PERMANENT COMMISSION OF THE NAVY DEPARTMENT.

We have received the following official communication, which defines with accuracy the objects for which the Permanent Commission of the Navy Department is instituted; also the correct names and titles of its members:—

"On the 11th of February, 1563, the Navy Department organized a Permanent Commission, to which all subjects of a scientific character, concerning which the Government might require information, could be referred. The fundamental rules governing this Commission are as follows:—

"'1st. There shall be constituted a Permanent Commission, consisting for the present of Commodore (now Rear Admiral) Davis, Professor Henry and Professor Bache, to which shall be referred questions of science and art, upon which the Department may require information.

"'2d. This Commission shall have authority to call in associates to aid in their investigations and inquiries.

"'3d. The members and associates of the Commission shall receive no compensation for their services.'

"Such matters as are presented to the Department, and come within the scope of this precept, are referred to the Commission for examination and report. Since the Commission was first created, it has been enlarged by adding to it Brigadier-general Barnard and Mr. Saxton; subjects are occasionally referred to it from the War Department. The present members of the Commission are also members of the National Academy of Sciences; and the Commission itself would probably never have been created if the Academy had been in existence at that time, since they both have the same objects, and are designed to perform similar duties; it is not impossible that the former may at some future time be resolved into a Committee of the latter.

"The following is a correct list of the members of the Permanent Commission of the Navy Department:—

"C. H. Davis, Rear Admiral and Chief of Bureau of Navigation.

"Professor A. D. Bache, Superintendent of the U. S. Coast Survey.

"Professor Joseph Henry, Secretary of the Smithsonian Institution.

"Brigadier-general J. G. Barnard, Lieutenant-colonel of Engineers.

"Joseph Saxton, Assistant Superintendent of Weights and Measures.

"The head-quarters of the Commission are in Washington; and all communications should be addressed to Hon. Gideon Welles, Secretary of the Navy."

THE WAY BOILER SCALE IS DEPOSITED.

Carbonate of lime is scarcely soluble at all in pure hot water, is a little soluble in pure cold water, and quite soluble in water containing carbonic acid. Cold water, exposed for a long time to the atmosphere, always absorbs its own bulk of carbonic acid; and if, while thus mixed, it comes in contact with carbonate of lime, a portion of the stone will be dissolved. Hence the hard water of our springs and wells. If this water is placed in a boiler and heated, the first action of the heat is to drive off the carbonic acid; and this action, with the raising of the temperature, deprives the water of its power of holding the carbonate of lime in solution. The salt is consequently precipitated, and deposited as a hard scale in the boiler.

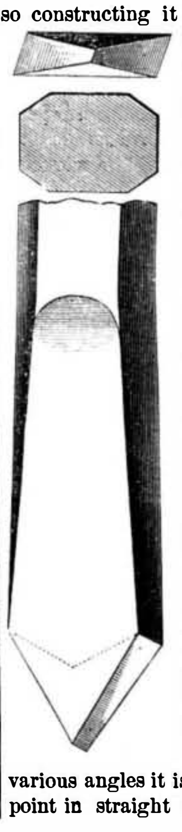
THE DRILL AND ITS OFFICE.

The office of the machinist's drill is to bore a true hole of a certain size in any metal. The conditions thus imposed upon the tool are sometimes fulfilled, but oftener not, and the reasons for this are to be found in a want of knowledge of the principle of a drill in those who made the tool, and sometimes from causes beyond the control of the mechanic; for good work cannot be made with bad materials. Three-sided holes, holes crooked in the length, holes small at the top and large at the bottom, and the reverse, ridgy holes, or those which appear to have been made with a coarse-threaded tap, oblong holes, nondescript holes, compounds of each and all the bad qualities previously mentioned, are made at times by poor workmen; and as there is no effect produced in the natural world without some cause, so also may the phenomena above mentioned be traced in mechanical operations to the omission of some important point in the construction of the drill which has been overlooked, and which is essential to its perfect operation.

To drill a straight, true hole in metal of any kind, excepting lead or copper perhaps, is just as easy as to make a wretched "apology" which runs in every direction but the right one, and is remarkable for nothing but its unworkmanlike appearance. Neither does it take more time to make a good hole, but on the contrary a properly made drill works much quicker and better than one badly constructed. We have no means of ascertaining whether drills of the present form were used by the ancients, for in all the hieroglyphics disclosed by the efforts of Layard at Nineveh, the tombs of the kings of Egypt, and in more modern discoveries at Herculaneum and Pompeii, we have seen nothing at all corresponding to the modern drill. There must have been some means at the command of these people for working metals in the manner mentioned, but their precise form is unknown to us, and their nature undisclosed. We imagine, however, that to the American mechanic of

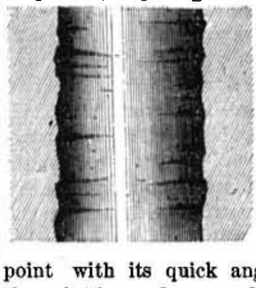
the present day it matters little whether the eye socket of a bronze pagan idol was drilled in, or cast "cored out;" and whether the nostrils of the Sphinx, which sits forever in the sands of the desert gazing steadfastly into the future, were chipped, cast or rimmed with a rose bit is not pertinent to this article. The work of the past in a majority of cases lies hidden; let it be the aim and object of the artisans of to-day to strain every effort for improvement.

To drill a simple straight hole in any metal we have the ordinary drill as herewith illustrated. This seems a very simple tool to make, but it is surprising to see what apologies and substitutes for it are to be found in almost every machine shop; below is the drill as usually and improperly made. In the first figure it will be seen that the tool is a thin flat steel bar for a proportionate distance, which should be so far as it is proposed to drill in the work; that the cutting edges are at right angles with each other or square, that the section shows the drill to be slightly rounded on its edges, and lastly, that the extreme point is as small and fine as it can be made consistent with strength. This is a plain, flat drill without "lips." Now the object and design of so constructing it is this; the drill should be made

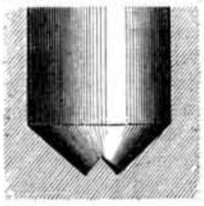


flat and straight, so that the borings may escape freely and not be crushed or broken in trying to get out; neither carried round and round for several revolutions without rising to the surface, for in doing so they impede the newly formed chips below from rising out of the hole. The point should be made thin so that it will always work true to the center, and not tend to run out, or make a crooked hole; and the cutting edges are square for the reason that with this angle they cut equally from point to corner and no part works faster than the other.

Let us take the badly-made drill, as shown in the second figure, and see what its defects are; these can readily be noticed where they depart from the well formed drill. This drill is not exaggerated in the engraving, being far short in reality of some specimens of handiwork we have seen kicking about on machine-shop floors. The dotted lines of the point and cutting edges show the various angles it is ground to, and the section and point in straight lines will now be noticed. This is a very bad drill—it is almost unnecessary to say that; it is stubbed and blunt, and could not drill an inch with decent feed without getting so hot as to draw the temper. The section is octagon, which is the worst possible form, because the chips catch at the angles and, not being able to get out, are ground to powder, requiring more power to turn the drill



than Fig. 1; the edges are sloped directly from the cutting edge to the back of the drill and the point is thick and square. With such a drill as this a hole like this one, at the left, would be made, and for these reasons: the thick point with its quick angles cuts unevenly; first the point bores down, and then the labor comes on



the edges, and the drill-point works loose, making a cone center in the hole like this diagram; the consequence is that the hole is untrue. The sharp edges sloping so quickly toward the back are also a disadvantage, because they afford no support to the cutting edges, which go astray in consequence.

(To be continued.)

Destruction of a United States Steamer by a Torpedo.

The sloop-of-war, *Housatonic*, one of the new vessels, was recently destroyed while on the blockade off the Southern coast. The circumstances of the disaster are these:—

"About 8:45 P. M., of the 17th ult., the officer of the deck, Acting Master J. K. Crosby, discovered something in the water, about 100 yards from the vessel, moving toward the ship. It had the appearance of a plank moving on the water, and came directly toward the ship. The time when it was first seen till it was close alongside was about two minutes. The torpedo struck the *Housatonic* forward of the mizzen-mast, on the starboard side, in a line with the magazine. The after-pivot gun being pivoted to port, they were unable to bring a gun to bear upon the torpedo. About one minute after she was close alongside the explosion took place; the *Housatonic's* sinking stern first keeling to port as she sunk. Most of the crew clung to the rigging, and a boat was despatched to the *Canandaigua*, which vessel gallantly came to their assistance and all were rescued but the following named officers and men: Ensign E. C. Hazeltine, Captain's Clerk C. O. Muzzy, Quartermaster John Williams, landsman Theodore Parker, second-class fireman Jno. Walsh, who are missing and supposed to be drowned."

The rapidity with which this torpedo approached the vessel would seem to indicate that it was propelled by some machinery. Vessels lying at anchor, on blockade duty, should be protected by rafts or booms projecting from the side, having lines rove through the ends all around the ship. In this way those incendiary machines would be prevented from doing much mischief. The arrangement could be made very simple and yet effective.

Delay in raising the Monitor "Aquila."

Our California exchanges are in tribulation over the delay in raising the sunken monitor; one correspondent writes as follows:—"The delay in raising the monitor by some one of the feasible plans before the public, because it cannot be determined which is the best, may subject the city to the fate recorded by the poet of an ancient worthy, to wit:

> The great Bomfogus, who of old
> Wore his legs bare, and died of cold.

Because he could not decide whether to put the right or left leg first into his breeches, and therefore went breeches-less, and met with the catastrophe recorded of him. The lady Bomfogus urged him by all feminine entreaties to put one leg or the other into his inexpressibles, no matter which. "But how can I," replied the great Bomfogus, 'when I have not yet decided which is the proper limb to take the predence?' And so he died of cold. And so our fair city lies out in the cold, defenseless, while our Bumfogi are seeing which is the proper plan to raise the *Aquila*."

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."

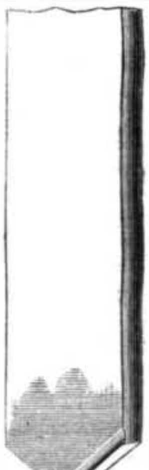
Dr. Rowell—"As soon as the vapor begins to go off, the liquid comes down instantly to 212°."

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

THE DRILL AND ITS OFFICE.

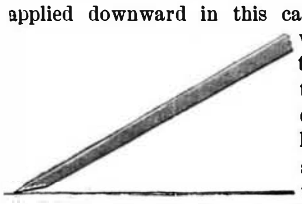
[Continued from page 165.]

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.

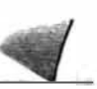


A great deal depends on grinding a drill; for while the cutting edges may be all right in shape, if they are ground at too quick an angle, they are soon rubbed off on the work and do not perform efficiently; or if one side is ground longer than the other the hole will not be round. The back part of the 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.]



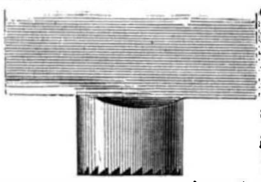
Not as some grind them thus [left-hand fig.] A planing tool also furnishes an illustration of this matter, for if a finishing flat-nosed tool was ground like the last diagram, it would do nothing but chatter, while the first would cut smoothly and without jar. These are the main points of good drills 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 one nugget.

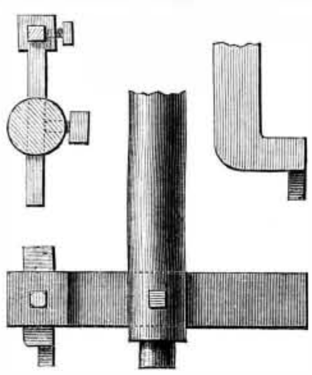
and fan or resistance shaft. The Commission are under the belief that they will be able to determine with sufficient accuracy the actual power to drive the fan shaft, without any fans on it, and the power to drive one or more fans, up to twenty, and that they will therefore be able, not only to determine the relative economy of using steam with different measures of expansion, but the actual power developed, expressed in pounds, raised at an ascertained velocity, and therefore expressible in horse-power—the conventional unit of power."

The commissioners are Horatio Allen and B. F. Isherwood. The engine is now well under way at the Novelty Works, in this city. The experiments will be conducted in a building on Fourteenth street, New York. When they take place we hope to be present.

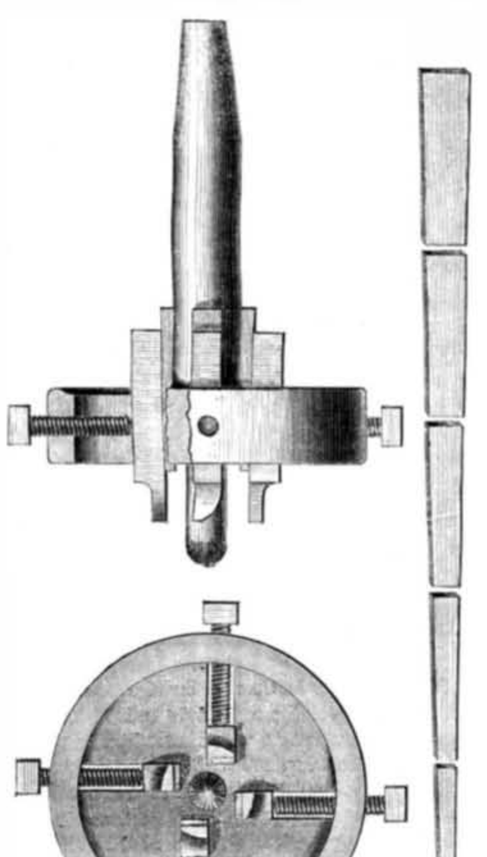
THE DRILL AND ITS OFFICE.

[Continued from page 181.]

Here is a plan for an expanding or an adjustable tool by which holes in flue sheets can be made of any size, varying only with the plan of the cutters. The apparatus is very simple and by altering the shape of the cutters, a hole but little larger in diameter than

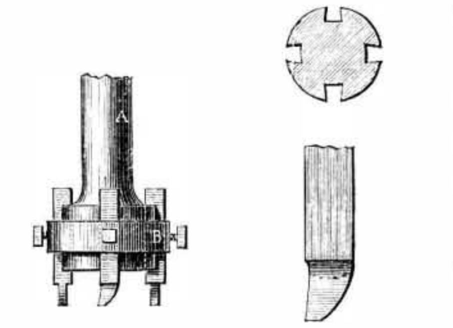


he rod or shaft that carries the arm can be made. The advantages of this appliance over an ordinary drill, such as is frequently used, are that the cutter, which breaks often even with the utmost care, can be



easily dressed when broken in much less time than the counter-borer could, thus making it cheaper to use both in point of execution and cost of repair when injured. We are indebted to Mr. Herman Winters, an accomplished engineer, now with Donald McKay, Esq., of Boston, Mass., for the plan of the tool presented above. It is, as may be seen, adjustable, and will cut holes of varying diameters, according to the sizes it is constructed for. The arrangement is simple and consists of a central head forged solid on the shank. This head is planed out for the reception of the tools or cutters and has further a wrought iron ring shrunk over it. This ring is tapped out to receive the set screws which hold the tools fast. Behind the tools are wedges which, when driven or slacked off, advance or retract the cutters with great nicety, the taper is planed in the shank for the wedges, so that the cutters always stand vertically. The wedges should all be planed at once so that there will be no variation in them, and several sizes should be provided so that holes of any diameter can be made. The cutters need not all travel in the same track, but each may set a little inside of the one that forms the size; in this way they cut freer and are less liable to break. This tool is useful not only in the boiler-shop but also in the finishing department, for by changing the character of the cutters, work of almost any kind can be done.

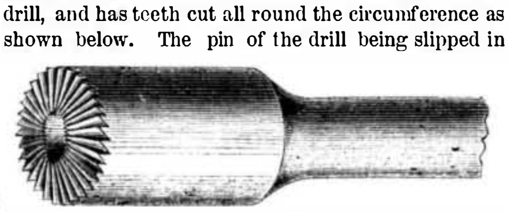
Here is another plan for a boring tool or tube sheet-



borer more properly, for this is the object it was designed for. It is not so good a tool as the first one for some purposes, but as all persons may not have the same opinion we give it place. It is not adjustable except limitedly, it costs more to make at first but it will work faster and do equally as good, if not better work than the ordinary adjustable cutter. The bar, A, is merely forged with a larger portion on the end, and is grooved on four sides to admit the cutters; these are simply square nosed, offset on one side and the cutting part, of course, curved to suit the circle it works in; a wrought-iron ring, B, is then slipped over the cutters to hold them firmly in place and adjust them so that all the points may work at once; this ring has set screws for each cutter and one of the cutters may be made to countersink the sheet at the same time if it is preferred to do it on the side drilled from. The burrs or ragged edges left on the under side of the sheet by this tool will be very slight indeed if it is properly made, and can be rubbed off with an old file.

Still another drill for boring tube sheets is given herewith. It is one commonly used and is a very ef-

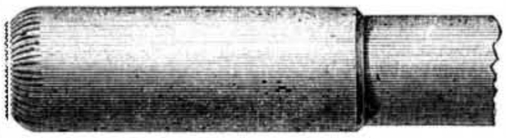
ficient tool when well made. It is costly to construct, however, and requires to be turned in the lathe by an experienced workman and afterwards filed up so as to cut properly. The spaces between the pin and the cutters are very troublesome to cut out in the lathe with an ordinary tool, as the work in revolving strikes square and suddenly on the lathe tool and soon dulls it or else breaks off the end and throws the drill out of the centers. A useful cutter for making these drills is shown below. It is simply a steel bar turned up and bored out the size of the tit or pin on the drill, and has teeth cut all round the circumference as shown below. The pin of the drill being slipped in



the hole in this cutter, the radiating teeth cut away the central portions so difficult to remove in the lathe. The drill may revolve in the steady rest, or the barrel cutter may be so used and the work screwed up to it by inserting the center in the dead center of the lathe; by employing this tool much time may be saved and better work done.

A work might be specially devoted to this detail or part of the mechanic's tool-chest; the drill is one of the most indispensable of the minor instruments employed by mechanics and it is only reasonable to add that the tool most in use, simple though it be, deserves all the attention that can profitably be given to it.

Although the rose bit is not in any sense a drill, it is of the same class, and is indispensable to good work in the drilling machine, for if a man does not know how to grind a drill or make one, and the holes he makes are neither round, square, nor oval, then he has only to use the rose bit and he will have a perfectly round straight hole. This is the bit. It may



be made wholly of steel or the shank may be iron, and the cutting end only of steel. The end is composed of a series of fine cutters arranged regularly all around, and the body is a shade smaller at its upper end than at the lower. When the hole is drilled in the work to nearly the right size, the drill is taken out and replaced with this bit, which cuts regularly and steadily all around and corrects any untruth in the first hole. There should be but very little metal left for it to work on, and the job must be well oiled during the process. If these conditions are observed the hole will be a true cylinder.

Antidotes for Strychnia.

The *British Medical Journal* says "Professor R. Bellini, after conducting a long series of experiments on poisoning by strychnia and its salts, arrives at the opinion, that the best antidotes are tannic acid and tannin, chlorine and the tinctures of iodine and bromine. Chlorine, he maintains, attacks the strychnia even when it is diffused through the system, for he found that in rabbits poisoned with the sulphate of the alkaloid, on being made to inhale chlorine gas in quantity, such as was not sufficient in itself to kill, the convulsions were retarded, and were milder when they occurred; death, also, was less rapid. The author further observed, that when strychnia was exhibited with pyrogallic acid, the convulsion was retarded for the space of half an hour, by comparison with other experiments in which the alkaloid was given by itself. Professor Bellini believes that this arrest in symptoms is not dependant on the acid acting chemically on the strychnia, but only through the astringent effects produced by the acid on the mucous membrane of the stomach, whereby the absorption of the poison is rendered difficult. The same author, dwelling on the frog-test for strychnia, asserts that this test is not be trusted, inasmuch as other poisons produce the tetanic symptoms, although in a lesser degree."

SPECIAL NOTICE.

Lewis Moore, of Ypsilanti, Mich., has petitioned for the extension of a patent granted to him on July 2, 1850, for improvements in seeding apparatus of seed planters.

It is ordered that the said petition be heard at the Patent Office, Washington, on Monday, June 13, 1864.

All persons interested are required to appear and show cause why said petition should not be granted. Persons opposing the extension are required to file their testimony in writing, at least twenty days before the day of hearing.

Business done in the Patent Office.—From a report communicated by the Commissioner of Patents to Congress, it appears more business has been transacted than during any year in the history of the Government, excepting 1859 and 1860; 6,014 applicants have been received; 4,170 patents have been granted; 787 caveats have been filed; 40 applications made for extensions have been granted. Of the issues, 48 were to English inventors, 37 to French, and 27 to persons of other nations. The funds on hand January, 1863, were $38,400; the amount received during the year, $195,600; expenses, $189,400, of which $143,000 were for clerk hire. Balance on hand January last, $44,600.

of the places struck. The plates were of undoubted excellence both in the quality of the metal and in their manufacture. Messrs. Brown's plate was then selected for firing against, with improved cast iron spherical (crucible) shot from the Elswick 100-pounder smoothbore gun, (diameter of bore 9in. and weight 120 cwt. 2qrs.,) with a charge of 25lbs. of powder. Three shots were fired. No. 1 struck the lower edge and touched a bolt. It produced an indent of 4in. at its greatest depth, with a diameter of 9½in., and with only a surface crack round the indent. No. 2 struck just over the lower edge, producing an indent of 10in. in diameter and a greatest depth of 3 8-10in. with a slight surface crack in the indent. Both these shots were destroyed in the ordinary manner of casting projectiles. No. 3 shot struck fairly on the plate, and part of it remained fastened in the plate's outer surface. It will be seen that the damage inflicted by these improved cast-iron shot was hardly commensurate with their increased weight and the extra 9lbs. of powder charge as compared with the 68-pounder gun. The Millwall plate had next three steel shot sent against it from the same Elswick gun, with a similar charge of 25lbs. of powder, the result being—No. 1 shot struck about 4in. below the upper edge of the plate, a distance away from any damaged part, and breaking right through, buried itself, and the broken parts of the plate in the ship's side 12in. beyond the plates inner surface. No. 2 shot struck the plate in a central and undamaged part, went clear through and buried itself with the broken fragments in the side of the ship, the outer surface of the shot being 3in. below the plate's outer surface. No. 3, the last shot, also struck the plate in a central and undamaged part, and about 2ft. aside of the last shot. It cuts its way in with 9½in. diameter, about one-third of the plate thickness, and then carried everything before it on the lower deck of the target ship. The shot in passing through the broken pieces of plate increased the diameter of the hole it made on entering the plate from 9½in. to 3ft. at the other end. It passed entirely through one side of the ship, and struck against the opposite side. The shot entering the plate by a hole 9½in. diameter passed into the ship by a hole 3ft. in diameter, tearing five planks away from the inside, and covering both sides of the deck for some distance round with broken pieces of wood and iron. One piece of plate, measuring 17in. by 14in. was picked up on the ship's deck, 15ft. from the side of the ship where it had entered with the shot. The shot itself was found on the opposite side of the ship's deck, and was but very little changed in form.

Estimating the Weight of Cattle by Measurement.

The *Canada Farmer* in reply to a correspondent, says :—

Many experiments have been made by graziers and salesmen to ascertain the net weight of cattle by measurement, and a number of rules and tables have been formed from the results obtained. None, however, can be regarded as absolutely correct. With the most accurate measuring is required a practical acquaintance with the points and forms of animals, and allowance must be made according to age, size, breed, mode and length of time of fattening, &c. ; conditions which require a practical eye and lengthened experience to correctly appreciate. We have found the following method to lead generally to trustworthy results :—

Measure carefully with a tape line from the top of the shoulder to where the tail is attached to the back; this will give the length. For the girth, measure immediately behind the shoulder and fore legs. Multiply half the girth by itself in feet, and the sum by the length in feet, and the product will give the nett weight in stones of 8 lbs. each. For example, with an ox or cow 5 feet in length and 7 feet in girth, the calculation will be as follows:—

Multiply half the girth by itself in feet	3.5
	3.5
	12.25
Multiply by the length in feet	5
Weight in stones	61.25

THE DRILL AND ITS OFFICE.

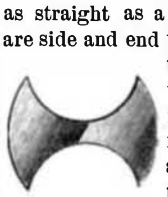
[Continued from page 213.]

In our last article on this subject we considered counter-borers or composite drills, and we will now allude to the same class on different plans.

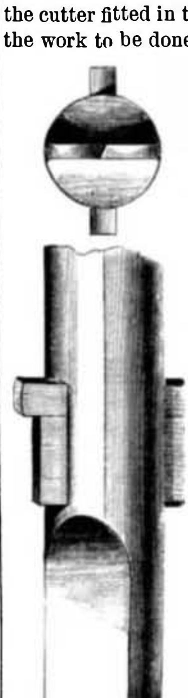
There is still another kind of drill for peculiar work which is employed by some machinists, though for our own part we see no special virtue in it, for it is troublesome to use and to make, and very liable to break. It is called the tit or center drill and here is an engraving of it.

The center marked out by the punch is of course the point where the tit is inserted on the work. This tit is the cause of all the trouble with the tool; it must be filed up in the vice, it tries the tool-dresser's patience to harden it, for the small quantity of metal in it compared to the heavier parts in proximity causes it to get hot in the fire more speedily and also to cool quicker, so that while the cutting edges are of the right temper the tit is soft or hard as the case may be; for all ordinary purposes the common flat drill is far superior.

Another kind of drill is illustrated below; it is a turned drill and will go, if it runs true in the machine, as straight as a die in the work. These two figures are side and end views; the tool is simply forged and then turned up in the lathe afterward, and it is much used for drilling holes in the tube sheets of surface condensers.

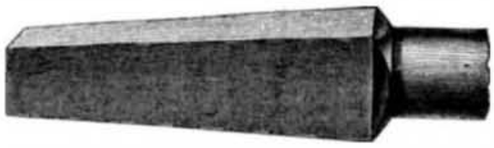


Composite drills are those made by combining cutters with drills in such a manner that while the hole is being drilled or just after the operation, it is also countersunk on top, or counterbored to a certain depth; and this without removing the drill from the hole, thus saving a great deal of time. When the tube sheets of surface condensers are drilled, such tools do good service, for the vast number of holes requires some such method to render it economical as well as to expedite the job. The plans for a drill capable of being used for such work are given below. The drill is simply a turned steel bar flattened on the end for but a short distance; as the plate to be drilled is not thick it does not require to be long but should be made as short as possible. There is a key-way or slot, in the shank in which the cutters are set, and secured by a small key at the back. The shape of the cutter fitted in the key-way, of course varies with the work to be done, and the corners may be rounded off to make a round-bottomed hole, or made to conform to any pattern desired, and the key may be made short so that the cutter can go clear through.

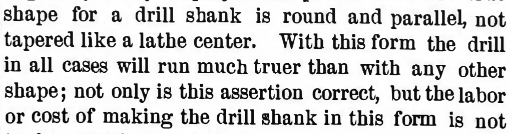


Drills of this kind are also extremely useful for counter-boring in lathes; a dog may be slipped over the round shank and screwed up while the center in the drill shank is received by the dead center of the lathe. It is much more economical to use a tool of this kind where the circumstances admit of it, than to bother with boring tools of the usual pattern. It is in the minor details of this kind that workshop economy may be practiced to advantage, and there is nothing that calls more for the exercise of ingenuity than the simple matter of drilling holes speedily and accurately. In every instance it must be borne in mind that it is of the utmost consequence that the drill should run *true* on its end. Without this the finest temper and the best shape are of no value, and it is impossible to do good work where the point of the drill describes a circle of greater or less diameter.

From specific designs of drills let us depart at present and turn our attention to the other end of the same tool, where we shall find something worthy of attention. We might fill page after page with drills of peculiar shapes; those with and without lips, those with lips or cutting edges curved so that a section would be like this, ∞ ; others with round corners, &c., but as the main principles of drills have already been given it is not necessary that we should follow out every design, as it would interfere with more important matters. Let us look at the drill shank. It is a common and a favorite expression with many that the minor trials of life cause more sharp annoyance and vexation than severe visitations. Be this as it may, it is very certain that the simple matter of the formation of the drill shank has caused more profanity, delay, and actual pecuniary loss than any similar part of any other tool. The shank is in general made square and taper as in this engraving,



and the adherence to this form, the most injudicious and expensive that could be devised, is remarkable. Drilling machines upon new plans are made every day, and are fitted with some ingenious device for expediting the work, but for some inexplicable reason the spindle is squared out, duly tapered, and with—the hight of absurdity—a set screw in addition. It is among the impossibilities of mechanical practice that a square-shanked drill should ever run true by any possibility except one involving great expenditure of time and consequently money. It must be acknowledged by every unprejudiced person that the true shape for a drill shank is round and parallel, not tapered like a lathe center. With this form the drill in all cases will run much truer than with any other shape; not only is this assertion correct, but the labor or cost of making the drill shank in this form is not to be mentioned with a square or taper one. The round hole in the spindle of the machine is capable of being wholly finished in the lathe, so that when it leaves that tool it is completed and does not require to be chipped out or even filed. Squaring the hole makes it untrue with the center of the spindle, even when great care is used, and the drills themselves have to be forged exactly alike or else they will not fit. In a shop where there are thirty or forty drilling machines and a thousand drills there are scarcely any two alike, and when a square-shanked drill is put into a squared spindle, the point describes a circle of no small magnitude. Then comes the corrector of this evil—bang goes the hammer—the drill falls out, and a piece of emery cloth is wrapped about it because it is rough and holds better; the tool is replaced and the same process goes on again and again, sometimes varied by breaking the drill short off at the shank, at others only succeeding after much time and trouble in making the drill run true. Each time it is dressed the drill is altered so that it is no exaggeration to say that it never runs twice alike. The set screw is a nuisance, it is of no use at all; when set up to its place it strikes one-sided, and instead of securing the drill actually pushes it out. How easy it would be to avoid all this complexity by making the shank in this form, or forging the drill of round



steel ! There are many advantages in this, although round steel is not uniformly of as good a quality as square steel. The most marked advantages are lessened first cost of construction, greater efficiency of the tool itself and less time expended in straightening and setting the drill ; a standard size for all drills so that each one will fit every machine in the shop, and less work in making the drill machine itself. The taper round shank drill is not so good for these reasons : It costs more than either of the others, it is troublesome to get out of the machine, for a key has to be driven in at the end, which often gets lost. The hammer is used to loosen the drill by men too lazy to take the key when it is not lost; the taper gets bruised by the blacksmith in dressing the drill; when the drill has to be upset, as it does at times, the taper is injured on the end and don't fit without filing, and lastly it cannot be extended as the straight round shanked drill can. By this we mean that sometimes a drill is just an eighth or one-fourth too short to go through the work with all the screw that can be got. If a taper round-shanked drill is used the workman must either get another or else derange his work to block it up higher; but if we have a straight shank we may put a piece of round iron in the spindle and let the end of the shank bring up against it, and thus attain the end with but little trouble. Thus the straight round shank appears to have decided advantages over any of the other plans.

This article concludes the series under this head, but we shall at an early date present some views of the latest turning tools in connection with those formerly used, so that the new and the old may stand side by side for a verdict from the impartial.

Another article entitled "How to lay up an eight strand gasket," fully and completely illustrated, so that any person can make one as easily as a child braids its hair, will be given in an early number. This will be a useful article to engineers and they should not hesitate to avail themselves of it.

The Sunken Monitor "Comanche" at San Francisco.

Many of our readers are aware that the vessel which carried out the California monitor-battery sunk alongside the dock in San Francisco with the battery on board, in pieces. It seems there was not skill enough in California to raise the ship, and they are now working at her contents piecemeal; the progress made is thus recorded by the *Bulletin* of San Francisco :—

"The wrecking party has been working most successfully in recovering the portions of the *Comanche* stored in the between-decks of the *Aquila*. Their operations have resulted thus far in getting about 350 tuns of iron work, and it is believed that the whole between-decks will be cleared out in a week. All the most important parts of the *Comanche's* machinery have been recovered, as well as the turret plates, pumps and attachments. When the present deck is cleared of cargo, the same programme of operations will be gone through with in the lower hold, the work of discharging to be commenced aft, and thence forward. This action on the part of the wreckers is made necessary on account of the position of the ship, the stern being the highest part. Captain Merritt thinks that the 15-inch guns will be got out in about 20 days from date, by which time he will have worked from aft up to the main hatch, where the guns lie. It is Capt. Merritt's intention, if possible, to discharge the *Aquila* entire, with the exception of boilers, before attempting to raise her, for which purpose he is now having made 8 large air-tight wooden boxes or camels. These 'camels' are made of heavy timbers, strongly bolted, which are covered on the bottom and top with 4-inch and on the sides with 3-inch planking the whole being thoroughly caulked and pitched. They are to be 32 feet long, 12 feet broad, and 7 feet 3 inches wide, and are estimated to have a lifting capacity of over 80 tuns each. To each of these camels two heavy chains drawn under the wreck are to be attached, the strength of which is deemed sufficient to lift the *Aquila*. In addition, considerable lifting power is expected from the boilers, which are in the lower hold. These boilers are represented to be very large, and to have been placed in the ship's hold completely air-tight.

Pure Copper Paint.

A new pigment, calculated at the same time to increase the resources of the decorative painter, and to afford a ready means of preserving iron and other metals, has recently been introduced at Paris by M. L. Oudry of the Auteuil Electro-Metallurgic Works. He first obtains a pure copper by throwing down the metal by the galvanic process ; he then reduces the precipitate to an impalpable powder by stamping. This powder is then combined with a particular preparation of benzine, and used in the same way as ordinary paint; beautiful bronzed effects are produced upon it by means of dressing with acidified solutions and pure copper powder. The articles painted with the new material have all the appearance of electro-bronze, whilst its cost is less than one sixth; it will last from eight to ten years. Mr. Oudry also proposes to substitute benzine oil for linseed and other oils, over which he states it possesses great advantages.

Correspondence

The Comparative Efficiency of the Screw and the Paddle.

MESSRS. EDITORS :—Seeing on page 67, current volume of the SCIENTIFIC AMERICAN, a notice of a trial of speed between the paddle-wheel steamship *Asia* and the screw steamship *City of Edinburgh*, in which the paddles came off victorious, perhaps I will be excused for making the following communication on the subject of screw propulsion—a subject of interest to many.

Perhaps the screw-propeller has arrived as near perfection as it ever will. English engineers, as a rule, seem to prefer a short pitch of screw, while American engineers appear to like a long pitch ; the efficiency of each form depends mostly on the sort of craft to be propelled—if for freight, a short pitch is the best ; if for speed, a long pitch is preferable. This has been established by experiment with different wheels on the same boat ; but the question of speed with similarity of model for screws and side-wheels has never been decided by actual experiment since the screw has arrived at its present perfection. Such experiments were made in the early days of using the screw as a propeller ; they are recorded by Bourne in his "Treatise on the Screw Propeller," the last of them were made in 1849, since which time the screw propeller has been much improved. In those experiments the paddle-wheel steamer did not run so fast as the screw, except when indicating more power; with the same indicated power on both, the screw was the faster. If such experiments could be made *now*, it would settle the question for a long time to come, at least until one or both are further improved.

Great improvements have been made in the engines for propellers, and there is room for still further improvement ; but to get as good speed, screw vessels must have as fine "lines" as the paddle ships. Screw steamers are seldom made so sharp, and never, I think, with so much engine power, every thing else being equal, as those with side wheels. When this is done, screw steamers will have better speed than side-wheel ships built for the same carrying capacity. The steamer *Water Witch*, lost on Lake Huron last Fall, was the only one ever built on the lakes with as fine lines as side-wheel ships commonly have. Her model was made for side wheels ; she was 170 feet long and 26 feet beam, was propelled by a Loper wheel, 9 feet diameter and 18 feet pitch, making 75 to 80 turns per minute; this was driven by a beam engine, set athwart-ships, and geared to the propeller shaft. Her speed and seaworthiness were remarkable ; she made as good passages and carried more freight than side-wheel boats of the same tunnage ; and it is believed, by those familiar with such things, that had she been fitted with paddle-wheels, with the same engine, her speed would have been much less with the same load.

It is not possible, perhaps, to apply as much power to one screw wheel as to two side wheels with advantage ; but two wheels, one under each quarter, have been used with much success on the lakes for a long time, and with separate engines. There was an account published in the London *Illustrated News*, dated Nov. 29th, 1862, of a screw steamer with two wheels and independent engines ; that being the first of the kind ever built in England, and they seem to have been used on our own coast but a few years ; while it is nineteen years or more since such arrangements were used on the lakes.* A propeller was built in 1845, at Malden, C. W., of about 300 tuns, fitted with two wheels and separate engines ; for a long time she was a first-class propeller. She was originally called the *Earl Cathcart ;* but her name has since been changed to the *F. W. Backus*. She is now in existence, and ran last summer on the "Chicago and Lake Superior Line."

If two vessels were built from the same lines and the same power applied to both, say to two screws, if they were light draft of water, let both be loaded the same, and when indicating the same development of power, I think the screw would run the faster. Side-wheel boats are the best for river and light-draft navigation ; but for 10 feet draft and over, screws will demonstrate in time their superiority over paddles. J. W. C.

Sugar Island, Mich., Feb. 22, 1864.

[*The *Quinebaugh*, an old propeller running to Norwich, Conn., some years ago, had two screws driven by one engine. It was built by C. H. Delamater in—we think—1848; certainly as long ago as that. English engineers have made so much ado over twin screws, claiming precedence among one another for the idea, that one would think they had invented them; but after twenty years use in this country they are just found to be novel and advantageous in England.

The Drill and its Office.

MESSRS. EDITORS :—On page 181, present volume of the SCIENTIFIC AMERICAN, in your article on Drills, I noticed some excellent remarks ; but in the engraving of the "twist drill," the construction is wrong—the lips are flat like the common drill, and would cut no better. The twist should continue to the extreme edge of the lip. I believe a twist drill properly made, and of the right temper, in the hands of a workman who knows how to use it, will drill more inches without sharpening than any flat one can be made to do. The only reason why the twist drill feeds easier is because the angle of the lip is more acute than the flat one. The flat-lipped drill will feed as easy as the twist, the angle of cut being the same. I think it important that the pod or shank be evenly finished, but quite as important that the twist should be irregular, or a "gain" twist. I find in practice that the best twist is about one turn in two inches at the point, and gain to one turn in three inches at six inches from the point, that is for drills of one-half inch and upwards. Smaller drills require a finer twist in proportion. The serrated "tit" on the counterborer would spoil the tool for a good work man. To get a good hole and countersink, the first tools should be rimmed to fit the "tit," and the tit should be rounded, then you would have a perfect hole. The manufacture of twist drills by machinery has been in progress for some two years in two places —South Bridgewater, Mass., and Newark, N. J. The manufacturers, I believe, make any size ordered ; but I think that there are none so good as the hand-made ones. A. M. W.

New York City, March 28, 1864.

[We are very glad to receive such sensible criticisms as the one above, and we take pleasure in publishing them even though they conflict with our own views, for every man has a right to be heard. Our correspondent must bear in mind, however, that all men are not accomplished mechanics ; and while the use of the serrated tit would be objectionable in *standard fine work*, in common jobs it is not only useful but indispensable, as in drilling many holes for the tit, some of them will be smaller than the others, even if the drill is never ground, for the wear of the sides is a considerable item; then it is that the serrated tit is useful, for it cuts its way through whether the hole be small or not. There is this objection to continuing the twists to the very lip of the drill—it makes the edge too thin, so that it is more like a wood-cutting tool than one for iron. Such a drill may work well for a few holes ; but in the long run and with men of average intelligence, the drill we illustrated is really better to be straight for a quarter of an inch at the end than to have the twists run to the edge, for in drilling down a quarter or half an inch no drill clogs, and after that distance the twists take hold of the chips and raise them. A "gain" twist may be better than a regular turn; but it strikes us that our correspondent's figures are too quick in the pitch, and that in long holes the sharp pitch would hardly effect the object.—EDS.

Do Ladies appreciate Science ?

MESSRS. EDITORS:—I hope you will excuse me for occupying your time while you read this, as I have really nothing of importance to say, except to fulfill the desire I have long entertained of expressing to you my high appreciation of your paper, which I have weekly perused, with a greater satisfaction that any other journal, for several years past. I find that the SCIENTIFIC AMERICAN is not only acceptable to mechanics as a promoter of their interests, but it is attractive to the *ladies* in the highest degree. My wife would sooner give up the "picture papers," lov