ments taken from other books, and a good many of these statements were made a long time ago, and have been copied and re-copied, and have in this way come down to us. When we come to try these statements, we find that a great many of them are incorrect. One of the statements, which is to be found in all the philosophies that I know anything about, is that, if water is deprived of its air, it will not boil at 212°, but may be heated to 240°, 250°, 260°, or 270° above zero before it will boil, and then it will explode. Now, in your surface condenser you get rid of the air the first time you use the water. What I want to know is, whether there is any explosion in consequence?"

Mr. Garvey—"Mr. Chairman, this is not a mere statement of old school-books, but it has been the subject of the most recent investigations. Tyndal, in his work on heat (just published), relates his experiments in connection with the matter, in his examination of the hot springs of Iceland. In evaporating water, the heat must overcome the resistance of three forces—the pressure of the atmosphere or of the steam; the weight of the superincumbent column of water above the point where the heat is applied; and the cohesion of the particles of water to each other. When air is scattered among the particles of water, the cohesion is nearly destroyed, but, if the air is removed, this force is exerted. Vapor, however, produces the same effect as air, and this force of cohesion is not exerted unless the liquid is quiescent."

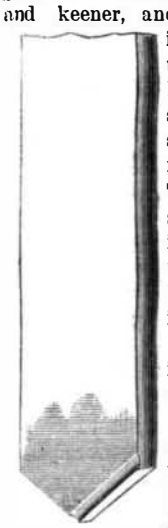
Dr. Rowell—"As soon as the vapor begins to go off, the liquid comes down instantly to 212°."

The subject of "Surface Condensers" was set down to be continued for the next evening, and the Association adjourned.

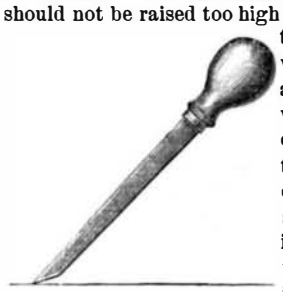
THE DRILL AND ITS OFFICE.

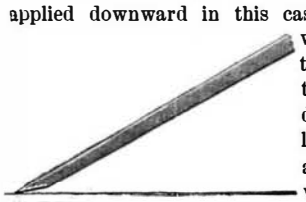
[Continued from page 165.]

For general use a plain drill without lips is as good as any, in fact better. A "lipped" drill cuts faster but gets dull quicker, because the edges are thinner and keener, and require grinding oftener; so it is a question whether it is any better for ordinary use. Where deep holes are to be drilled lips are an advantage, for the chips removed are heavier than the plain drill makes and do not clog so quickly. This is a lipped drill and consists, as mechanics know, in simply making the cutting edges hollow or thinner, so that they take a ranker hold of the metal, just as a plane iron does when pushed out too far.



A great deal depends on grinding a drill; for while the cutting edges may be all right in shape, if they are ground at too quick an angle, they are soon rubbed off on the work and do not perform efefficiently; or if one side is ground longer than the other the hole will not be round. The back part of the cutting edge should not be raised too high; in effect the cutters of the drill are two chisels which remove the iron as they revolve; now if we were to employ a chisel for cutting wood the angle of inclination of the edges to the work should be such that it would require little pressure to force them in. The tool would not be held thus, but as shown below. The force is not applied downward in this case, but in a plane, as with a screw-driver; therefore to follow out this illustration, the drill should have but little clearance behind as in this diagram, which is merely intended to show the idea and not as a pattern for a drill edge [right-hand fig.]

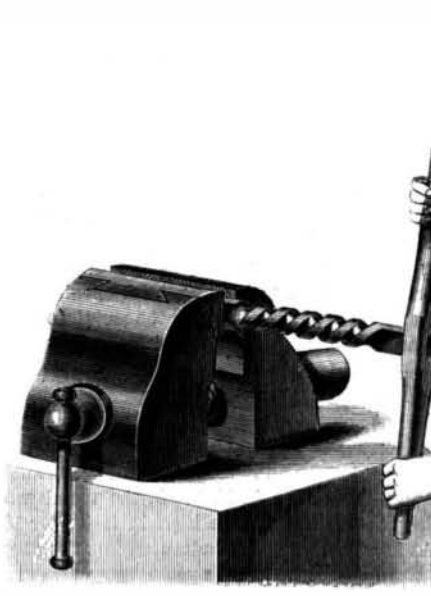




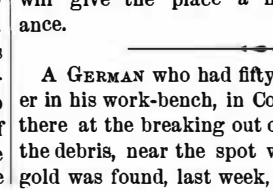
Not as some grind them thus [left-hand fig.] A planing tool also furnishes an illustration of this matter, for if a finishing flat-nosed tool was ground like the last diagram, it would do nothing but chatter, while the first would cut smoothly and without jar. These are the main points of good drills of the ordinary kind, but there are an almost endless variety of them, such as twisted, pin drills, counter-borers, &c., and each and all of these have different shapes to suit different work. It is impossible and unnecessary to go into these at length, and we shall only notice one of each kind mentioned above.

The twisted drill is another kind of boring tool used by machinists, and is deservedly popular with those who understand its construction; this is a twist drill. It has the advantage of clearing itself more easily in large sizes than a flat drill, for the cuttings or chips are raised out of the hole by the action of the threads or spiral part of the body. It is also a singular fact that this drill feeds with more ease than an ordinary drill; whether this be owing in any measure to the action of the twisted part in drawing the tool down is a matter of very great doubt, though this view is entertained by many excellent machinists; it is our own opinion that the twisted drill runs better than a straight one in deep holes, from the fact that the point and cutting edges are always clear, and at a reasonable depth it cuts as well as when first started.

Be this as it may it is important that the twists should be regular and even; *it is of the first importance*, next to the edges, for the truer they are, the more perfect will be the execution. In certain small sizes of these drills the shaft is turned like a common rod in the lathe and afterwards milled on a milling machine so as to have true grooves from end to end. The velocity with which these little drills work, or the actual duty they accomplish estimated by positive linear measurement is astonishing; we recently saw one in an armory, drilling cones, which had cut over 150 feet in steel without being ground or tempered; also some in the Waltham Watch Factory, which had shown equally good endurance. For large twist drills the plan pursued in their construction is simply to take a steel bar and draw it down on the anvil to the proper size. This bar is then heated as hot as possible without burning it, and one end inserted in a vice. If the end of the bar has been squared as it should have been, it is only necessary to put a wrench on the square and apply force by hand as shown in the engraving. The tool is then formed, but if the twists are not even they must be corrected as far as possible on the anvil. The best way to make such drills would be to devise a machine for this purpose, and we throw out this hint for such as are disposed to act upon it. Twist drills for the trade ought to be sold just as cheaply as augers for carpenters, and it would doubtless prove a profitable speculation for some one to embark in. Even if the larger and heavier sizes of drills were not thus made—that is, by contract—the smaller ones might be, with promise of profit. If we are not greatly mistaken, some shrewd mechanic addressed us on this very subject.



Here is a pin drill, some call it a counter-borer, but this is not a term which can be applied indiscriminately, for in some jobs the tool is used wholly as a drill and not as a cutter or tool to counter-bore, or drill against certain other holes. The use of this tool is to drill large holes more correctly and faster than a single drill could do it, and it is used the same as any other drill, with this exception, a hole must have previously been made for the "tit" or pin, in the work to be done. If this first hole is not straight the pin drill will not go straight, for the pin follows the first hole, which is usually small, in about the same proportion as the diagram. The first hole acts merely as a guide for the pin, and when it is made true the pin drill follows in it and takes out great curling chips of metal with the greatest facility. The pin should have very little clearance in the first hole, so that it cannot shake about, and the first hole is sometimes a trifle smaller, and the "tit" on the drill is serrated as shown below, so that it clears itself as it goes down and always fits snugly. If the first hole drilled in the work is too large, the pin-drill goes all over and neither makes a round hole or a true one. These drills are costly to make, as they must be turned in the lathe and afterwards filed up, since from the conformation they cannot be ground on the stone, although they may be sharpened on a true running stone when held by a steady hand.



There is an endless variety of counter-borers or pin-drills adapted to every class of work, but as the principle is the main thing, it is not necessary to follow or to illustrate every one. The counter-borer in one shape is used to cut out the tube holes in flue sheets, which in boilers as lately built require a great deal of time, and if the tool is not properly made many sizes are required in large shops where much work is done. This subject will be alluded to in our next article.

IMPROVEMENTS AT THE WASHINGTON NAVY YARD.—Work on the mammoth gun-foundry will soon be renewed and pushed to a speedy close. The building at one time occupied as a painters' department is being re-fitted and put in condition to become a receptacle for naval trophies, and specimens of engineering, and ordinance and arms waiting trial. The introduction of the Potomac water in unlimited quantity has rendered unnecessary the reservoir, built a few years since convenient to the principal entrance, and which was computed to hold three hundred thousand gallons; this structure has been removed, and buildings for officers' quarters are to be erected on its site. In addition to these improvements, the avenues of the yard are to be flagged with Belgian block pavement, which will give the place a neat and compact appearance.

A GERMAN who had fifty dollars in gold in a drawer in his work-bench, in Colt's armory, had to leave it there at the breaking out of the fire. On digging in the debris, near the spot where his bench stood, the gold was found, last week, melted into on e nugget.