[For the Scientific American.]

Improvements in Railroads.

The improvement of our railroads is a subject that not only affects the dearest interest of the companies but the whole people, and the best efforts of civil engineers should be directed to that branch of their business till the limit of speed depends upon the capacity of the engine.

The defects of the permanent way are very few, and most of them can be cheaply and speedily improved, and when the superstructure is built that is worthy to receive a rail, no doubt a rail will be found that shall not be a particle behind the structure in its perfection.

EARTHWORK—To commence at the foundation of the whole system, solidity is the great thing to be acquired, and upon that one idea is based the whole of the great results that have been, and are yet to be achieved.

Water is the great destroying element of all earthy structures, and its entire absence in the foundation of the road bed would soon place it beyond the action of frost or any perceivable deflection by the weight of the moving train. As it cannot be prevented from falling upon the surface, the next best thing that can be done is to remove it as soon as possible. A drain should be dug from three to four feet below the surface and tile laid therein, which will ensure its speedy removal in the most retentive soils. The experiment has been tried by experience agriculturists with complete success; and soils that could not be drained by open drains have been made productive by the covered drain, and at less cost. A covered drain, of sixteen inch caliber, seems to draw as much water from a field in the same time as an open ditch of ten times that capacity, so that, without doubt, a pipe drain of small size would do more towards removing the water from the road bed than both of the open ditches at the sides.

But falling water is not the only source of annoyance; it is raised in the embankments by capilliary attraction to a great hight, but depending upon the character of the soil. In clay, loom, or sand, if water stands in the hill ditches it affects badly the permanency of the bank, no matter what its elevation may be, it reaches the surface of either of those soils, and completely saturates them, so that the ballast gradually sinks. The only method of preventing its rising to where it can affect the ballast is to cut it off with a drain; for if there is a free passage for the water where it can flow easily and quickly, it will surely find it, even if it is surrounded by compact clay. Circumstances will govern the number, size, and length of such drains, and the calculations are as easily made as for any other branch of railroad engineering.

Side ditches, however, should not be neglected. On the contrary, they should receive more attention than they ever have had. Water should not be permitted to stand in them on any account. The appearance, health of the country, and inconvenience of crossing, are not the only reasons for the abatement of the nuisance; they too often afford good watering places for the cattle at the crossings, besides a very tempting one for the neighboring farmer's stock. Thorough draining is the main thing needed to ensure the stability of the road-bed, and until that is effected, no great improvement need be looked for in the "permanent way."

BALLAST—Gravel which comes the nearest to broken stone in quality—that which is neither too coarse nor too fine, which will pack firmly, and at the same time afford an easy escape for falling water—should in all cases be preferred. Inferior kinds might possibly be used over a drain, but if too fine, it will hold too much water, if too coarse, it cannot be well packed around the ties; an even, uniform, medium quality is preferable, and for a term of years will pay the extra cost of transportation. Clean sand has been used to a great extent, but would be far better were there a drain beneath it. Water will run up a bank of sand to a great hight if there is any in the ditches at the sides. In the drouth of 1854, six inches below the surface of a 10 feet embankment of clean b ach sand, it was damp enough to pack into a ball.

The manner of using ballast is almost always left to the care of those having little or no interest in its application—whose philosophical or mechanical knowledge is below the medium. The only idea with them has been to get it under the ties, so as to make a hollow between them, and such a thing as packing the gravel anywhere excepting there has never entered their heads.

To ballast a road with gravel like children's playing marbles is the hight of folly, for the weight of the train causes the ballast to rise between the ties, and affords no permanency, yet this is the way most of the roads are ballasted. When ballast is placed upon the road-bed before the track is laid, it would be a grand plan to lay it about four inches thick, then go over it with a very heavy cast-iron roller, then another course of gravel and another rolling, and so on until the required depth was on; but if it is deferred until the track is laid, no very heavy trains should be allowed to move till the gravel is under and well rammed down. If this precaution be not taken, many of the rails will be bent, and will have to be replaced by straight ones, at great cost.

TIES—Durable timber, of good size, firm texture, and well seasoned, are the requisites of a good tie, and any one not answering this description should not be used. They ought to remain sound at least ten years, be large enough to give a good surface for the rail on one side, and a good bed upon the ballast on the other; firm enough to hold a spike well, and be well seasoned as a pre-requisite to soundness and firmness. A tie of soft wood (cedar, for instance,) *gives* beneath the rail, and if placed between two hard ones is as bad, practically, as though it was not well tamped up, for the train sags at that spot,—every wheel of the train sinking lower and lower. It is just as bad if the tie be small, for it cannot receive that support from the ballast that a large one does, neither can it give the bearing to the rail. If all the ties were equally firm on the ballast the smallest would not hold their faces equally well, for the concussions of a moving train tend to loosen them all, and the smallest must suffer first. As long as the jointed rail is used, more care will be required at this point than any other, unless a more perfect chair is introduced, or a short cross tie be found to answer more perfectly. Believing, however, that a perfect rail will be, if it has not already been invented, this imperfection, of course, will cease, and the ties will then have to be arranged in classes. They should first be selected as regards their firmness, and subdivided according to their size. If small, more of them should be used in the same space, and none but the best white oak should be used on a curve.

CURVES—The elevation of the outer rail is too often left to the judgment of the track repairer, who is just as apt to get it too high as to have it too low. In either case it is wrong. The elevation that will exactly overcome the centrifugal force of the moving train at a certain rate per hour should in all cases be known, and all trains that are above the rate of freight trains should be required to conform to the standard in going round these curves. The concussions will then be comparatively light, if the calculations are perfect.

Parabolic curves give in practice all that is claimed for them in theory, and would be one of the great improvements to be introduced as the rule and not the exception in this country. Other improvements, undoubtedly, will be suggested by those who have seen the defects of the system, for such I consider the above to be; but these are the main ones, and until they are radically improved or a new system substituted, we shall be content to move some thirty miles an hour. H. DE L. S.

Pompey, N. Y.

Gun Cotton and Gunpowder.

Inquiries having been made of us lately as to the use of gun cotton, and whether it could take the place of gunpowder, we have obtained the following information on the subject from the Smithsonian Institution, viz.:—Gun cotton cannot be made with anything like the same uniformity in strength as gunpowder, and its explosive property diminishes on being kept for any length of time. It can be used with safety in the discharge of fire-arms, but not with as much safety as powder. Its cost, weight for weight, is a little more than gunpowder, but owing to greater strength, force for force, it is cheaper. The Governments of France, Prussia, Austria, Russia, and England, have made a great number of experiments on the use of gun cotton in fire-arms, and in all cases the reports of the engineers engaged in making the experiments were against its adoption in the place of gunpowder. In blasting rocks it is used extensively. The objections to its use are the inequality of its action compared with gunpowder, the effect on the gun is greater, its projectile force varies with the compression of it in the gun, it attracts more moisture, alters slowly from loss of acid, explodes under some circumstances at 154 deg. [Washington Star.

Adjusting the Number and Depth of Paddle-Wheel Blades.

It appears that something more may be said upon paddle-wheels; we will therefore remark, that so long as the common rectangular floats continue to be used, the number and depth of them should regulate each other upon the principle "that the right-angled resistance from the surface of one paddle at its central (or upper) edge, should pass below, and entirely clear of the paddle before it." It is upon this principle that we can account for the results of experiments where, sometimes, one-third of a steamer's blades have been removed from their upper edges without diminishing the speed, but rather improving it. In such cases the arms have been too numerous for the *width* of the blades. All the upper parts, which extended above a point, from which a line drawn at right angles to the arm would pass to, or below the lower edge of the blade before it, was disturbing the fluid to no good purpose, but rather loading the wheel with dead water, which, instead of pressing against the ocean, impinged upon the pre-dipping paddles. If an equable distribution of resistance shall continue to be approximately sought in the periphery of common paddle-wheels, by using a large number of blades, instead of seeking for it in the true form of propelling blades, let the depth or breadth of the floats be reduced, as above, and subsequent changes will be found unnecessary. How many wheels have become *water* instead of "paddle" wheels, by *guessing* at the proper number and depth of their blades!—[U. S. Nautical Magazine.

Pennsylvania Soapstone.

An American in London, in a communication to the *London Mining Journal*, states that the same causes which contributed to the formation of soapstone in Cornwall, seem to have produced the same result in Pennsylvania. He says:—

"On the banks of the river Schuylkill, ten miles above Philadelphia, the gneiss which, alternating now and then with mica schist and porphyry, has prevailed for the whole of that distance, is succeeded by an extensive tract of serpentine. The gneiss is much invaded by veins of trap and granite; and, at the junction, a great dyke of granite shows itself crossing the river. It is at this precise spot that the soapstone, in massive, irregular deposits, is seen. Nodules of serpentine are included in the deposit. The citizens of Philadelphia have good reason to remember this soapstone, since for a long time the doorsteps of their houses were invariably made from it. The rock wore away more speedily than the serpentine, which protruded in hard, indestructible, rough balls, not very genial to the soles of one's shoes. It is now wholly replaced by marble for doorsteps; but, for lining furnaces, where great heat is to be encountered, the soapstone is still extensively quarried and applied. It occurs on both sides of the River Schuylkill, here 300 feet wide, and on the east side is not less than 40 feet thick.

A singular fact attending the occurrence of this deposit may also, be here mentioned. The soapstone is interspersed with little nodules of iron pyrites. The portion of the rock in which this is most abundant wears off into a sugary substance. On being analyzed by a young Philadelphian amateur chemist, Theo. Rand, this substance was found to contain 8 per cent. of epsom salts—(sulphate of magnesia.")

Foolscap Paper.

Every body knows what "Foolscap paper" is, but would perhaps be puzzled to tell how it came to bear that singular cognomen. Well, when Charles I. found his revenues short, he granted certain privileges amounting to monopolies, and among these was the manufacture of paper, the exclusive right of which was sold to certain parties who grew rich and enriched the government at the expense of those who were obliged to use paper. At this time all English paper bore in water marks the Royal Arms. The Parliament under Cromwell made jests and jeers at his law in every conceivable manner, and among other indignities to the memory of Charles, it was ordered that the Royal Arms be removed from the paper, and the fool's cap and bells be substituted. These also were removed when the Rump Parliament was prorogued, but paper of the size of the Parliament's Journals still bears the name of "Foolscap."

Iron Rigging for Ships.

Two lines of ships (of about 800 tuns each) are running between Glasgow and Montreal, Canada. They are built of iron, and all their shrouds, stays, back stays, in fact, all their standing rigging is made of wire rope, with hemp centers, like that used on some inclined planes of railroads. This rigging looks very light, and is, in fact, lighter than hemp of equal strength. It holds less wind, and is not subject to stretch after being once set. Each shroud or stay terminates in a screw, by which it can be strained to any desired extent, and two men, in a couple of hours, can set up all the rigging, even in a storm. An improvement in the hanging of the yards is adopted in these ships, by which the yards are made to turn in their lifts, and roll up the sails upon them, from the deck, so that it is never necessary to go aloft to reef or furl them. These ships use the American steering apparatus, having a right and left handed screw upon the axis of the wheel, with rods from the screw boxes to a short tiller on each side of the rudder head, instead of the tiller rope.

Foot Prints of Reptiles in the Coal Strata of Pennsylvania.

At a recent meeting of the Boston Society of Natural History, Professor Wyman read an article on the foot-prints recently discovered by Professor Henry D. Rogers, in the Carboniferous Strata of Pennsylvania. He gave an analysis of the anatomical characters by which reptiles and fishes are distinguished from each other. He made comparisons between the form and structure of reptiles and the fins of fishes, showing that although they resemble each other as regards their functions, yet morphologically they are always distinct. There is no known fish, recent or fossil, the pectoral or ventral fins of which could produce a series of traces like those discovered in the coal strata of Pennsylvania by Prof. Rogers.

Prof. Wyman, therefore, thought that, in the present state of knowledge, there was no ground for denying that the quadruped tracks found in the coal formations were made by reptiles.

To City Subscribers.

So many complaints are made by our city patrons of the non-receipt of their paper by the carriers, that we would advise all who are about to commence taking the paper to call for it at the publication office, or obtain it at a periodical store in their neighborhood. One or two of the carriers serve the paper regularly; those the public, in their districts, know, and will continue to patronize; but others who serve it are so dilatory and unreliable that our subscribers are exceedingly annoyed by them, and blame us for an evil which is not in our power to remedy. Persons who will run their own risk in having the paper served them, may leave their names at our office, and they will be handed to a carrier, but we will not vouch for his faithful srrvices, nor receive money for nim.

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Brilliants of Fahlun, so called, are made from 29 parts of tin and 19 parts of lead. They are a very fusible and brilliant alloy.