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Subscriptions to our new Volume are pouring in from every direction far beyond our expectations, and we desire to thank our host of friends for their very generous co-operation in promoting our circulation, which is now much larger than at any time since the SCIENTIFIC AMERICAN began its existence. We shall endeavor not to disappoint the expectation of our readers. Five Editors are constantly employed on the Scientific, Mechanical and Literary departments of the paper, and are prepared to discuss all questions that belong to the character of the paper, in a plain practical manner.

Owing to the great number of claims of patents—covering about six pages—we are compelled to issue with the present number a four-page supplement. We would have gladly avoided the trouble and expense attending the supplement, but we did not feel willing to deprive our readers of the amount of excellent matter which will be found in this issue. The list of claims embraces the issues of two weeks; something that is not likely to occur again this year.

HANDLES---THEIR VARIETY AND ADAPTABILITY.

Does any one who uses some of the multifarious tools which pertain to the manipulation of the mechanic arts—to labor in all its branches—ever note the almost infinite variety of the appendages adapted to them to fit them for effective use? The handles differ as widely as the tools themselves. Without noticing the different manner in which the tools are attached to the handles, the variety in form and structure of the handles themselves, is surprising. Many of these appendages show plainly the object of their peculiarities. For instance, the scythe snath has a very crooked appearance viewed as a piece of timber, but every curve has its object. Where the handles proper are attached, it approaches a horizontal, when in use. Below the lower handle it descends at an angle, with a curvature intended to present the blade to the grass near the ground and to swing clear of the body in using. A straighter snath would compel the mower to stoop uncomfortably and add greatly to his labor.

Some handles are long, as that of the hand rake and hoe; others short, as the ax, the hammer, the mallet. But each one has its peculiarities. The handle of the carpenter's hammer is very different from that of the machinist's hammer. Those not acquainted practically with the details of the business of the carpenter and joiner and of the machinist, might not be able to distinguish, at first sight, in what that difference consisted. The carpenter's hammer is used for driving nails into a readily yielding substance. The handle is rigid; it gives a dead blow. The machinist's hammer is used on comparatively unyielding substances. If rigid it would jar and partially paralyze the muscles of the arm. For "chipping"—cutting iron by means of a cold chisel—the blow is received on the end of a steel chisel and transmitted through it to the rigid surface of wrought or cast iron. It may be called a spring blow. Soon as the hammer face strikes the chisel head it rebounds. All good chippers understand the necessity of having the hammer handle elastic. To produce this proper elasticity and graduate it exactly to the work to be performed, the workman will sometimes spend hours in rasping, scraping and sand-papering the wood. The blacksmith's hammer, on the contrary, has a stiff, unyielding handle, although used on the same material as that of the machinist. But in this case the material is soft and malleable.

Why do the handles of the sledge and the ax so widely differ in form? The ax may be nearly as heavy as a light sledge hammer and the handles of about the same length, but in no other respect have they any similarity. The sledge handle is straight and the ax handle curved. But the sledge and ax are not only used on different substances, but in a different manner. The striker grasps his sledge, one hand at the end of the handle and the other advanced, holding each to its place while the blow is delivered. He does not change the relative positions of his hands in striking. Even in delivering a swinging blow both hands remain together at the end of the handle. But see how the wood chopper handles his ax. With one hand at the end and the other in advance he swings his ax, bringing the advanced hand, with a quick, sliding movement, back to the end hand as the ax descends. Only women, unaccustomed to the ax, use it as the striker does the sledge. Now we see the reason of the downward, inward curve of the ax handle. The curve facilitates the downward movement of the hand by making the position of that portion of the handle more perpendicular as the blow is given. It is notorious among blacksmiths that the country lad, accustomed to the use of the ax, requires long practice and repeated instructions before he becomes a good striker. We recollect a laughable incident, that was nearly a serious accident, in illustration. A farmer's boy in a smith's shop was requested to aid in "upsetting" a bar at the end, the bar being laid across the anvil and held by the forger. He gave a blow ax fashion in this unusual, horizontal manner, and missing the bar, struck the stooping blacksmith full in the forehead, instantly "upsetting" him.

The advantage of a handle adapted to the work to be performed is exemplified in the difference between that of the modern shovel and spade, and that of the ancient mattock, or a spade of fifty years ago. This last was perfectly straight with a cross piece at the end. Being straight, the labor of pressing the blade into the soil was greater than it is with a curved handle, as the hand and foot were compelled to act in the same line. Besides, to retain the load on the spade or shovel, or to carry it, required a very strong grasp to prevent tilting. The downward curve of the shovel handle raises the point of suspension of the load, so that the center of gravity falls below the lifting force. The wooden grain shovel with its spoon-like scoop is a case in point. The advantage of this position of the load beneath the point of suspension can be easily tested by attempting to carry a shallow pan full of water by grasping the rim and a pail filled by using the bail.

Real science is shown as much in the form and adaptability of handles as in any mechanical device; and science is necessary: for if we examine the simple tools of savage peoples we shall see that it is not often the handles are well adapted to the work for which the tool is designed.

REMEDY FOR SMOKY AND DANGEROUS FLUES.

We are under obligation to Dr. Alex. H. Stevens of Huntington, L. I., for valuable suggestions relative to the construction of chimneys and fire flues in buildings. Most fires originating in flues, may be referred directly to the unphilosophical shape in which they have been constructed from the first, in deference to the rectangular form of bricks, and with the object of flattening them into thin walls. A given area for draft is obtained, by this form, with an excessive inner surface of masonry to abstract the heat of the ascending draft and thus diminish its force. At the same time, the corners, detaining warm air by their frictional resistance, invite counter currents of fresh air down the chimney, which not only diminish the draft proper, but increase the danger from the detention of fire, and materially assist combustion within the flue whenever a heated beam is ready to receive oxygen and burst into flame. Worst of all, the broad flat flues cannot well be avoided far enough by the timber ends set in the wall, to prevent frequent fires from their close proximity to the hot draft.

Dr. Stevens has constructed the fire flues of a number of dwellings with reference to these considerations, and as he informs us, with remarkable success. His flues were made in the form affording a given draft area with the least inner surface to abstract heat and oppose frictional resistance to the draft; leaving no corners as channels for counter currents; from each of these causes giving better draft with flues of less size; and by the size and shape of the flues permitting the floor timbers to be inserted in the wall at a safe distance from their inner surface. This form, it is unnecessary to state, is cylindrical. His experience indicates that eight inches would be sufficient diameter for the largest flues, while six-inch and even four-inch flues of this form, for ordinary dwellings, will give better drafts than those generally in use. An arrangement of three six-inch flues for one chimney, allowing four-inch timbers with the corners bevelled off to be set four inches into the wall between them, at a distance of six inches from each flue, would require an enlargement of the wall to twelve or fourteen inches in thickness, for a breadth of not more than three and a half feet. The expense of constructing a cylindrical flue need be no greater than that of a rectangular one: the mason needs nothing more than an old joint of stove-pipe to work around.

A simple contrivance for at once strengthening the draft of a smoky chimney, and so applying abundant fresh air as neither to exhaust that in the room nor reduce its temperature, was observed by Dr. Stevens in Paris when a medical student there, as long ago as 1812. It is called a *ventose*, and is nothing more than a tube of properly adjusted diameter, let down the chimney from a hole in its side near the roof, and opening directly under the fire. The descending current of cool fresh air supports a vigorous combustion, and leaves the atmosphere of the room undisturbed by currents, for the use of the occupants.

ANOTHER GREAT WORK PROJECTED.

Damming the St. Lawrence, is the topic of the day with the citizens of Montreal. Monstrous as the undertaking seems, engineers have laid it out, and capitalists are about to apply to parliament for a charter incorporating a capital of two millions of dollars for the purpose. It is needless to remark that the waterpower to be obtained by a successful accomplishment of this work would be many times greater than any other in the world, and could not fail to build up a mighty manufacturing metropolis around the present nucleus called Montreal. At the same time, the city would acquire what it must soon have by some means, a head of water and a pumping power adequate to its own supply.

The arrangements of nature to facilitate the gigantic work, are quite interesting. The Lachine rapids, just above the city, are said to afford a fall of twenty-five feet in about a mile. They are divided longitudinally by a series of islands running their entire length, and forming with the northern bank of the river a natural enclosure, lacking only the proposed dam at its lower end to make an enormous basin and to convert the rapids into a smooth mill-pond or rather lake, with a semi-Niagara at its outlet, and a hydraulic power estimated as two millions of horses. There is also another natural channel running between the islands, which admits of being made into a mill-stream of seventy-five thousand horse power. To complete the work of nature in this way, requires a dam two thousand eight hundred feet in length, leaving the southern and only navigable channel open for commerce, and the shoal rocky bed of the river below the dam, besides the shore, for the accommodation of a city of mills and factories. A great canal is also to be led inland from the new lake, to supply other factories and conduct an abundance of water to the city.

EXPLOSIONS FROM OVERHEATING BOILERS.

We have a communication from an able correspondent relative to the causes of steam boiler explosions, in which he reckons the following as a prolific cause: "The sudden formation of steam caused by a change in the position of the boiler, the sudden starting or stopping of a locomotive, the rolling of a steamer, or any sudden shock given the boiler. This formation of steam is caused by the water in the boiler being thrown suddenly on the sides of the boiler not before covered by water. An immense volume of super-heated steam is thus formed, as it were in an instant, exerting a greater pressure than that which the boiler is calculated to withstand."

We do not entirely agree with our correspondent in his views. If they were correct, explosions of the boilers of sea-going steamers should be much more frequent than they are. An article in the London *Mechanics' Magazine* puts the subject in a more reasonable light, we think. This article says:—

A great number of boiler explosions are attributed to overheating: in fact some theorists go so far as to assume this as the general cause of such catastrophes. Now this theory, taken in a broad sense, is a false one, although it is possible that a boiler may be exploded by the formation of a great quantity of steam from water thrown upon red-hot plates. But a consideration of some of the phenomena of heat places this possibility at the farthest limit, and the occurrence of an explosion from such a cause only just within its bounds. We quench the heat of a railway tire in a cistern, and why may we not as safely fill a red-hot boiler with cold water? It is surprising to see how small a quantity of steam is disengaged when a large body of wrought iron is plunged into twice or thrice its weight of cold water. Now if we reverse the operation and dispose the same weight of metal in the form of a boiler, heat it to the same degree, and throw the same quantity of cold water into it, is it not reasonable to expect that exactly the same amount of steam will be produced? If so, where would be the harm done to the boiler beyond the damage inflicted upon the iron by burning?

If we look into the matter a little more closely, we shall find that the metallic plates of a steam boiler are not capable of containing sufficient heat to change a very large quantity of water into steam. The total quantity of heat which would raise the temperature of 1 cwt. of iron through one deg. would, according to the best authorities, impart the same additional temperature to 12 1-2 lbs. only of water. And this makes it clear that overheating is not the sole cause of an explosion, although it may lead to a rupture by weakening the plates.

The writer fortifies his position by the following account of an experiment:—

An empty boiler 25 feet long and 6 feet diameter, and with the safety valve loaded to 60 lbs. per square inch, was made red hot. While in this condition the feed was suddenly let on and the boiler filled up. The experimenters expected a mighty explosion, for which they were fully prepared, but no such event occurred, the result being simply a sudden contraction of the overheated iron, which allowed the free escape of the water at every seam and rivet as high as the fire mark extended. Although we were not witnesses of the occurrence, yet arguing upon the hypothesis regarding the action of heat already referred to, we cannot hesitate to accept the fact; the more so in that we have heard of other experiments of a similar character having been made, and which were attended with similar results.

Charles Wye Williams maintained that steam in a boiler under pressure is as much in the water itself as in the steam space. He contended that in the case of an explosion the globules of steam contained in the water and confined by pressure in a medium over eight hundred times denser than the steam alone, fly into the steam space when the pressure is removed, and expand in volume in proportion to the density of the two mediums, or over eight hundred times. The *Mechanics' Magazine*, however, adopts the theory of Mr. Zerah Colburn, and says:—

In all boiler explosions, the pressure of steam is instantaneously liberated from the surface of the hot water present