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(Illustrated articles are marked with an asterisk.)

THE INVENTOR—SOME OF THE OBSTACLES TO HIS SUCCESS.

Did it ever occur to the reader of the SCIENTIFIC AMERICAN who looks over the long list of patents published weekly, how few of these he ever hears about afterward? It would seem, sometimes, that the result of a patent was to send the invention to oblivion, from the fact, so frequent, that its publication is the last heard of it. That this is not so, however, is proved by the hundreds of successful patentees whose inventions bring wealth to their owners. We must look elsewhere for the reasons of failure, and no direction is more natural and proper than that which points toward the inventor.

Ignorance of the laws of mechanics is a fruitful source of failure. Men will spend years of time and much money in trying to contravene the simple, but immutable and unvarying laws of nature, when a slight acquaintance with natural philosophy would prevent this waste of valuable time and treasure. In machinery the expectation of getting more than is given, increasing power by multiplying intermediates between the source of power and its development, is the cause of the hallucination of hundreds. Refusing to recognize the presence of friction and attempting to remove it by adding to its sources of production is so common among those who essay improvements in machinery that the wonder is so many succeed rather than that so many fail. We might, from our experience, cite many individual instances of earnest, honest, struggling men vainly attempting to override the bounds of physical possibilities, when a little calm reflection, combined with knowledge of nature's laws, would show them, at once, their error.

Want of mechanical practice is another cause of failure. No doubt many mechanical improvements have been made by men not practical mechanics, but their success was not because of the want of this practical experience, but in spite of it. They will be found to be, in nearly all cases, natural mechanics, whatever their profession or occupation, and, in the pursuit of their object, to have acquired not only a theoretical knowledge of mechanics, but skill in manipulation. In many cases, however, the inventor possesses only a crude idea of his device and the model maker is the real inventor, working out the half formed idea into shape. This class of our mechanics has never been properly estimated. They do much toward the improvements which assist the progress of the race. Usually they are regarded merely as skilled workman, while, in fact, they are actual inventors. It requires something more than a practical knowledge of the use of tools to become a successful model maker; he must also have a fund of intellectual knowledge, great patience, perseverance, and a faculty of overcoming obstacles. He is the main reliance of many inventors.

Another cause of failure may be found in misdirection of endeavor; either the object sought is valueless, or the means employed to compass it inadequate. The number of so-called improvements which are merely alterations, and of so-called inventions which are revamps of long ago, exploded ideas is surprising. Instead of informing himself of what has been done in the department to which the would be inventor directs his attention, he blunders on over a road which has been laid out for him by those who have gone before and either achieved the goal or stopped disheartened by the way; or he persists in attempts at success by the employment of means and appliances wholly unfitted for his purpose. What can be the benefit of using machinery for an object much easier attained by hand? Yet hundreds persist in pushing these useless inventions before the people. Still, the value of an invention is not to be judged by its apparent insignificance. The balanced handle table knife was a simple and seemingly trifling improvement, yet it became very valuable to the inventor. In soliciting the extension of a patent in as simple an article as a clothes pin the other day, the only difficulty we had to encounter before the patent office was the large sum, almost sixty thousand dollars, which had been realized in working the patent during its existence.

Having, perhaps, perfected a working model of his invention, the next thing for the inventor is to make it "pay." Here is where more fail, perhaps, than in any other stage of their progress. To be pecuniarily valuable the invention must become popular, and to become so it must be introduced to the public. The inventor, not seldom, is peculiarly unfitted to this task. He has been directing his attention, perhaps for years, on the details of his improvement—has concentrated his whole mind on its perfection—and understands nothing about "business" or has no inclination for its excitements and annoyances. Or, he lacks the faculty of properly presenting the claims or explaining the construction, operation, and merits of his invention, and bores and annoys where he would interest and please. Many fail here. Such cases come before us continually. They seem to suppose that because every detail of their contrivance is as plain as day to themselves, who have watched, and worked, and thought on it for years, it must be so to others. Perhaps they become disgusted at the want of enthusiasm evinced by him to whom they would exhibit the excellences of their improvement, as though everybody should ride their hobby, and give up the task in despair. No doubt many inventions now lie unused from these causes which if properly managed might yield a rich return to their owners.

BAD WORKMANSHIP IN STEAM BOILERS.

The unusual number of steam boiler explosions which occurred during the past three or four months, prompts us again to call the attention of those who employ steam power to those fruitful causes of boiler explosions, namely faulty construction and deterioration.

We feel confident that if these two points receive that attention which their importance as agents in destroying human life, demands that they should receive, boiler explosions will be reduced in frequency to such an extent that careless management or ignorant planning will be found sufficient to account for the rest of the boiler accidents without calling in the assistance of either "gas" or "electricity."

Of equal importance with the requisite thickness of iron, particularly if the form is circular, to resist the pressure put upon it, with an ample margin for safety, is the construction of the seams or laps where the plates are joined. And a large proportion of the fearful boiler catastrophes which are of almost daily occurrence may by accounted for by carelessness or, in too many cases parsimoniousness on this very point. To say nothing of the improper size of the rivets which are not infrequently employed, as well as the improper pitch of the holes, we will in the first place briefly allude to the use of that abominable tool known as the "drift pin"—a tool which by the way should be kicked out of every boiler shop in the land.

This tool, it is well known, is used by boiler makers to force the two rivet holes, which have been carelessly laid out in overlapping sheets, to come in line with each other so that the rivet can be inserted. It is a piece of round steel, tapering from the point which is about ⅛ of an inch in diameter to the butt which is considerably larger than the hole in the sheet; suppose the edge of one hole overlaps so that its circumference passes through the diameter of the other, this part of the tool is inserted in the lunar space left between them and a pair of sledges, handled by a pair of stalwart arms, applied at the other end soon rips, tears or strains the iron so that a rivet can be put through the hole. If even after this treatment the proper sized rivet cannot be got in, a smaller one can, and this is the very thing which is constantly done even in "first class" establishments. Let five or six of the rivet holes in a single riveted seam of say thirty rivets, be treated in this way, and we have a structural deficiency which no doubt if it were known would account for many a first class blow up.

Here then we have two causes which no one we think will deny are of constant occurrence and which we likewise think could be wholly prevented by proper legislative enactments specifying among other things, the sizes and pitch of rivets for various thicknesses of iron and prohibiting the use of "drift pins" in boiler shops.

In England, we are informed, these matters of detail receive much greater attention than they do in America; and one firm near Manchester, has we believe, given so much care and attention to the joints of their boilers as to have achieved a very high reputation for constructing safe boilers. This concern carries this important matter to such a degree of nicety as to lay out the boiler sheets with very accurately made steel templets and then to drill the holes instead of distressing the iron by the usual method of punching.

We are also informed that the boilers built by this establishment are remarkably free from accidents, and we must say that we are glad to hear it; beside it corroborates our view that very many accidents may be prevented by proper attention to construction and proportion.

Before leaving the subject of boiler joints, let it not be forgotten that the ignorant use of the caulking tool very frequently destroys that small margin of safety which is left after the "drift pin" and small rivets have done their best to weaken the joint. This for the most part is done by holding the calking tool nearly perpendicular to the sheet and banging away on it with a heavy hammer: by this process we have, on more than one occasion seen sheets of iron cut into nearly a quarter of their thickness. We did not always witness this defect be it remembered, during the life of the boiler, but on one occasion after a huge gap had been rent in it and eighteen or twenty people were scalded to death. As usual philosophers were as thick as blackberries, every one with a theory, which included every agent from "gas" to "super heated steam."

These remarks which were merely intended in the outset as a short caution to boiler builders and users have reached such a length that we must close them by a word of caution respecting braces and stay bolts. Braces and stay bolts are for the most part used to sustain flat surfaces and hence the strain which will be put upon them by the pressure of the steam may be pretty accurately calculated.

Now when it may be set safely down as a rule that no brace should have more than one fifth of its breaking strain put on, there is no difficulty in determining their sizes; and it remains to see that the jaws, pins, and crow feet, are made of good material and so proportioned that they will stand as much as the brace rod or bar.

It is intended in a short time to take up this subject again when some suggestions will be offered on other matters connected with the construction and durability of boilers, particularly the subjects of design and corrosion, we trust however that enough has been said to show that causes strictly within the control of the boiler maker will go far to account for very many explosions and much loss of life.

THE USEFUL MECHANIC.

All mechanics are useful; but the useful mechanics, *par excellence*, may be be divided into two classes, those who are skillful or "close" workmen, and those who are ready for any emergency. The first are always in demand in shops where fine work is the rule; the second are useful everywhere. The sewing machine, gun, and tool business have had the effect to educate machinists, probably more than all other causes combined—at least to educate them to skillfulness in the use of tools. In the gun business, the construction of plugs and templets, for gaging the bore of rifle and pistol barrels, requires the careful manipulation, the experience, and the judgment of a first class workman. The result may appear to be purely mechanical, but it is not so. No machine yet invented could produce these gages. The plug, as its name imports, is simply a cylinder finished to a certain size, which is the same throughout its length. This fits a hole drilled through a block of steel—the plug, also, being of steel, and both hardened. Now it may be a work of no peculiar difficulty to turn and finish a plug to fit nearly, if not quite air-tight a corresponding hole in a block; but when both must be subjected to a hardening process, which will invariably warp them more or less, and still leave them as hard as steel can be made, the problem of perfection becomes somewhat difficult. The hole in the templet must be scoured, ground, abraded, and polished until its surface is like glass, and at the same time perfectly true from end to end. Then the plug must be also ground, polished, etc., to fit perfectly air-tight, yet without binding or requiring pressure to pass it through the hole. So delicate are these gages, and so perfect their fit, that not a particle of air can pass between their engaging surfaces. Such work as this requires the talents of the close workman, of whom there are few. Many other manipulations in the mechanic arts require similar skill. Such concerns as Whitworth's, in England, Brown & Sharpe's, Providence, R. I., Pratt, Whitney & Co., Hartford, Conn., and Colt's of the same place, have secured a world-wide reputation for their attention to these niceties in details of the machinist's art. They use the best tools and employ the best mechanical talent, and they have their reward.

The "men at a pinch" are an entirely different class of mechanics. They have always a plan at their fingers' ends. They can contrive and manage almost without means, or with means which none but they would think of using. In the late war such men, drawn from the ranks of our armies, were invaluable. They improvised bridges over otherwise impassable streams, repaired dilapidated and almost destroyed locomotives, relaid tracks, constructed roads through otherwise impassable morasses, utilized the means at hand, otherwise valueless, and contributed largely to the success of the armies of the nation. Such men are invaluable on railroad lines, on steamships—indeed on all vessels—in "job shops," and in a hundred places. Their faculty of adaptation of means to anend should bring to them an adequate reward—a reward they do not always receive. In a country like ours, where cultivated mechanical skill is pitted against the obstacles or obstinacies of nature, such men are always required. They are born engineers, and from them are drawn our best specimens of engineering talent.

We knew of one, who, sent to repair a boiler in an out-of-the-way place, found no tools with which to work. He wished to remove the manhole of a boiler, but had no wrench and could get none made. He managed, by twisting a rope, to coax the nut from its seat, and after inspecting the boiler and packing the manhole flange, to return the plate to its place and secure it steam-tight by the same means.

Such men are invaluable mechanics. They are not dismayed at difficulties before which some others might succumb, but, "making the best of a bad job," they go heroically and confidently to work, and generally "snatch victory from the jaws of defeat." So long as our country needs such men—which it must until we have tamed the forces of nature and wildness that beset us—we believe in the man for an emergency. In other words, the best apprenticeship for a young man who desires to become a thorough mechanic, is first a job shop, where he has to work on building or repairing everything,