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Contents:

(Illustrated articles are marked with an asterisk.)

HAVE THE MECHANICAL APPLICATIONS OF STEEL REACHED THEIR LIMIT?

The great number of the useful applications of steel in the arts, which characterize the present age, have given to it the appropriate title of the "Age of Steel." It has been commonly predicted that the number of uses to which this metal can be put will be largely extended, and that iron will eventually give place to steel on railways, in bridge construction, and in many other important applications.

Sir William Armstrong in his recent address to the mechanical engineers at Newcastle, made some statements upon this subject that will attract the attention of the mechanical world, and will not probably pass unquestioned by those who are perhaps not less authorities on the subject than even Sir William Armstrong himself.

The conclusion at which he arrives is, to use his own language, "that although steel has a much greater tensile strength than wrought iron, it is less adapted to resist concussive strain." This conclusion is based upon the assertion that "the vibratory action attending excessive concussion, is more dangerous to steel than to iron," and also upon "the want of uniformity in steel, which still continues to be an objection to its use."

It must be admitted that these views were supported with much ability. The speaker alluded to experiments made by him some years since, on the toughening of steel in large masses by plunging it, when heated, in oil, from which he was led to expect that he would be able to produce armor plates of extraordinary resisting power. An armor plate of steel was made specially for the experiments, and was tempered in a large bath of oil. Its quality was then tested by cutting off pieces, bending and subjecting them to tension. The speaker asserted that although the result showed a very high tensile strength, combined with so much toughness that he was unable to match it by any sample of iron he could compare with it, yet when the plate was sent to Portsmouth for trial in the fullest confidence of its success, two shots from a 68 pounder sufficed to break it in various directions, and it was justly pronounced a failure.

Here then we are presented with an anomaly. The best and only tests which are available to the iron master, in order to prove the strength of iron and steel, having demonstrated the great strength and tensile power of the steel in the armor plate described, it utterly failed under a trial that an iron plate of similar dimensions would undoubtedly have withstood.

Now, whatever plea may be made against the validity of the preliminary test, will not avail to controvert the fact that steel is not understood, and in that fact we find, if not the proof that Sir William Armstrong is wrong in opinion in regard to the limit of the availability of steel, at least the ground for the hope that he may not be right.

There are yet unpenetrated mysteries in the nature of this wonderful material, which, notwithstanding the unremitting efforts of investigators, still elude their grasp. Even the nature of the common process of tempering is, as yet, a matter of theoretical discussion, about which absolutely nothing is known positively. To entertain the belief which Sir William Armstrong avows, and in which he is partially backed by *The Engineer*, is to entertain the unwelcome idea that the limit of knowledge in this field is reached.

The mind of most scientists would shrink from such a conclusion; the progress made in the manufacture of steel within the last decade forbids it; and the name and fame of the man who thus avows it, will fail to add weight enough to his views to lead to their extensive adoption.

WOOD AND CONCRETE PAVEMENTS.

That the days of the barbarous cobble-stone pavements, and of all other roadways approximating to them in character, are numbered, must, we think, be evident to every careful observer. This is an age of progress, but it is an age which favors smooth and rapid progress, and is intolerant of jolting and jarring. It has sickened of the intolerable nuisance of stone blocks and cobbles, and now demands something that will exact less of man and beast and vehicle, and it will get what it wants by and by.

The construction of good and durable roads is no easy problem, especially in a climate like ours, where giant frosts annually get under the surface and upheave it, unless some adequate means can be devised to prevent them. To dig down below the reach of frost, and carry up a solid structure to the surface as in a foundation for a building, would, of course, do away with this difficulty; but it introduces another, even worse—enormous expense.

The problem may, perhaps, be stated as follows: Required to make a roadway impermeable to water (which alone renders the action of frost destructive to roads), and at the same time sufficiently thick and strong to withstand the heaviest traffic for a reasonable period of time; smooth on its upper surface, but not so hard as to fail to afford good footing for horses; and *cheap*. But cheapness does not by any means mean small outlay in the first instance. A road costing four dollars per square yard at first, and having the capability to endure for twelve years, is cheaper than one costing two dollars, and lasting only three years. And a road that will transfer a great proportion of the wear and tear from beasts of burden and vehicles to itself, may wear out rapidly and still be a very cheap road.

There are also some minor requisites for roads in cities, such as facility in getting up and repairing gas and water-pipes and sewers, which may not be disregarded.

In no field of construction, perhaps, can mere theorizing be less relied upon than in the improvement of our roads, proverbially bad both in city and country. Everything proposed must be brought to the test of actual and prolonged experiment, before it can be pronounced either good or bad. Hence it is impossible at present to pronounce intelligently upon the merits of many new claimants upon public favor. And in the cases of many of those which have been for some time under trial, it is equally difficult to decide, as the circumstances under which they were tested have been in many cases the worst possible, and in no manner of accordance with the intentions of their originators.

Thus the *American Builder* informs us that "The manner in which the wooden pavements are being put down this season in Chicago is enough to make the dead inventor of the Nicolson pavement laugh in his coffin. Indeed it is a ghastly joke. To avoid paying an honest and just royalty, the city authorities are compelling the sorely taxed people to throw their money away."

The Nicolson pavement, if not the most durable, is certainly the most agreeable of roads, but we insist that in very few instances have its promoters been able to secure for it anything like a fair chance. Its durability depends upon the manner in which the work of laying is performed perhaps more than any other pavement possessing equal merit, and so long as the work is performed as the *Builder* states it is now being done in Chicago, there will not be lack of those who will saddle the shortcomings of contractors upon the character of the pavement.

We are informed by one of the promoters of the Nicolson pavement, that an important improvement has been made in the method of constructing it. It originated with Mr. De Golyer, of Chicago, we believe, and consists of replacing the wooden pickets hitherto used to separate rows of the blocks, with a layer of concrete rammed as hard as possible. This supports the blocks laterally in a much more efficient manner than was attainable by the old method, and greatly adds to the durability of the pavement.

We believe that experiment will ultimately lead to the construction of concrete roads which will answer all the requisite conditions.

In fact, some statements made in regard to the Scrimshaw pavement, if they are to be relied upon, would seem to give hope that this ultimatum has already been reached. We are informed that this pavement has been tried in Portland, Maine, on a piece of road exposed to very severe wear from heavy trucks used to carry large blocks of granite, and has stood the test of wear and weather for eight years.

This pavement is now being put down on Bedford avenue, in Brooklyn, and also in Fifth avenue, New York. It consists, first, of a foundation of stone laid like the cobble or block pavements. The earth and sand being carefully swept from the interstices of these stones, a layer of gravel and asphalt mixed with coal ashes is spread over the surface, and the whole rolled down with heavy rollers. Successive coats of fine gravel, asphalt, and coal ashes complete the work. Each coat is heavily rolled down as applied; and the road when finished has an elegant appearance, and is delightful to drive over.

The method of laying the concrete upon the old pavement without previously relaying it, is, we think, not likely to prove so efficient as when the stones are relaid, although on account of diminished expense it is done in some instances.

Per contra to the above favorable statements in regard to the Scrimshaw pavement, we hear rumors of unsatisfactory results in Montague street, Brooklyn, where it has been recently laid, and some assert that no such results as the above, given on the authority of the committee, appointed to investigate the merits of the Scrimshaw pavement, previous to its adoption in Bedford avenue, can be realized.

Without crediting or discrediting the statements put forth in regard to this pavement, we shall patiently await the result of the experiments now in progress and, while we yet prefer the Nicolson pavement when properly and honestly laid, to any road we have yet seen, that does not prevent us from hoping and expecting something which will prove an advance on anything yet devised for American roads.

RAILWAY CONSOLIDATION.

Our able and spirited cotemporary, the Philadelphia *Public Ledger*, in a recent issue discussed this subject in a manner which leads us to believe that it not only anticipates rapid and extensive consolidation of various railroad interests in this country, but that it favors such consolidation under the plea that it would prove beneficial to the country at large.

It sees in the struggle, now taking place between rival lines, the indications that the big fish are to eat up the little ones, and, in an able review of the various railway routes of the country, comes to the conclusion that in this process the traveling and commercial public will be great gainers, even though the little fish suffer. It says: "By thus consolidating the companies, the expense and the evils of a variety of managing boards will be avoided, and the public will have greater regularity, less changing of cars, and uniform rates of fares. There will probably be sufficient competition between the great companies to insure the transportation of goods and passengers at reasonable rates."

Now we not only feel some pangs of pity for the little fish, whose bones are so complacently crunched by the remorseless jaws of more powerful monsters, but also some fears that when the supply of minnows falls short, the public may itself become the food of fat railroad sharks, whose hunger seems to be of that chronic kind which no amount of stuffing can allay.

It seems to us that the *Ledger* entirely ignores the great power of combination, or the plainly-indicated will of large capitalists to combine whenever there is money to be made by it. Though the railway kings of the present are, some of them, fighting among themselves with a bitterness which, to the outside observer, might seem irreconcilable, let them see how some millions might flow into their coffers by united movement, and you shall see them to-morrow as loving as brothers. So well is this understood on Wall street that in the last great Erie fight no one would have been surprised at a *denouement* which would have exhibited the principal contestants as partners in some deep game for the mutual interests of both.

It is difficult to see how the reduction of the number of rival interests could reduce competition, as the *Ledger* seems to think it would. This view seems to us as altogether opposed to both experience and the general law of supply and demand. How has it been with the great express companies? Has competition reduced their rates or has combination enabled them to maintain prices at a high standard? We do not at present see how such combinations can be prevented; but, at the same time, we are far from deeming them desirable. With the facilities afforded for manipulation by our present railway system, almost anything surprising seems to be possible, if not probable. It is a very difficult thing to see how a repetition of the extraordinary transactions which have within the last two years so astounded the world can be prevented at any time the "kings" again will it, unless some means can be devised to prevent consolidation. Let these men once secure full control of the great trunk lines and their tributaries, and with it the power to enforce their demands upon the commerce of the country, and who doubts that those demands would be despotically exorbitant?

GRANTS versus PATENTS.

We believe it was proposed recently, by Lord Stanley, to substitute grants from the national purse, instead of allowing patents for new and meritorious inventions. His lordship appears to have forgotten the fact that this system of grants was tried a century ago in England and abandoned. It encouraged imposture and gave no advantage to the public, as can be shown by reference to some examples. One Johanna Stevens obtained $25,000 for disclosing the secret of her cure for the stone. A Mr. Blake got $12,500 to assist him in perfecting his scheme for transporting fish to London by land; while a Mr. Foden was greatly overpaid with $2,500, to enable him to prosecute a discovery made by him of a paste as a substitute for wheat flour. If we mistake not, the British Parliament granted a considerable sum of money to pay Lady Webster for divulging the secret of her celebrated dinner pills, which were made up of aloes, mastic, red roses, and sirup of wormwood. The pills, perhaps, afforded a very comfortable relief to aristocratic gourmands, who, no doubt, were astonished to find of what simple elements they were composed.

Give a man a sum of money for his invention and you run the risk of paying him either too much or too little. Give him a patent and you secure the invention for the public, while his remuneration in money is determined according to its value. If the invention enrich him, it must also have benefited the nation. If the invention be a delusion, the public suffers no loss and the patentee reaps no gain. As a means for providing that the reward shall be fairly apportioned to