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(Illustrations are indicated by an Asterisk.)

TAPS AND THEIR CONSTRUCTION.

A good set of taps and dies is one of the most valuable properties in a machine shop, but the various forms adopted for them show that, sometimes, very little attention is given to the nature of the work required. The strain brought upon a screw thread is tremendous; in some places the lives of thousands of persons depend upon the fidelity with which the machinist has done his work; in any event, economy and good workmanship alike call for thoroughness. A discussion of the pitches proper for certain sizes of bolts is not necessary, as that question is pretty well settled now to the satisfaction of intelligent men; and if some unanimous action was held by those persons most interested on the question of adopting a standard, there would doubtless be very little further complaint made about uneven threads and fractional pitches. The office of a tap is to cut out certain parts of the iron and leave the others in relief; in plain terms, to form a thread by actually *cutting;* this is impossible with some taps, for, by the angles of the edges cutting is impossible; bruising would be a more correct term. Some roughly-made taps are cut with a chaser, and to complete the clumsy job are planed square on the sides. Such a tap is good for nothing but to raise a thread in soft metal, such as Babbitt-metal, lead and copper. It is not fit to use on steel or iron, because it does not cut its way, but squeezes the iron up into ridges. A thread of this kind has no strength, because the iron is crushed by the tap, and the fibers comprising it are twisted and torn by the passage of the tool. Taps are also made by cutting many grooves all around the circumference, which lead one way, like the teeth of a circular saw, only a little more rounded on the back. This is a good form for a tap that cuts in one direction only, or for a finishing or "plug" tap to run down, after a stouter one has formed the thread. The chief trouble with it is, that if the grooves are many in number, the edges of the thread or teeth break off and ruin the tool; this is certain to occur if the tap is turned backward; the threads will be shelled off like corn from a cob. Another form for a tap is to cut four grooves at equal distances up and down the body; these grooves are to be made with a round-nosed tool, and as the cut would be straight as the tool was fed down, the sides of the grooves must be run under, slightly, so that the teeth will be hooked, or hawk-billed to some extent; this form permits the tap to be used either way, backward or forward, without danger of breaking off the teeth or threads. Working a tap back and forth is an indispensable feature in tapping large holes, where the strength of the workman and the quality of the work render it improper to force the tap straight through. Of course, when the tap is large, the number of grooves must be increased, and for very small ones even less than four may answer.

All things considered, we prefer this form of construction over any other. The object in making a tap is to obtain a tool that will do the work well and be durable; these ends are attained in the plan mentioned. We have seen a number of "fancy" taps at various times, which would have answered for surgical operations, so keenly did they cut. Of this variety, one made like a half-round rimmer, or cut clear down to the center, performed very well, except that it had this defect—it made the thread larger at the top than below, for it was impossible to steady it when first entered.

We have also remarked the mischievous practice of using chasers on taps; such a tool is not needed and is obviously a damage instead of a benefit to the work in hand. Every tap should be finished in the lathe by the same tool that cut it, as it can be, by good workmen. No man can carry a chaser over a tap as steadily as a slide rest can move, and a little divergence of the chaser to one side or the other makes the thread uneven and irregular, or, as machinists call it, a "drunken thread." Tempering taps and dies has a very great effect upon the durability and execution of them; no matter how well the machinist performs his part, if the hardening is defective the time has been wasted. This subject will be discussed at some future period.

THE NATURE OF SCIENCE.

Many persons entertain the most erroneous notions respecting the character of science. They think and speak of it as if it were some mysterious intellectual subtlety, revealed to the few and denied to the many. Such ideas may have come down from the olden times when all men believed sincerely in mysterious powers communicated through incantations and charms by deities and spirits who had power over "the earth, the water, the air and fire." The ancient alchemists and astrologers kept what they called "science" secret, as something too sacred to be communicated to the mass of men; hence they taught favorite disciples only. Many of these old plodders in the paths of science were sincere in their peculiar views, but it must be admitted that too many of them employed secret discoveries in chemistry for the purpose of astounding their unlearned fellow-men by their curious experiments, in order to obtain power over them. Astronomy also, such as a superior knowledge of eclipses and the movements of the heavenly bodies, was employed in a sort of quack manner to obtain power by foretelling events. Many of these impostors were very like the learned Irish prophet set forth in Hibernian verse, who knew every event before it happened after it took place. Science simply means knowledge of any subject—its nature and operation; and whoever knows most of any branch of knowledge, and can apply it in the best manner, is the most scientific in that branch. Knowledge means truth, as there can be no knowledge based upon fiction. A man, however, may perform a mechanical or chemical operation in a very superior manner and yet not be scientific. A parrot can speak, but a parrot is not a linguist, nor has it any knowledge of the science of language. A man, to be scientific, should know "the why and the wherefore of the operations he performs." Mathematics is a science, but great powers of calculation afford no evidence of scientific acquisition. Some individuals, not much above the reach of idiocy, have been great calculators. Yet mathematics as a science requires a high grade of intellect and great persistency of mental effort to master. Science may be said to be a collection of facts and experience accurately arranged and properly understood. Chemistry, for example, is an art and a science, because it is a collection of the results of careful experiments. Geology is simply a collection of facts carefully arranged. A theory is not a science; it is simply the explanation of phenomena. Every science has, according to Max Muller, first an empirical stage, in which facts are gathered and analyzed. After this they are classified or arranged, and according to the inductive method, theory explains the purpose or plan of the whole.

THE POWER OF STEAM.

If water were heated in a confined space to 1,212° Fah., it would flash instaneously into steam when exposed to the atmosphere. In the use of steam as a substitute for powder for discharging projectiles in the famous steam gun of Perkins, the water was heated to 1,212° Fah., then conveyed so as to act upon the shot with all its concentrated expansive energy. Below a temperature of 1212° Fah., the evaporation of heated water is not instantaneous, and it gradually decreases until it reaches the freezing point. Specific heat is the measure of the intensity of its force, just as the intensity of mechanical force is measured by the pressure of water forced into a vessel by the hydrostatic press. It is not the quantity of water or size of the pump that forms a measure for the intensity of mechanical force, but the pressure. A strong vessel may be burst by a pump forcing water through a tube no larger than the stem of a tobacco pipe, just as surely as with one ten inches in diameter. The force which is indicated by the pressure of a vapor or gas, is the true measure of the energy capable of producing motion or work in an engine, or in discharging projectiles from guns. Heat is undoubtedly held to be the force, but it is only available in producing motion as a motive power when applied to an expansive agent.

A remarkable instance of the destructive energy of pure steam as an expansive agent is related in the report for September last, of Mr. Fletcher, the chief engineer of the Manchester (England) Association, for the prevention of steam boiler explosions. A large hay-stack boiler, intended for a chemical establishment, was being tested with steam, at 50 lbs. pressure on the inch, not produced from water in the boiler and heated by a furnace underneath, but supplied by a pipe from another boiler. The boiler to be tested was laid upon its side, and six men were engaged upon it caulking its seams, when it exploded, the bottom being blown out entire and thrown upon the roof of an adjacent building at a distance of thirteen yards; and four of the men engaged upon it were thrown to a distance of forty yards, upon the roof of another building, one of them being instantly killed. We have never heard of another such explosion. In this case the pressure of steam was but fifty pounds on the square inch, and no extra heat or pressure could be supplied; yet a great boiler, the plates of which were from seven-sixteenths to half an inch in thickness throughout, was torn in pieces, and some of the parts weighing several hundred pounds, thrown to a considerable distance. The boiler was 11 feet in hight, 8 feet 9 inches in breadth at the base, and 7 feet 9 incnes at the waist, When it is taken into consideration that at 50 lbs. pressure on the inch, this amounts to 7,200 lbs. on the square foot, some idea may be formed of the great amount of force that was confined in that boiler.

CURRENCY—MONEY.

The currency of the world includes many kinds of money. Gold, silver, copper, iron, in coins or by weight—stamped leather, stamped paper, wooden tallies—shells of various kinds—pieces of silk or strips of cotton-cloth, of a fixed size and quality—are, or have been, all in use among mankind as forms of currency, as convenient or negotiable forms or representatives of property. Many of these kinds of money are simultaneously in use in the same country. Gold, silver, copper and stamped paper co-exist as different forms of money in the currency of Europe and America; gold, silver, copper and shells in India; silver, copper and pieces of silk in China; copper, cotton-strips, shells and the silver dollar in various parts of Africa. Sparta had a currency of iron. There is ample variety in the substances out of which money is made—metal, shells, cloth, leather, paper; and moreover, every country shapes the substances, or such of them as it uses, in a different form from the others. The generic quality which constitutes money is manifestly something extrinsic to these substances—some quality superimposed upon or attributed to them, or at least to the shape they assume as currency. Gold coin is not money in China, it is silver. In England silver is not a legal tender, save to the extent of forty shillings in payment of debt. Above that amount it is simply bullion: it is no more money than brass or tin or platinum is. Half a dozen kinds of silver coin are current at Shanghai—five kinds of the dollar and the Indian rupee; but a few years ago only one of these coins, the old Spanish Carolus dollar, was a legal tender. This state of matters was remedied in the autumn of 1855.

The States of Europe have in some respects almost become a commonwealth, but the currency of one State will not circulate in another. The English sovereign, indeed, is readily taken in payment in some