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(Illustrated articles are marked with an asterisk.)

GAGING THE DIAMETER OF CYLINDRICAL BODIES.

Sometimes the simplest tools used by the mechanic are the most difficult to use properly, because of this very simplicity. The proper use of the file for instance, can be acquired only after long and patient practice, yet no tool used by mechanics is simpler in form and construction. The callipers is another instance, and even those rigid steel gages for measuring one particular size will give different apparent results in different hands. Delicacy of touch—the educated fingers—an experience acquired and rendered valuable only by long practice is necessary to the use of the callipers. The two jaws but touch at an almost infinitessimal point on either side of the object to be gaged and if that object is a cylinder the act of gaging requires much caution.

The machinist's apprentice invariably gages large, or he forces the callipers over the shaft in one place and allows it to pass without pressure in another; the consequence is an imperfect job. As much depends on the manner of use as on the reliability of the instrument. Unless the same degree of force is employed at all times and on all parts of a shaft in callipering, the result is imperfect work. Testing a turned shaft while rotating is eminently unreliable; the presence of oil or dirt on the surface of the shaft will render the gaging inaccurate, and callipering a shaft on the rough surface left by a dull tool is useless.

It is surprising that mechanics do not more generally use a gage that measures the whole circumference rather than one that touches it at only two points. The callipers is valuable in detecting irregularities in the cylindrical form, but a simpler tool will more accurately determine the size of one portion as compared with another. It is merely a flattened copper or steel wire furnished with a handle at each end. When used, one end is passed under and around the shaft and drawn past the other, one end being held in one hand and one in the other. By slacking up a trifle and moving the wire back and forth around the shaft it will accurately fit the shaft's surface, when a line can be drawn with a scratch-awl across both parts of the wire where they pass each other on the shaft. These lines will be the gage for the size until the job is finished. If the shaft is too large the two lines will not meet and if too small they will pass each other. Copper is preferable to steel wire, as it is more yielding to the curvature of the surface of the shaft. Of course this is not to be used while the shaft is turning, as the wire would soon become enlarged by wear. For ordinary purposes the callipers are sufficient, but where accuracy is required we commend a trial of the wire callipers.

ENGINEERING TALENT REQUIRED IN AGRICULTURE.

This country is new. Although portions of it have been settled by civilized men more than two centuries, yet those portions, the earliest settled, are still new when compared with European countries. Neither Virginia, the site of the first English settlement, nor Massachusetts, the home of the pilgrims, exhibits the careful culture or even the settled appearance of many European localities. Vast tracts of valuable land lie unreclaimed in Virginia; and almost as large an amount in the aggregate, although distributed in smaller parcels, are fallow and untouched in the Eastern States. These neglected lands, valuable only as pastures, are really the richest on our farms. They are called "sour," barren, and "cold," but they need only judicious aid to become generous, fertile, and valuable. Marshes may be made fields, swamps be reclaimed and made fertile meadows, and sand hills, gardens, by the employment of manual skill, guided and directed by scientific knowledge. Our now barren hillsides may be made to yield a good return for labor judiciously expended. Our swamps, instead of breeding musketoes and malaria, may be made to return a rich harvest of edible products, and our rocky, stony, slopes to give sustenance to sun-loving products with the aid of intelligent management joined to industrious carefulness.

We do not advise the expenditure of money upon all lands now unproductive. Happily we have millions of acres of the richest soil unimproved and unused which require no outlay beyond the ordinary labors of the husbandman to produce in profusion grain, vegetables, and fruits. But there are localities in the immediate vicinity of our mercantile and manufacturing centers which would richly repay the expenditure of scientific talent as well as manual labor.

For this result we need the direction of our engineering and scientific talent into this purely utilitarian channel. We need agricultural engineers. Engineering, as at present understood in this country, is considered nothing unless directed to the inception and completion of large works of a private nature, or those of a public character. Farming, unless "landscape farming," the decoration of the villa of some retired business man or ambitious ruralizer, or the laying-out of some public park, is almost entirely ignored by our engineers.

We are aware that much money and time has been spent within the past fifteen years in amateur farming, each landholder being his own engineer as well as manager. Most of those who desire to improve the condition of their lands have believed that but little practical knowledge was required; the theories obtained from manuals and periodicals they supposed all-sufficient. Perhaps this was and is a mistake. It may be possible that men, not practical or resident farmers, might know better what to do to reclaim a bit of waste land than the farmer himself; at least such men are to be found in Europe, and we do not believe they are wanting in this country. Certainly there is room for the exercise of engineering talent, beside the building of bridges, aqueducts, tunnels, and other works of a public character, and for the proper employment of scientific knowledge. Notwithstanding the rapid increase in our manufacturing facilities, we shall still be, as a nation, agricultural. It would be well that our scientific mechanics believed this and diverted some of their talents to the improvement of the land. When they do this we may look for a new era in the development of our natural resources. The field is wide and extensive, but the laborers —the willing laborers—are few.

THE CARE OF WATER PIPES IN WINTER.

Where water is conveyed to dwellings by pipes whose ramifications extend through the building, it is difficult to prevent it from freezing, as however perfectly the house is warmed there are passages in the walls, under the floors, through the area, and in other places where the heat cannot affect the pipes. Severely cold nights will at times leave the evidence of their recurrence either in frozen or ruptured pipes.

A common plan adopted is to leave the water running during the night, which besides being wasteful and extravagant where the water must be paid for and the supply is limited, is not always effectual. The freezing begins from the outside of the pipe, and allowing a diminutive stream to flow through the cold hours of the night may diminish the danger of freezing but not entirely prevent it. The proper method is to have a cock in the cellar by which the water can be turned off from the distributing pipes.

When a pipe is frozen, pouring down hot water is of no use. It is speedily cooled and becomes as cold as the pipe, while it cannot be removed. Cloths wound about the pipe and hot water poured upon the cloths is the most effectual means for thawing frozen pipes we have ever tried. Still with any preventives or remedies, constant care and judicious management are required to prevent annoyances from frozen water pipes.

THE WEAR OF IRON RAILS.

Railway managers and stockholders, if not the public generally, are well aware that the life of rails lately laid is much much shorter than those put down when railroading was in its infancy in this country. The *Railway Times* states that "in one case on the Boston and Providence line, iron rails have been in continuous use on the main track over thirty years; in an other on the New Bedford and Taunton, iron rails have worn twenty-seven years, and are still in good condition; and the original 45-pound rail laid down on the Philadelphia and Reading lasted over twenty years under an amount of traffic unsurpassed in this country; and we have several other accounts of rails that have worn from fifteen to twenty years. The rails especially mentioned above were of English make, or rather Welsh make, and weighed only 45 pounds to the yard. The specifications for the manufacture of these rails were very short, and were stated concisely as follows:—'Best No. 1 cold-blast mine iron was first run out in a finery fire; second, puddled, and the balls shingled under tilt hammers; third, rolled into bars; fourth, these bars were cut, piled, heated, and hammered into blooms; and fifth, these were re-heated and rolled into rails.' The rails thus made and thus light in weight, stood an amount of wear very much greater than rails since made have been capable of, even when the weight is double per yard. Indeed it has been in one instance, shown by templates, that the wear of a 62-pound modern-made rail is greater in a use of a single year than that of the old 45-pound rail in a continuous wear of twelve years."

It is well known that a large proportion of modern made rails have worn so as to need repairing within two years after being laid, and in many cases they were entirely worn out in five years. It is certain that as good ore can now be obtained as could be twenty or thirty years ago, and that the processes of working iron have received many improvements; so it would seem that we might obtain rails not only equal to those mentioned above, but that we ought to get superior work. Whether the opposite result is to be attributed to the parsimony of railroad managers or the cupidity of manufacturers is a question we do not care to discuss. It is certain, however, that true economy and real business enterprise demand an improvement. Perhaps the authority from which we quote is correct when it says:—

"The iron can be under-worked, leaving too much cinder in it, the common fault, or it may be over-worked, as it is found in practice that the old 45-pound rail, so remarkable for its wearing qualities, when re-worked into rail looses its original superiority, and is apt to be too soft. The mixture and amount of working needed to give the great wearing qualities pertaining to the earlier make of iron rails, we think rail manufacturers could easily find, if railway managers would pay a fair price for the article when made. Wearing qualities are worth paying for in rails as in every thing else. A machine that will last twenty years, doing a given amount of work, is surely worth double that of one that will not last but five years. Our remarks are just as applicable to steel rails as to iron. Railway managers must insist upon good wearing qualities, and rail manufacturers may very properly insist upon being well paid for good work."

IRON WORKING---THE PUDDLING PROCESS.

Our article on puddling, published on page 361, Vol. XVII., has brought out several letters from practical men. P. McC., of New Jersey, says: "Your article is in the right direction. If there is any one employment in the mechanic arts which calls for improvement by the inventive genius of the age, it is that of puddling. In the first stage of the process, when the metal is melting, and in fact until it has reached what is termed a "foment," it exhibits the strangest tendency to stick to the bottom, back wall, bridges, jambs, etc., and if allowed to do so, there it must usually remain until loosened by the increasing heat. While "balling," bad melting cannot be remedied; the iron that was permitted to stick has not advanced a stage, yet it must be got rid of. It will not run off with the slag, and it is "sopped" up by rolling the balls into the now fomented iron, until absorbed. The after working, squaring, rolling, heating, etc., will work out some of it, but not all. This is the greatest difficulty encountered in the adaptation of mechanism as a substitute for the live puddler, who has eyes to see, judgment to guide, and hands to manipulate the contents of the fiery furnace."

W. R. J., of Pennsylvania, writes: "Your article on the puddling process will, I know, be read with great interest by all your readers concerned in the manufacture of iron. I have always thought that this most important process has never received the attention it deserved from those writing on cognate subjects. I am satisfied that there are a great many of the readers (myself among the number) of your excellent paper that would like to see the article referred to followed up by some of our practical men in a series of articles on this important subject; and carried through the rolling-mill department. I have been a weekly reader of your valuable journal for a long time, but have never summoned up courage to write to you on this subject. But as you have introduced it in such an able manner I hope to see a continuation, and ask you to invite the attention of persons qualified to communicate the results of their experience to numbers of American iron workers who are anxious to learn."

A Popular Error.

Sometime ago we noticed in an exchange a statement that "some old iron is rendered much more valuable by being knocked about. Thus, old iron in the form of horseshoe nails, and, indeed, horseshoes themselves, fetch a much higher price than the original metal from which they were made; the toughness it acquires by constant blows and concussions gives it a greatly enhanced value in the market." We much doubt this; the toughest wrought iron rather becomes deteriorated by "constant blows and concussions," unless these blows are given while the material is in a semi-plastic state, as when red hot. It is well known that the material for horseshoes and horseshoe nails is of the toughest and most fibrous iron. It is not uncommon to see a farrier or a country blacksmith take a nail rod, and without placing it in the fire, form a nail which, by the percussion of hammer and anvil, becomes red-hot, so that the finished nail is cut off and falls glowing at the foot of the anvil. This could not be done with any but the toughest iron. Possibly the thorough hammer-working to which horseshoes and horseshoe nails are subjected in the process of their transition from the bar to the finished article enhances their value so that they may fetch a higher price than the original metal; but the reason is not to be found in their use on the feet of horses or on pavements, but in the toughness acquired in their manipulation.

The Coroner's Jury on the "Angola" Disaster.

The coroner's inquest into the causes of the late railroad disaster at Angola, N. Y., after eleven days' investigation, has decided that the accident was caused by a bent axle under the car which was burned—the last car on the track, that which first left the rails. The jury recommended the adoption and enforcement of a more thorough system of gaging and inspecting wheels and axles.

THE SURGEON GENERAL'S REPORT for the year ending July 1st, just received, shows that during this period two hundred and eighty soldiers were furnished with artificial legs; two hundred and thirty-six with arms, and thirty-eight with surgical apparatus. Six feet, nine hands, three eyes, and one palate complete the list of artificial substitutes provided for the loss of dame nature's gifts.