants of the valley as far as Darnflask, and that only a few lives were lost there, but that the warning was not sent to the thickly peopled districts below.—*London Times, March* 15.

A Blacksmith Outwitted.

An English paper says that while the Danes were making their preparations for the defense of the Dannewerk, they found it advisable to cover the tops of the palisades with *cheveaux-de-frise*, and the work was just completed when they abandoned the position. In the innocence of his heart, the blacksmith who had taken the contract asked for an interview with Field Marshal Van Wrangel, and presented him with his little bill for the work done; imagining that the Prussians, as the present possessors of the Dannewerk, were responsible for all outstanding liabilities, and he was not a little disconcerted to hear the Field Marshal congratulate him on having accomplished his work so well, and expressed his hopes that he would soon receive payment—from the Danes.

The Armory at Trenton.

Some idea of the perfection to which the manufacture of Government arms has attained can be gathered from the annexed account of the Trenton armory, New Jersey:—The machinery cost about $300,000. There are requisite for each musket 15.83-100 pounds of iron, and 2.46-100 pounds of steel and 7 feet of black walnut. So rigid is the Government inspection, that should 1,000 muskets from all the armories in the United States be taken to pieces, and these parts thrown into a promiscuous pile, so that in selecting components to assemble a complete gun no two parts chosen will be from any one gun of the one thousand as they stood, yet they must come together without recourse to file or alteration, and make as perfect an arm as the model musket.

Is Flax Exhaustive?

It is believed by many that flax is an exhaustive crop, but it is to be doubted if it is more so than most of the small grains. All of them are so if the land is continually cropped and nothing returned to the soil. Experiments of Professor Johnson showed that flax is less exhausting than either wheat or oats, judging from the amount of phosphoric acid given by its ash. Dr. Hodges, of Belfast, Ireland, recommends the application of 48 lbs. muriate of potash, 16 lbs. soda ash, 54 lbs. bone dust, 56 lbs. sulphate magnesia, 34 lbs. gypsum, per acre, as a manure for flax land.

SPECIAL NOTICE.

A. S. Macomber, formerly of Bennington, Vt., and now of Hamilton, N. Y., has petitioned for the extension of a patent granted to him on Nov. 5, 1850, for an improvement in straw-cutters.

It is ordered that the said petition be heard at the Patent Office, Washington, on Monday, Oct. 17, 1864.

All persons interested are required to appear and show cause why said petition should not be granted. Persons opposing the extension are required to file their testimony in writing, at least twenty days before the day of hearing.

Lighthouse illumination produced by a magneto-electric apparatus has been in successful operation at the South Foreland and Dungeness beacon for two years. Currents of air produced by the rotation of masses of iron in the neighborhood of powerful permanent magnets generate the current of electricity, which ignites pieces of carbon intensely, thus producing the light.