The International Exhibition of 1876.

English manufacturers have scarcely done with the Vienna Exhibition of 1873 before they are officially invited to take part in a similar international demonstration in 1876. This time, however, the scene shifts from the old world to the new—from Vienna to Philadelphia—the actual *raison d'être* of the exhibition being to celebrate the hundredth anniversary of American independence. For this purpose, a large part of Fairmount Park, one of the boasts of Philadelphia, has been allotted, and since many months engineers and contractors have been pushing on the work with untiring energy; for although a year has yet to pass before the exhibition opens, unceasing labor will be necessary to complete the task.

We shall in due time publish full drawings of the designs and construction of the various buildings, but we may take this opportunity of giving some idea of the scale of the exhibition. There will be five main structures—the Industrial Hall, the Machinery Hall, the Art Gallery, the Horticultural Pavilion, and the Agricultural Hall. Besides these, there will of course be the numberless smaller buildings in the park, which will spring up of necessity in all directions.

The main building is constructed chiefly of iron and glass, and in its general design bears a marked resemblance to the Great Exhibition of 1851. It lies about due east and west, and covers a rectangular area 1,880 feet by 464 feet in width. The greater part of this large building is only of one story, the hight being 70 feet. At the corners are four towers 75 feet high, and in the center of the building the roof, for the space of 184 feet square, is raised, and at each corner is placed a tower 120 feet high. The total areas of this building are as follow:

	Acres.
Ground floor	20·02
In galleries	0·85
In towers	0·60
	21·47

In the direction of its length, the building is divided into seven parts. In the center is a main avenue 120 feet wide and 1,832 feet long; on either side is an aisle 48 feet in width, then two more avenues each of 100 feet, and between them and the wall of the building on each side are two other aisles of 24 feet. Three transepts of the same width, and divided in the same way, break up this enormous hall, and destroy the monotony of a long, unbroken roof line.

The Machinery Hall is also on a grand scale, but neither its design nor construction call for special remark here. It is 1,402 feet long and 360 feet wide, with an annexe 208 feet by 210 feet, and the area covered is 12·82 acres, the available floor space being 14 acres, including the galleries. This building is divided into two main avenues, each 90 feet wide, with a central aisle, and one on each side, all 60 feet wide. In the center is a transept 90 feet wide. The annexe already mentioned is to be devoted to the exhibition of hydraulic machinery.

The Art Gallery resembles somewhat in general design the corresponding building at Vienna. It is built of granite, iron, and glass, so as to be practically fireproof. It is 365 feet long, 210 feet wide, and 71 feet in hight.

The Horticultural Building is a large and elegant structure of glass and iron, 383 feet long, 193 feet wide, and 72 feet high. The Agricultural Hall is also of great dimensions, and of some little architectural pretensions. The materials employed are wood and glass. The general plan consists of a long nave crossed by three transepts, and the leading architectural feature is a Gothic Howe truss. The nave is 820 feet long and 125 feet wide. The central transept is 100 feet in width, and the outside ones 80 feet, the hight being about 75 feet.

Such is a very general outline of the exhibition buildings, which, covering an area of about 50 acres, will be opened in Philadelphia in May, 1876, and to which English manufacturers are invited to come with their exhibits. It should be mentioned that it is not a government undertaking, but simply a public enterprise, to which, however, the government has lent its support by a payment of some $200,000. The responsibility of failure or success rests, therefore, with the promoters; but we believe we may say with certainty that American public spirit will carry through the exhibition to a triumphant conclusion, even if a pecuniary loss should be sustained. With this matter, however, we have little to do, but it is a question of paramount importance whether there exist sufficient inducements to English manufacturers to encourage them to come forward as they have done at previous foreign international exhibitions, or whether the probable disadvantages are too certain to justify their incurring the large expense and great trouble which must inevitably attend the representation of British industry.

It must be evident at once that the disadvantages, if not many, are at least serious. The distance to be traversed, and the cost attendant upon the transport of goods, are of themselves sufficient reasons to discourage many, and we think it is to be regretted that the English Commission can offer no facilities for free transport under government aid, such as will doubtless be afforded by some foreign governments. But the most serious objection is found in the existence of the prohibitive import duties, which rule in the United States, and which effectually check competition of foreign with native manufactures in many branches of industry. Again, the English manufacturer fears, and doubtless his fears have some good foundation, that any special merits possessed by the objects he exhibits will, unless protected by patent right, or by secret of production, be copied or improved upon by some appreciative American competitor. These objections must weigh most powerfully with a large number of manufacturers, and especially with those who would, under more favorable conditions, crowd the space allotted to the British section in the Machinery Hall.

On the other hand, the Philadelphia Exhibition offers strong inducements to exhibitors, above all to some of a certain class. The facilities afforded by the United States patent law have been taken advantage of by a large number of inventors, who, having thus secured their inventions, have every reason for gaining as much publicity as possible, and may do so, not only without fear that they will be grossly pirated, as was the case in the Paris and Vienna Exhibitions, but with the certainty that, if the invention is of such a nature as to create a demand in the United States, they will be able to make advantageous arrangements during the period of the exhibition, either for the sale of their American patents, or for the granting of licenses under them. British exhibitors will also be dealing with an English-speaking, appreciative nation, always eager to adopt anything of promise.

Another powerful inducement is found in the fact that English manufacturers will not contribute their exhibits only for the inspection of United States visitors. For a long while past American manufacturers have been pushing their trade with great success in the various countries of South America, and these countries will look with interest to the Philadelphia Exhibition as a means for making them better acquainted with the United States market. If English exhibitors refrain from contributing, they will lose the opportunity thus afforded of entering into direct and profitable competition, as the objection of prohibitive tariffs does not apply in this connection, and English makers can far outstrip those of the United States in point of price.

In all branches of the industrial arts, English exhibitors have strong reasons for being present, because not only can the producer in this country compete even in the face of the high duties, but the people of the United States, while they possess keen appreciation of the beauty of form and material, are not able either to originate, or even to imitate, high class productions of this nature. That this fact is well known amongst manufacturers is evidenced by the numerous and extensive applications for space in the Industrial Hall made to the English commission. The area originally allotted to Great Britain and her colonies in the building was 46,000 square feet, and already the applications have exceeded a space of 60,000 square feet for the United Kingdom alone, while Canada demands 30,000 feet, and all the remainder of our colonies have yet to be provided for. These applications, moreover, do not include those for hanging exhibits, and for these 27,000 square feet for carpets alone have been applied for. These facts indicate that in the Industrial Hall, at all events, this country will be powerfully represented.

Regarded from a higher point of view than that of immediate trade benefit, it may be urged that a powerful and concerted action on the part of British manufacturers may do much towards breaking down the barriers existing in the channels of free trade with the United States. No better way of appealing to the people of that country in favor of this object could be found than by thus convincing them of the cheap producing power of England: but we think that the chances of success are too remote to encourage our manufacturers into such united action.

Fortunately English exhibitors will have facilities for bringing forcibly under the notice of the American public the difference in cost between free goods and those subjected to existing duty, by marking on each exhibit the actual price, and that made necessary through protective policy.

Judging from present appearances, we believe that the space in the Industrial Building allotted to this country will be crowded to excess, while that in the Machinery Hall will be but scantily filled. The Agricultural Building will, as we gather from (in our opinion) the somewhat premature announcement of the English agricultural engineers, be left without any exhibits of machines and implements belonging to this class, and we fear that but little space will be required in the picture galleries for English paintings or statuary.

Upon one all important point English exhibitors have good reason to congratulate themselves. The government has wisely placed at the head of the British commission the man who, of all others, is best suited for the position, and in whom those who had to do with the Vienna Exhibition have learned to place perfect confidence. Mr. Philip C. Owen will find, we feel sure, a far less onerous and ungrateful task before him than that of 1873, and the liberal grant made by our Government will enable him to render more assistance to exhibitors, and to carry through his work in such a way as to reflect credit upon the country and himself.—*Engineering.*

Purification of Metals by Filtration.

If the substance of which a filter is composed has no attraction for the particles of the liquid to be filtered—that is, is not wetted by it—the interstices of the filter do not act like capillary tubes, and the liquid will not pass through. Mercury will not run through a very fine sieve of iron or copper wire unless the wire be amalgamated; and if this be done, although the meshes be very fine, the mercury will pass through easily, while any pieces of iron, copper, or amalgam will be retained on the filter.

Lampadius, formerly Professor of Metallurgy at Freiberg, Germany, has attempted to make use of this principle in purifying the easily fusible metals, and with what success the following will show: Tinned sheet iron, as thin as paper, was cut into strips six inches long and four inches wide. Five hundred of these were placed face to face and fastened in an iron frame, with wedges driven in to bring them closely together. This frame was luted into the bottom of a graphite crucible. Some impure Bohemian tin was melted in another crucible, and allowed to cool until crystals began to form on the surface, when it was dipped into the filtering crucible. The tin, which was still fluid, ran through almost chemically pure, while a pasty magma remained on the filter, which contained iron, arsenic, and copper chemically combined with iron.

ASTRONOMICAL NOTES.

OBSERVATORY OF VASSAR COLLEGE.

For the computations of the following notes (which are approximate only) and for most of the observations, I am indebted to students. M.M.

Positions of Planets for June, 1875.

Mercury.

On the 1st of June, Mercury rises at 5h. 53m. in the morning, and sets at 9h. 15m. in the evening. It is at its greatest elongation, east, on the 9th, and should be looked for after sunset, north of the point at which the sun disappears. On the 30th, Mercury rises at 5h. 32m. A. M., and sets at 7h. 51m. P. M.

Venus.

Venus is seen in the morning, rising on the 1st at 3h. 8m., and setting in the afternoon at 4h. 46m. On the 30th Venus rises at 2h. 47m. A. M., and sets at 5h. 48m. P. M.

Mars.

Mars rises on the 1st at 9h. 17m. P. M., and sets the next morning near 6 o'clock. On the 30th Mars rises near 7 P.M., and sets at 3h. 11m. the next morning.

According to the *Nautical Almanac*, Mars occults or hides from our view the star Ʃ *Sagitarii* on the 30th, at 1 in the morning. As Mars passes the meridian at 11 P. M., it will be in the southwest, when the occultation occurs, and, as its greatest hight above the horizon is but 20½° (in this latitude), it will not be very conspicuous; but the star is of the fifth magnitude, and a telescope of small power will show the phenomenon.

Jupiter.

Jupiter rises on the 1st at 3h. 11m. P. M., and sets at 2h. 17m. the next morning. On the 30th, Jupiter rises at 1h. 15m. P. M., and sets at 0h. 22m. the next morning.

On the 19th of June two of Jupiter's satellites will disappear by coming in front of the planet, and one by going behind the planet; so that for two hours a telescope (unless it be a powerful one) will show but one of the moons, and that the fourth, or the satellite farthest from the planet.

Saturn.

Saturn rises on the 1st just after midnight, and sets at 10h. 26m. A.M. the next day. On the 30th, Saturn rises at 10h. 9m., P.M., and sets at 8h. 24m. the next morning. The best time to look at Saturn is between 3 A. M. and 4 A. M., when it is about 34° in altitude and near the meridian.

Uranus.

Uranus rises on the 1st at 9h. 12m. A. M., and sets at 11h. 25m. P. M. On the 30th, Uranus rises at 7h. 25m. A. M., and sets at 9h. 35m. P. M.

Neptune.

Neptune can be seen to be a planet only by the use of the best telescopes, and at present is above the horizon almost wholly in daylight, so that it is useless to attempt observations.

Sun Spots.

The report is from April 20 to May 18 inclusive. The picture of April 20 shows, near the western limb, the pair of spots mentioned in the last report, one still distinct, the other divided into two smaller ones. On April 4 this group was seen on the very edge, while a small spot appeared, coming on. In the photographs of April 23 and 24, no spot is seen. On April 29 a large group, consisting of penumbra containing several spots and closely followed by two small ones, appeared coming on, while near the center of the disk was another small pair. The pictures of April 30, May 2, and May 3 show a change of motion and position of spots in the penumbra, independent of the motion across the disk.

Photographing was interrupted from May 3 to May 11 by clouds; and since that time till to-day, May 18, no spots have been visible with a glass of 2½ inches aperture.

Paint.

At a recent meeting of the Society of Engineers, a paper by Mr. Ernest Spon on "The Use of Paint as an Engineering Material" was read. The author, in the first place, considered the necessity for the use of paint, and then noticed the composition and characteristics of the pigments usually employed by engineers. White lead, he observed, should be of good quality, and unmixed with substances which may impair its brightness. It is usually adulterated with chalk, sulphate of lead, and sulphate of baryta, the latter being the least objectionable. Zinc white is not so objectionable as white lead, but is dry under the brush and takes longer in completely drying. Red lead is durable and dries well; but should chemical action commence, it blisters and is reduced to the metallic condition. Antimony vermilion was suggested by the author as a substitute for red lead, and its qualities enlarged upon. Black paints from the residual products of coal and shale oil manufacture, and oxide of iron paints, are generally used for iron work, for which purpose they are peculiarly suited. Allusion was also made to anti-corrosive paints, and to those containing silica. Referring to the oils used in painting, the author stated that linseed oil was by far the most important, and that its characteristics deserved careful study. It improves greatly by age, and ought to be kept at least six months after it has been expressed before being used. It may be made a dryer by simply boiling, or by the addition of certain foreign substances. Nut oil and poppy oil are far inferior in strength, tenacity, and drying qualities to linseed oil, and are used to adulterate the latter. The author noticed the dryers employed, and alluded to the properties and means of testing the purity of spirits of turpentine. He then dwelt at length upon the mixing and practical application of paint to new and old woodwork, the preservation of cast iron by means of Dr. Smith's pitch bath, and the cleansing, painting, and care of wrought iron structures. He stated that, when used under proper supervision, no better protection could be found for iron structures than oxide of iron paints. He concluded by observing that the real value of any paint depended entirely upon the quality of the oil, the quality and composition of the pigment, and the care bestowed on the manufacture; and that the superiority of most esteemed paints was due to these causes rather than to any unknown process or material employed in their preparation.

PRACTICAL MECHANISM.

BY JOSHUA ROSE.

NUMBER XXIV.

HAND TURNING—FINISHING TOOLS.

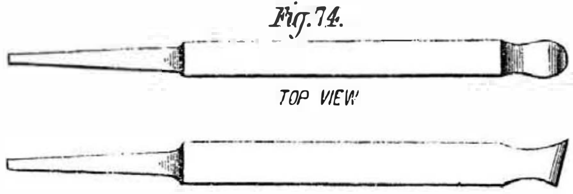
The tool shown in Fig. 73 is an excellent one for finish-

Fig. 73.

ing wrought iron or steel; it must, however, always be used with water, and should be hardened right out at and near the cutting edge, A.

For cutting out a round corner, a round-nosed tool, such as shown in Fig. 74, is the most effective; it will either rough out

Fig. 74.

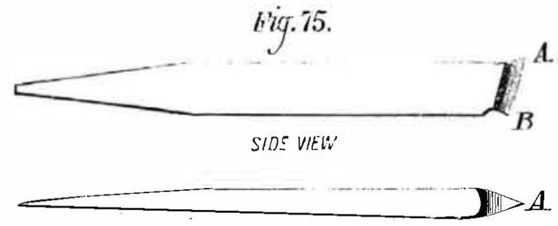


or finish, and may be used with or without water, but it is always preferable to use water for finishing wrought iron and steel. A is the cutting edge, and B, the heel of the tool. This is a sample of a large class, applicable to steel and wrought iron, the metal behind the cutting edge being ground away so as to give to the latter the keenness or rake necessary to enable it to cut freely, and the metal behind the heel being ground away to enable it to grip the rest firmly.

CUTTING A THREAD.

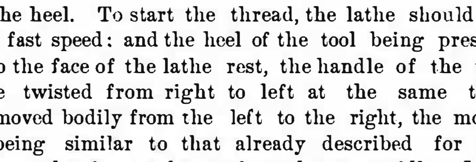
Our next operation will be to cut a thread upon an iron bolt, supposing it to be roughed out according to the instructions already given. The tools necessary for this purpose are a graver or V tool, with which to start the thread, and a chaser, with which to cut the thread after it is once started. Fig. 75 presents a V tool, A being the cutting point.

Fig. 75.



and B, the heel. To start the thread, the lathe should be run at a fast speed: and the heel of the tool being pressed firmly to the face of the lathe rest, the handle of the tool must be twisted from right to left at the same time as it is moved bodily from the left to the right, the movement being similar to that already described for the graver, save that it must be performed more rapidly. It is in fact the relative quickness with which these combined movements are performed which will determine the pitch of the thread. The appearance of the work after striking the hread will be as shown in Fig. 76, A being the work, and

Fig. 76.



B, a fine groove cut upon it by the V tool; from which it will be observed that the judgment alone must be depended upon to gage the speed of the movement of the tool necessary to cut the fine groove, B, which must be the same width from one groove to the next as is the chaser from the point of one tooth to the point of the next.

The reason for running the lathe at a comparatively fast speed is that the tool is then less likely to be checked in its movement by a seam or hard place in the metal of the bolt, and that, even if the metal is soft and uniform in its texture, it is easier to move the tool at a regular speed than it would be if the lathe ran comparatively slowly.

If the tool is moved irregularly or becomes checked in its forward movement, the thread will become "drunken," that is, it will not move forward at a uniform speed; and if the thread is drunken when it is started, the chaser will not only fail to rectify it, but, if the drunken part occurs in a part of the iron either harder or softer than the rest of the metal, the thread will become more drunken as the chaser proceeds. It is preferable, therefore, if the thread is not started truly, to try again, and, if there is not sufficient metal to permit of the starting groove first struck being turned out, to make another further along the bolt. It takes much time and patience to learn to strike the requisite pitch at the first trial; and it is therefore requisite for a beginner to leave the end of the work larger in diameter than the required finished size, as shown in Fig. 76, so as to have metal sufficient to turn out the first few starting grooves, should they not be true or of the correct pitch. If, however, a correct starting groove is struck at the first attempt, the chaser may be applied sufficiently to cut the thread down to and along the body of the bolt; then the projection may be turned down with the graver to the required size, and the chasing proceeded with.

After the thread is struck, and before the chaser is applied to it, the top face of the rest should be lightly filed to remove any burrs which may have been made by the heel of the V tool or graver; or such burrs, by checking the even movement of the chaser, will cause it to make the thread drunken. Where the length of the thread terminates, a hollow curved groove should be cut, its depth being even with the bottom of the thread; the object of this groove is to give the chaser clearance, and to enable you to cut the thread parallel from end to end and not to leave the last thread or two larger in diameter than the rest. Another object is to prevent the front tooth of the chaser from ripping in and breaking off, as it would be very apt to do in the absence of the groove.

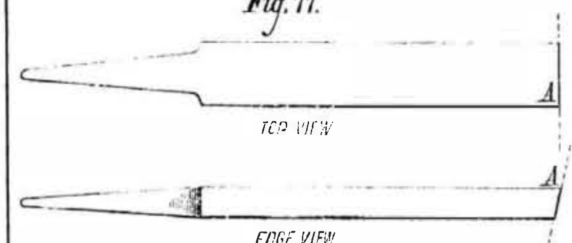
TO MAKE A CHASER.

Chasers are cut from a hub, that is to say, a cutter formed by cutting a thread upon a piece of round steel, and then forming a cutting edge by cutting a series of grooves along the length of the hub. These grooves should be V-shaped, the cutting side of the groove having its face pointing towards the center of the hub, as shown in Fig. 78. Hubs should be tempered to a brown color. A chaser is made from a piece of flat steel whose width and thickness increases with the pitch of the thread; the following proportions will, however, be found correct:

Number of threads per inch	Number of teeth in the chaser	Thickness of the chaser
24 to 20	12 to 14	1-4 inch
18 " 14	10	5-16 "
12 " 8	9 to 6	5-16 "
6 " 4	7 " 6	3-8 "

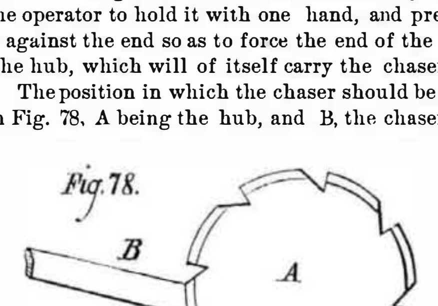
The end face of the chaser should be filed level and at an angle with both the top face and the front edge of the steel,

Fig. 77.



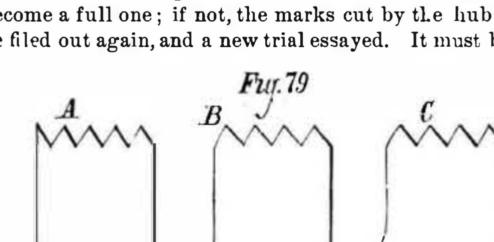
as shown in Fig. 77, the edge, A, being rounded off so that it shall not strike against any burr upon the face of the rest, and thus be retarded in its forward movement while being cut. The hub is then driven in the lathe between the centers, the chaser being held in a handle sufficiently long to enable the operator to hold it with one hand, and press the shoulder against the end so as to force the end of the chaser against the hub, which will of itself carry the chaser along the rest. The position in which the chaser should be held is shown in Fig. 78, A being the hub, and B, the chaser, from

Fig. 78.



which it will be seen that the chaser is held upside down while it is being cut, the cutting face resting upon the lathe rest. After the chaser has passed once down the hub, special attention should be paid as to whether the front tooth will become a full one; if not, the marks cut by the hub should be filed out again, and a new trial essayed. It must be borne

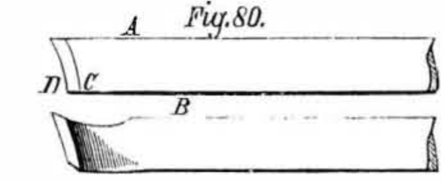
Fig. 79



in mind that, the chaser being held upside down, the back tooth, while cutting the chaser, becomes the front one when the chaser is reversed and ready for use. The hub should be run at a comparatively slow speed, and kept freely supplied with oil, it being an expensive tool to make, and this method of using preserves it. In Fig. 79, A is a chaser whose front tooth is not a full one; B is a chaser with a full front tooth; and C is of the same form as A, when it is, as far as possible, corrected.

The cutting operation of the hub upon the chaser is continued until the thread upon the latter is cut full, when it is taken to the vise and filed as shown in Fig. 80, A being the

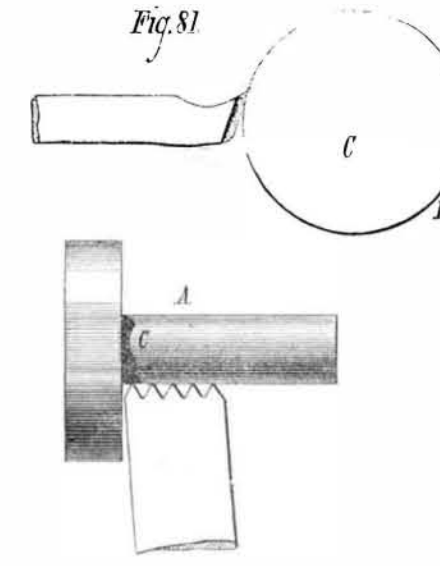
Fig. 80.



chaser as it leaves the hub, and B, as it appears after having the edge, C, and corner, D, rounded off.

The angles of the end face of the chaser to the top and edge faces of the body of the steel, and the uses thereof, are made apparent in Fig. 81, in which A is a top, and B, a side view of a chaser when in operation, C being, in each case, the work. From this it will be observed that the angle in the direction of the thickness gives rake to the teeth, while the angle in the direction of the breadth serves to keep the front side of the chaser from coming into contact with the head, shoulder, or other projection of the work. In the absence of a hub, a chaser may be made by cutting a slot in a blank nut, fastening the end of the chaser in the slot, and tapping the hole. The difference in shape between a chaser for use on wrought iron, as shown in Fig. 81, and steel, and one for use on cast

Fig. 81



iron, brass, or other soft metal, is shown in Fig. 82.

The difference consists in making the teeth less keen, by beveling off the top face and cutting the teeth less hollow in their length. The latter object is obtained by moving the handle, in which the chaser is fixed, up and down while the hub is cutting it.

The lathe rest should be so adjusted that the chaser teeth cut above the horizontal center of the work. The teeth of the chaser should fit the thread on the bolt along all their length when the body of the chaser is horizontal, and then the least raising of the handle end of the chaser will present the teeth to the work in position to cut, while the teeth behind the cutting edge will fit the thread, being cut sufficiently close to form a guide to steady the chaser. This method of using will not only keep the thread true, but will preserve the cutting edge of the chaser. If a chaser has top rake, as shown in Fig. 81, and the handle end is held too high and so that the back of the teeth are clear of the thread, it will cut a thread deeper than are its own teeth; if, on the other hand, the top face is beveled off, as shown in Fig. 82, and the handle is held too high, it will cut a thread

Fig. 82.

shallower than are the chaser teeth.

The proper temper for the teeth is a deep brown, or, for unusually hard metal, a straw color. For chasing wrought iron, the lathe may be run so that the teeth will perform about 40 feet, for steel about 30 feet, for cast iron 50 feet, and for brass about 80 feet, of cutting per minute.

France and the Centennial Exposition.

We printed last week an extract from *The Engineer's* recent editorial on the Philadelphia Centennial, in which the general disinclination of English manufacturers of agricultural and other machinery was especially mentioned, and ascribed to the high duty which is charged in this country on the entry of such products. The same objection is now being urged in France to the contributions of French manufacturers. M. Herman La Chapelle, one of the largest engine builders of Paris, publishes a long letter in the *Moniteur Industriel Belge*, in which he strongly condemns the prohibitory nature of American duties, and points out that, with the exception of wines, silks, and works of art, of which France has almost a monopoly, it is useless to exhibit the principal industrial products of that country.

SIGNATURES made with a lead pencil are good in law