Continued from first page.

for some 20 hours, and finally the bubbles disappear, and the now fluid mass becomes homogeneous and clear. Then the furnaces are allowed to cool until the contents of the pots become pasty and viscid, the proper working state; and the heat is subsequently maintained at a degree sufficient to keep the glass in this condition.

At the Exposition, the glass is mostly pressed at once into the required form. Some blown glass is made, but the sketches shown on our initial page relate mainly to the former operation. The mold, which is represented taken apart, so as to show its construction, is one of those designed for pressing goblets. It consists first of two hinged iron pieces, in each of which are hollows, corresponding in shape to the portion of a goblet below the bowl. The ring portion shown, above the mold proper, holds the glass which forms the bowl of the goblet, and the still smaller ring above fits in the one just mentioned and limits the hight of the bowl in the mold. Lastly, the conical plunger enters the bowl portion, and between it and the mold the glass is pressed into proper cup shape.

The mold is placed on the greased metal table of the press, as represented in the sketch, and the plunger is attached to a screw rod which passes through a crosshead which slides on vertical guides. The cross head is eccentrically connected to disks on the side of the machine by pitmans, and to one of these disks is secured the long lever manipulated by the workman. The apparatus being ready, a "gatherer" takes a long iron rod called a punty, to the end of which a little ball of viscous glass is attached. This he dips into the pot of molten glass, and twirls it around until a moderate sized nodule is gathered on the end. Carrying his rod over to the press, he holds it so that the glass slowly drops into the mold, until the workman deems that a requisite quantity has entered, when a pair of shears is used to clip off the material. If too much glass remoins on his punty, the gatherer rolls it along the edge of the iron slab beside the pot of water shown, when the excess of glass falls hissing into the water, and the remainder is rolled into a neat ball. The pressman now pushes his filled mold under the plunger, seizes his lever, and forces the plunger down with such force that the hot glass is driven into every crevice of the mold. A moment of waiting follows, the plunger is thrown up by the action of heavy spiral springs, the mold is drawn back and opened, and there stands the goblet, rapidly changing from cherry red to its natural transparency. An attendant now has ready a punty with a bit of hot glass at the end, which he deftly attaches to the bottom of the article, to serve as a long stem. The goblet is thus carried to the glory hole, a smaller furnace, and here it is reheated. This gives it its subsequent polish. While hot and blackened, it is removed and passed to a workman who sits on a bench on each side of which are long inclined iron-covered arms. Taking the stem or punty in his left hand and resting the object on one arm of his chair, the workman rapidly rolls it forward and back, holding meanwhile inside the bowl a flat piece of charred stick termed the "battledore." This smooths the glass and renders it perfectly circular in shape. Next the punty is removed. and another stem is attached to the bowl portion, as shown in the sketch. The glass is again rotated as before, and the workman now holds against the bottom the flat upper portion of his tongs or "pucellas." This tool is represented separately in the engravings, The effect of this is to smooth the bottom and render it perfectly flat.

When these operations are concluded, a boy seizes the glass in a fork, and carries it to the annealing oven and stands it on the floor. Here the annealing is continued over several hours at a low heat; and as it concludes, the floor of the oven is carried rearward, so that the glass passes into cooler compartments and finally is withdrawn at the rear. Grinding the bottom smooth on a grindstone follows, and any engraving or like ornamentation is done. Nothing then remains except to polish the glass, when it is ready for the market.

When glass is blown, of course no pressing operation comes into use. The blower first gathers the requisite amount of glass on the end of a long tube and rolls it on a smooth polished cast iron slab called a "marver" until it assumes a cylindrical form. Then he blows into the tube, expanding the glass as much as he thinks necessary, and also swinging the tube when he desires to elongate the object; then by means of tongs, scissors, and battledore, he molds it into the desired form. After the shape is once produced, the subsequent operations are similar to those already described.

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THE MEETING OF THE NATIONAL ACADEMY OF SCIENCES.

We give below our usual brief abstracts of the principal papers read before the above-named body at its recent meeting in Philadelphia.

General H. L. Abbott gave a synopsis of the results obtained by his observations of the

VIBRATIONS FROM HELL GATE.

The instrument employed at the various stations, for noting the vibrations, was a seismograph, which principally consists of a basin of mercury, giving what is called an horizon of that metal. The agitation of its surface when the vibrations reach it is observed by telescopes with delicate means of measurement. So easily is it disturbed that the footfall of a horse 300 feet away is at once indicated A number of experiments led to calculation that the explosion on Hallett's Reef, where 3,680 charges were fired simultaneously, ought to be indicated at 59 miles; but General Abbott was very anxious to obtain something more than negative or doubtful results, and hence selected distances not much over 9 and 12 miles. An observation was attempted at West Point, 52 miles away, and no results were obtained. The stations used by General Abbott are all on Long Island; their distances from the reef were very accurately ascertained, and are given in round numbers in the table below:

Stations.	Distance, miles.	Arrival in seconds.	Velocity of transmission in feet per second.
Fresh Pond Junction.......	5⅓	63·0	3,873
Jamaica....................	9⅓	23·5	4,521
Willett's Point............	8⅓	72·3	8,300
Springfield Junction........	12¾	19·0	5,309

The sound, as distinguished from the rumbling of the earth, is described as a dull roar such as comes from a torpedo explosion at a distance. At Springfield Junction, the noise is spoken of as a low, rumbling sound, gradually increasing to a maximum and then dying away.

General Abbott said that he had never seen so quick an explosion. Within half a second of the actual time of firing, the water of the East River thrown up had reached half its hight. During the discussion, Professor O. N. Rood referred to Professor Mayer's experiments at South Orange, N. J., which gave for the vibrations from this explosion a speed of about 3,000 feet per second. Professor Henry mentioned the curious coincidence that the boiler of the Lighthouse Board's steamer sprung a leak at the time of the Hallett's Point explosion; steam had been blown off just previously. It was also mentioned in connection with the theories of vibration that nitroglycerin will tear gun cotton to pieces if exploded upon it; but the cotton does not explode. But if the converse experiment be tried, the explosion of gun cotton sets off the nitroglycerin. Gun cotton will not explode gunpowder.

Professor Loomis discussed

LAST SUMMER'S HOT WEATHER,

and stated that during the whole "heated term," a low barometer was associated with high temperature. On a very hot day, especially selected for observation, the excess of heat was about 20°. Of this about 10° may be fairly attributed to southerly winds bringing hot air from the more heated regions to the south of us. For the other 10°, Professor Loomis proposed to account by the prevalence of extraordinary dryness at the northwest—a region usually dry indeed in summer, but in this instance subjected to unusual drouth, while southerly winds, sweeping over it, kept back the north wind by which it is ordinarily visited at intervals. Here a stratum of heated air was continually formed, which supplied to the general weather of the country 10° of the extra 20°.

THE SUN'S TEMPERATURE.

The actual heat of the sun's surface is one of the unsettled questions of Science, and estimates have varied between 10,000,000°, and 2,700° Fah. Professor S. P. Langley read a paper detailing how he compared the sunlight with that from the molten steel poured out of the Bessemer converter, and thus approximately estimated the solar temperature. A heliostat arrangement was employed to transmit a sunbeam into the foundry of the Edgar Thomson Steel Works, and a Ritchie photometer was used to measure the respective intensities of the lights. The first conclusion reached was that the sun's light, which turns the light from the molten steel into a black spot, must be at least 50 times the greater. Then the spectroscope was employed and the two rays compared. The steel rays were again blotted out. Hence the sun rays must have been at least 64 times brighter. Next, Professor Langley made comparisons of the sun's rays with those from the flames above the converter, when the latter were at their brightest. This was a less difficult proceeding and furnished more specific results. The photometric comparison could be made directly. It is admitted, however, that the flame light may not be quite as bright as that of the molten steel. The arrangement was somewhat like that of a camera obscura. It gave the image of the sun so accurately that sun spots could be easily examined; it also gave an exact representation of the furnace flame. Each was alternately superposed on the other. The conclusion is that the sunlight is at least 2,168 times brighter than the furnace flame. As the heat is presumably of the same relative order, the result is adverse to the law of Dulong and Petit. The actual heat of the sun is probably among the higher values that have been suggested.

Professor Henry's important paper on ocean echoes we reserve for fuller review.

Correspondence.

Centennial Awards.

To the Editor of the Scientific American:

In your issue of October 28, on page 273, are some editorial comments, to which a few additions may usefully be made.

If there are a large number of awards, it must be remembered there are a large number of exhibits; and there may be a few judges or groups of judges that did not fully comprehend their duties, the consequence being that mistakes may have been occasionally made. I know, indeed, that some judges have not recognized the difference between a report and an award, and that awards have been made which are mere copies of the reports by secretaries of groups, who did not quite understand the difference; and the General Board of Judges could not go well behind these awards without thegreater chance of injustice to the exhibitors. I fancy, however, that these cases must be very few. I have been a juror in a group that has had almost continuous exercise since the beginning, and considering the novelty of the plan, I am surprised to see how few are the exceptions to its working well.

Your statement of the plan is not quite correct. You say: "The judges simply write reports on exhibits which they deem commendable, and the Centennial Commission thereupon decides which out of the exhibits so reported on are entitled to the medal and diploma." I will not say what some groups of judges may have understood to be their duties; but our group not only reported on those they deemed commendable, but on every person's exhibit. The failure to send in descriptions, to which you refer, made no difference; these requests for descriptions were only to ascertain what the exhibitor claimed. If no description came, the judge used his best judgment. The Centennial Commission did not select, from our report, the awards. We selected them ourselves from our own reports. These have to be confirmed by the Commission. The actual merit of every man's exhibit is the matter of the report; the special merit, the matter of the award. To show you that awards are by no means so freely scattered as you suppose, I will say that, in one particular line of articles, I examined five hundred and twenty-six different exhibits, and have notes of each exhibit on my judge's memorandum book; only forty awards were made.

It is quite possible that some of the judges have not understood their duties under the system, or the system itself; but this should not militate against the whole system, which, from the extended experience I have had of it now, I believe to be the best ever devised, and far superior to the old plan of specified premiuns for specified articles, of which, too, in times past, I have had an ample experience.

Philadelphia, Pa. ONE OF THE JUDGES.

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[For the Scientific American.]

CUTTING A LEFT HAND SCREW WITH A RIGHT HAND TAP.

J. W. S. sends us an interesting letter upon a method of cutting a left hand screw with a right hand tap, which we herewith illustrate. Fig. 1 represents a piece of iron with the hole (of the size of the bolt to be threaded) drilled in it. A V slot is then cut in it, and a tap ground to an angle with the thread left on the narrow end, which projects into the hole. If, then, the bolt be placed in the hole and the tap in the V slot, and we screw the whole into a vise, with the jaws gripping the back of the tap and the opposite side of the piece of iron, the pressure of the vise will hold the tap and force it to its cut, which is taken by screwing the bolt through the hole in the piece of iron.

Fig. 1.

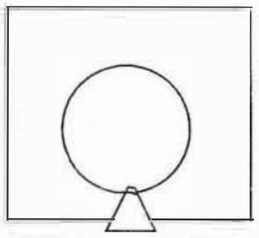
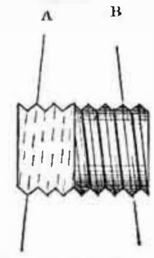


Fig. 2.



The reason why this can be done is as follows: Suppose that Fig 2 represents a piece of iron with a thread cut upon it, and that at one end it is filed down to half its diameter, as shown: it is evident that the side of the thread furthest from the observer stands at an angle slanting from the left to the right, during half its circumference, as denoted by the line, A, shown; so that, if we commence at the bottom and follow the thread for one half a revolution, we shall advance in the direction of A; whereas, if we perform a similar operation, beginning at the bottom on the other side of the thread, we shall, in moving half a revolution, travel in the opposite direction, B: showing that, notwithstanding that the thread advances in one direction, its threads slant in an opposite direction on one half of the circumference as compared to the other.

J. W. S. uses one side of the thread to cut the other with, and thus reverses the angle; and if he will turn to page 21, volume XXXI, SCIENTIFIC AMERICAN, he will find the same principle explained for cutting up inside chasers, in which operation a chaser, to cut a right-handed thread, must, to have the teeth start in the right direction, be cut off a left-handed hub. J. W. S. has, however, given us a new application of the principle. J. R.

New York city.

Watering House Plants.

If the causes of failure where plants are cultivated in windows were minutely investigated, the system of waterering would be found to be the principal cause. A plant ought not to be watered until it is in a fit condition to receive a liberal supply of that element, a good drainage being previously secured, in order that all superabundant water may be quickly carried off. Those who are constantly dribbling a moderately small quantity of water upon their plants will not have them in a flourishing condition for any length of time. This must be obvious to all, for it is quite evident that the moderately small quantity of water frequently given keeps the surface of the soil moist; while at the same time, from the effects of the good drainage, which is essential to the well being of all plants in an artificial state, all the lower roots would perish for water, and the plant would become sickly and eventually die. In many instances when the contents of flower pots are sprinkled daily with water, the soil in the middle will become hard and dry. When the ball of earth becomes dry, it takes water a long time to penetrate it, and surface waterings do not accomplish the object. In this case set the pot in a pail of water, and let it soak until the earth is thoroughly wetted through. If proper care in the respect above mentioned fails to induce a proper growth, then the plant must be re-potted with fresh earth, and have a portion of its top cut back. Irregularities in shape must be corrected from time to time by pinching off the shoots which may start to grow out of place.

The red spider is quite averse to moisture ; the green fly, however, likes it, but may be destroyed so readily by tobacco smoke that only neglected plants will suffer from this cause. The mealy bug is so large that it may be easily picked off.

Watering must be properly attended to; and while the plant must not suffer from lack of moisture, the roots must not be kept saturated with water. The sound of the pot when struck by the knuckles is quite different from what it is when dry. This, and the lagging look of the plant, will indicate that water is needed. A little practice will soon enable one to anticipate the wants of the plant and to supply water at the proper time. Plants growing in a cool atmosphere will be found to flourish much better by giving them water which is almost hot. House plants that have bloomed freely during the winter should be denied their usual supply of water, and be placed in the open air for a few hours during the middle of bright days, if this course is practicable.

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PRACTICAL MECHANISM.

BY JOSHUA ROSE.

SECOND SERIES—Number XIV.

PATTERN MAKING.

The construction shown in Figs. 92, 93, and 94 is so nearly the same, and the slight difference is so obvious, that an explanation of Fig. 94 will cover the ground. For Fig. 94 we plane up a piece over twice as long and more than half the size of the required flange, and out of this piece cut the two half flanges. If, however, the flange is of sufficient size to make it necessary to study economy, the two half flanges may be set out on the plank, lapping each other, as shown in Fig. 99. We next, with a flat scriber, draw a line on the chuck exactly through its center, and set the half flanges to this line, and then screw them to the chuck and turn them as if they were solid. By setting the halves exactly true to the line, it is insured that the flange shall part exactly at the center.

To make the pattern shown in Fig. 93, we take two pieces of wood long enough to make the two halves, and allow about half an inch or an inch to turn off each end, so that the impressions of the fork and center may not appear on and disfigure the finished work, and for other reasons hereafter to be mentioned. We plane these pieces on one edge and on one face, making them of equal thickness. We make the flat surfaces, which come together, true, trying them with the winding strips shown in Fig. 37, to detect any twist. Our next operation is to insert the pegs, and we may, for this purpose, adopt either of the two following methods, the more ready of which we will take first: Clamping the two jointed faces together, as shown in Fig. 100, we bore two holes right through the top piece and into the bottom, one to a little greater depth than the hight to which the pin is intended to project, as shown by the dotted lines. We then plane up a piece of hard wood, about two and a half feet long, to fit the holes tightly. It is just as easy to plane a long piece as a short one, and what is left over will serve for a future occasion. A useful tool for preparing pin stuff is illustrated in Fig. 101, which represents a hardened plate of steel, pierced with holes of the sizes of the pins usually required. The wood for the pins, having been planed up to the required size, is driven with a mallet through the plate, saving a great deal of time, and making the pins more nearly round than is possible by hand work. In some of these plates the holes are made taper, as shown at A, in Fig. 101; this, however, is detrimental, and the parallel hole is the best, because it guides and supports the stick while it does not impede the cutting action of the tool. A hollow formed around the edge of the hole, as shown in the sectional view, at B B, would improve that action; or it might be still further improved by inserting bushes in the plate, with a portion left projecting above the plate and beveled off to resemble a chisel, as shown at C.

Fig. 99.

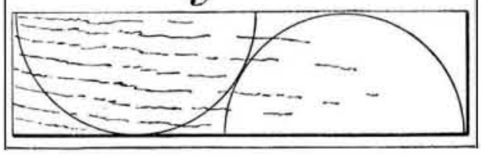


Fig. 100.

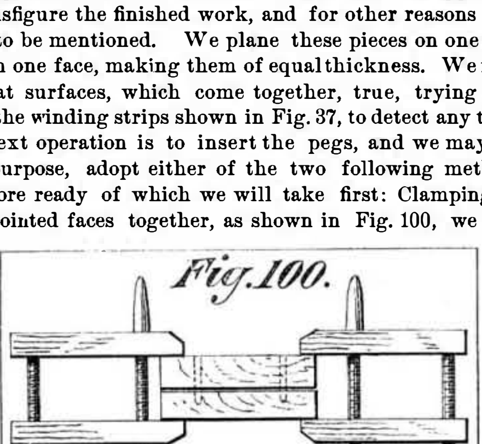
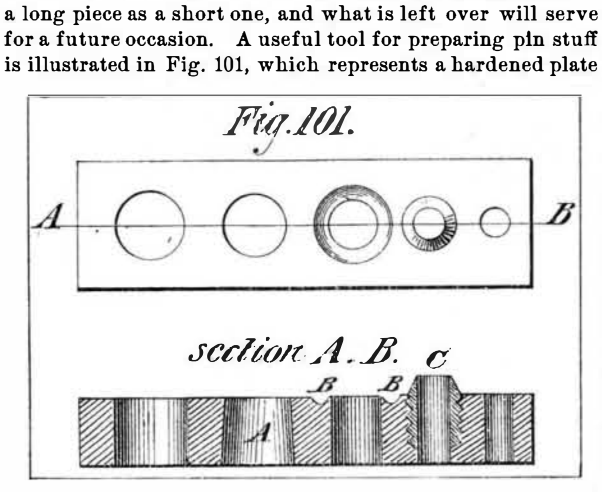
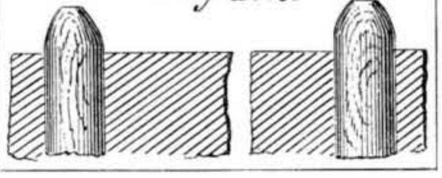


Fig. 101.



The pin stuff being prepared and inserted into one half of the pattern, the projecting end is then tapered off as shown in Fig. 102. The formation of this projecting pin may seem a very simple matter; but if sufficient consideration is not given to it, a great deal of annoyance is caused to the molder, and the castings will be imperfect. If we reflect for what purpose these pins are inserted, we shall find the proper shape. First, with regard to the projecting length, some workmen seem to be guided by the diameter of the pin, making it project to a distance equal to its diameter; but it is obvious that a short peg or pin will govern the position as well as a long one, and will be less liable to stick in the loose half of the pattern: hence it is better to let the protruding end stand out from three sixteenths to one half inch, and let from one sixteenth to one eighth inch of the large part fit the hole, the nut being tapered off so as to be sure that the pin can be released easily. These conditions inevitably bring us to the parabolic form shown in Fig. 102. Another point to be observed is to make the pin of as large a diameter as is consistent with the work; for the larger the pin, the longer it will remain free from shake. Above all, it is essential that the pin be perfectly round at the part that fits the hole; and if these elements are neglected, castings will be produced of which the halves will not match, which is always very unsightly. Nothing is gained by making the pins to a tight fit in the loose half of the pattern, as they will not work that way; and the molder will enlarge the holes with a red hot rod, and then, after a little while, the charred part around the hole falls out, and the pin becomes too slack.

Fig. 102.



After inserting our pins, the two halves of our patterns are to be fastened firmly together; and this may be readily done by brushing the end faces with hot glue for a breadth of one half or one inch, according to the amount we have allowed our pieces to be larger than the finished work. Then we hold them firmly together with a screw clamp, leaving them until they are perfectly dry. If there is not time for the gluing, the two halves may be screwed together; and indeed, if the job be a heavy one, it will not be safe to trust entirely to glue, but to use screws or dogs. Dogs are a kind of square staple, made of steel, and of the form shown in Fig. 103; and two of them driven in each end of a pattern will hold its loose halves very firmly together. While very handy, however, on large or small work, they are cumbrous; and the gluing or screwing is preferable. The work can now be mounted in the lathe, and turned as though it were solid. Care must be taken that the center points are exactly in the joint, and it was to ascertain if this was the case that our two halves were planed of equal thickness; for if, in the process of turning, one flat is seen to be narrower than the other, as shown in Fig. 104, at A B, it is proof that the centers are not in the joint; and unless the error is corrected, one half of the finished pattern would be thicker than the other. To remedy the error, we tap the pattern lightly with a hammer in the required direction, and then screw up the lathe centers a little more, continuing the process until the flat sides upon the pattern, when very nearly trued up, as shown in Fig. 104, at C C, are equal, and finally disappear.

Fig. 103.

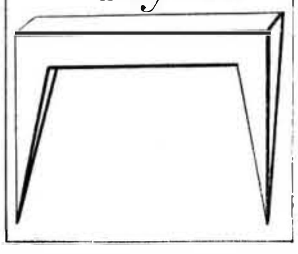
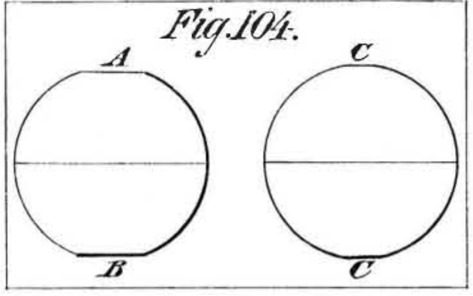


Fig. 104.



Our pattern being then turned and sandpapered, as already directed, the next proceeding is to stop up all holes or cracks that are not desired to appear, with either beeswax or putty. This is a simple process, but it may have been noticed that some workmen take a much longer time over it than others, at least when beeswax is the stopping material. One who is expert at this work guesses just the proper amount necessary for each hole or crack; then he forms the wax into a worm-like shape, and with a warm chisel (that is not hot enough to make the wax run but only to cut it easily) he presses the wax into the hole, and seldom leaves any surplus to remove. The same knack is necessary in filleting, that is, in filling in an internal square sharp corner, when it is thought too small to be filled in with wood; for if the worm or string of wax of the right size be laid along the corner, the pressure of a warmed gouge will cause it to expand to the required fillet; while if too much wax is inserted, much time will be occupied in trimming off the surplus.

The third and last of the finishing processes is the application of two or more coats of spirit varnish, which adds to the appearance of the pattern, and increases its durability by giving it a surface impervious to water, and by producing that smoothness so necessary for its easy extraction from the sand. A varnished pattern escapes much of the rough usage commonly bestowed upon patterns, because the molder does not rap it so much as he otherwise would do. Several thin coats of varnish give a much finer appearance than fewer and thicker ones. The first coat fills up the pores of the wood, and frees the fibrous projections left by the sand paper; and after the first coat is dry, fine sand paper is again applied to remove the fibers so fixed. The second and succeeding coats give the gloss.

The pattern maker invariably mixes his own varnish, which he does in the following manner: The varnish pot should be of stone, and not of iron, which would discolor the varnish. The cover should be of thick leather, having through the middle a hole of such size that the brush handle, forced through it, will be suspended, and will not pass through to the bottom of the pot. The object of making the cover of leather is that the varnish collects around the lid and sticks the cover down, requiring sometimes so much force to remove it that wood would be liable to split. In the pot is placed so much shellac, and there is added just sufficient alcohol to cover the shellac, the whole being occasionally stirred with a piece of stick, and not with the brush. The consistence should be that of raw linseed oil; and to hasten the mixing, a little warmth may be applied. The color of the varnish used is, strictly speaking, optional; the usual plan, however, is to use clear varnish for the pattern, and black for core prints and the insides of core boxes, which thus distinguishes them. The black is made by adding the best dry ivory black to the clear varnish. A very durable varnish may be made by adding powdered oxide of iron to the clear varnish, which gives a hard varnish with a reddish brown color. In mixing colored varnishes, however, we must remember that, the lighter the pigment, the easier they work. Ivory black is the lightest pigment, and so always pervades the varnish, and does not readily settle to the bottom; hence it does not often require stirring. Oxide of iron requires frequent stirring, even in the course of varnishing one pattern, if it be a large one; because it settles so rapidly that a perceptible difference in the coat is apparent unless the varnish is stirred previously to each insertion of the brush. The brush should never go to the bottom of the pot, and the pot should always be kept covered when not in actual use. Varnishing lathe work cannot be done while running the lathe; but after the work is varnished, running the latter hastens the drying. Work should always, if possible, be varnished on a dry day; for if the air is damp, the varnish becomes what is technically termed chilled, that is, it assumes a soapy or milky appearance, as though it had absorbed water, and hence is spotty when dry.

Having thus finished our example, we may now explain the process of putting pins in patterns, which we omitted to do, when speaking upon that subject, to avoid digression. There are many cases in which it is not suitable for the pin hole to show on the outside of the pattern; and again, in large work, the holes would require to be bored so deep and the pins made so long that it would be too elaborate an affair altogether. In such circumstances, lines are resorted to, being drawn in the following manner: Place the pieces side by side, with the planed edges touching and the ends fair, as shown in Fig. 105, the line, G, representing the edges; and make two fine notches at A B. Then separate the pieces, and square the very fine lines, C C, D D, across with a knife. Then set a gage to half the width of the pieces, and mark the intersecting lines, E F; and the centers for the respective pin holes will be the intersection of the lines, C E and D F. If, however, we have no planed edge to work from, and the job is of such size as to involve so much labor as not to admit of planing, we may take two small brads or finishing nails (or as many as we desire to have pins), and drive them almost entirely into one piece of the wood in the spots where the pins are ultimately to be, and then file the projecting part of each to a point. By then resting the other half in its proper relative position upon the filed points, and, when adjusted, applying a little pressure to it, the nail points will enter the top piece and mark the corresponding centers for the holes to receive the pins. We may then extract the brads or nails, and proceed to bore the holes and insert the pins.

Fig. 105.