THE HILL KINK BOOKS

PATTERNMAKING KINKS

COLVIN-STANLEY

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Patternmaking Kinks

COMPILED BY

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INTRODUCTORY WORD

THE kinks and other information given in this book have been selected from the experience of thoroughly practical men, as originally published in the *American Machinist*. This volume forms one of a series of this nature, aiming always to make available out-of-the-way information when most wanted. In this form the Kink Books, which can be kept in the tool-chest or the pocket, and always referred to, will, we feel, meet a demand and serve a good purpose.

F. H. COLVIN.
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NEW YORK, November, 1907.

PATTERNMAKING KINKS

THREE CENTERS FOR PATTERNMAKER'S LATHE

The sketch, Fig. 1, herewith shows a center for a wood lathe which will be found convenient when turning split patterns. It is very annoying to find, after great care, that the center has shifted to one side and that one-half of the

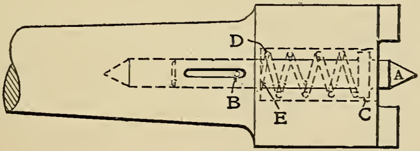


Fig. 1. — Center for Wood Lathe.

pattern is thicker than the other, a branch pipe pattern, for example. *A* is a small center pin, *B* a cross pin in *A*, which moves in the slot and prevents *A* from falling out. *C* is a collar on *A*, and *D* a light spring between *C* and *E*. In using this center it is not necessary to make a center hole in the wood — simply locate the center with a pencil and drop the center point *A* on it. *A* is not forced into the wood, but backs into the driver until the jaws engage in the wood. Both head and tail centers are made with spring points.

Another form of wood-turner's center is shown in Fig. 2. The center is particularly useful for

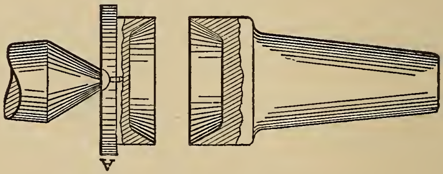


Fig. 2. — Wood-turner's Lathe.

split work. To locate the two parts, simply scribe around the center points two circles equal in diameter to the center and the friction plate. The shape of the dished portion tends to draw the point closer. The flange *A* is to enable the plate to be "leveled" out of the work.

This center, Fig. 3, is a combination of the two, inasmuch as it has the feature of drawing the halves of the pattern together, and it also has the centering arrangement of the other. With some it is necessary to scribe with the compass circles the same diameter as the center and plate, respectively; with mine, this is not necessary. The locating center *A* is placed on the center of the pattern and then tapped with

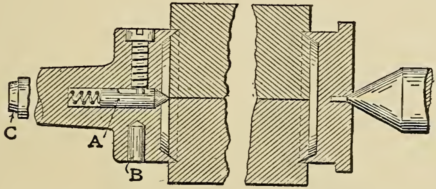


FIG. 3. — Another Wood-turner's Center.

a hammer on the end of the taper shank, which is reduced a little so as not to burr the bearing part and so spoil the fit. The lever hole *B* is for taking the center out. A trial of a center of this description will prove its merits.

TURNING TOOLS FOR PATTERNMAKERS

NOWADAYS patternmakers make tool-chests as small as possible and at the same time carry all the tools they require by economizing in size of handles, etc. A set of good turning tools is handy and necessary, but few like to lug them about in the tool-chest owing to the amount of room required. A very neat set of turning tools can be made from $\frac{1}{4} \times \frac{1}{4}$ inch, $\frac{1}{4} \times \frac{1}{2}$ inch and $\frac{1}{4} \times 1$ inch tool steel; each tool is about 15 inches long and shaped on both ends. Some object to the

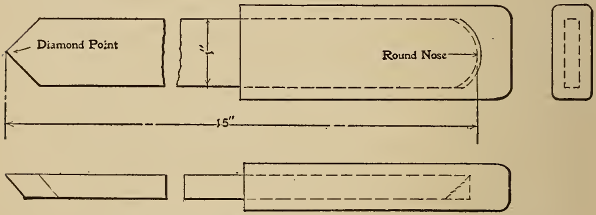


FIG. 4. — Turning Tool for Patternmakers.

double-end tool as being dangerous to work with, but with the handle shown the objectionable features are overcome. Fig. 4 shows the idea, and the reader will see that the tool reaches almost to the end of the handle, which is made a snug fit so that it may be slipped on and off. The handles can be made of wood or leather, one for each size of steel.

THE PATTERNMAKER'S LATHE

Not every shop possessing a patternmaker's lathe is deriving the good from it which might be obtained, simply through the lack of proper tools and accessories.

By a patternmaker's lathe, in distinction from an ordinary hand or speed lathe, we mean one with a movable carriage, having a slide or compound rest attached, holding a tool-post. An ordinary rest-holder and set of rests usually go with one of these lathes in addition, but many believe in discarding this feature entirely, and, when using ordinary hand tools, just place a plain bar in the tool-post and use this for a rest instead; for it does not pay to be continually changing the rest-holder. Even this will not in all cases be necessary, for it often happens that when some corner is to be rounded or fillet made, which cannot be conveniently done with the tool in the tool-post, a hand tool can be used to finish the place by holding it right on this fixed tool in lieu of a rest.

It is not every job by any means that can be most economically done with fixed tools, and here is where good judgment and common sense must take their turn, using the carriage and slide-rest where time can be saved, and the hand tools when their use will be the most expeditious.

Often a combination of both ways on the same piece of work is best. For very small turning, a regular speed lathe is of course the handiest. But, to return to the subject, let us examine the patternmaker's lathe somewhat closely, and try to note a few features that will help to do accurate work quickly and easily.

One with a swiveling headstock is far ahead of those of the fixed type, and it should move through an arc of at least 3 degrees each side of the *O* mark, and when at this mark it is a most excellent plan to have it located by a taper pin set just back of the index mark on the movable portion of the headstock. This makes the setting sure before the screws are tightened, without relying on graduations which a careless workman will occasionally fail to match properly, and then the work done by the carriage is sure to be tapering. We know of two shops, each having one of the most widely known makes of pattern-maker's lathe, that have had the taper plug fitted themselves, because the makers did not.

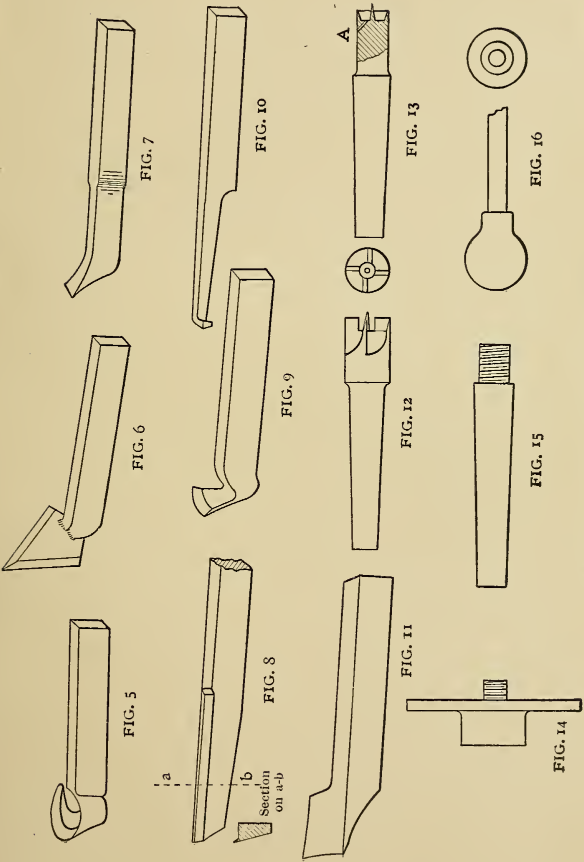
It has been our experience that, on general pattern work, the tailstock will not be set out of line once in fifty times compared with the head-stock, for the latter is constantly being shifted to get the necessary draft on all face-plate work of any depth. The compound rest on the carriage should swivel, and be provided with graduations from 0 to 90 degrees in each direction, to facilitate such turning as gear blanks, etc.

About the most important feature, outside of the bare lathe itself, is the question of tools for the tool-holder. We have had a chance to see and study the effect of quite a number of shapes, in the different shops, but have not seen a style that will cut smoother and faster than these.

Fig. 5 is a roughing-out tool. The cutting edge should slant downward somewhat as it approaches the end or tail, to give a drawing cut, and the outside face ought to overhang at least 10 degrees from a perpendicular all the way around, so as to take hold nicely at the very edge, and not have any point of contact below where it is doing work, to retard its action. An emery wheel about 8 inches in diameter gives a good concave to the outer face, and when this tool has a few finishing touches with an oil stone, it is surprising to see the heavy chips it will take from a rough piece, without even previously removing the corners.

Fig. 6 shows the "arrow point" tool for finishing, and it should be set slightly angling to the work. When properly sharpened it will cut almost as smooth as glass, and on straight work, like rolls, etc., it works as nearly perfect as one could wish. The action, it will be noticed, is similar to a wood-turner's skew chisel.

Fig. 7 is a cutting-off tool, which does not tear and scrape like the ones generally used, that are flat on top. It is intended to be sharpened on an emery wheel, about 6 or 8 inches in diameter, and then be touched up on an oil stone, as in fact are all of them. The curvature on the upper side of this tool allows it to enter the work easily and take a fast cut, while the curve below removes the stubbed end frequently seen on tools



Tools for Patternmakers' Lathe.

of this class. One of these tools, made in every respect like Fig. 7, except with a wider cutting face, is excellent for shouldering down on work. With it a number of cuts can be made down to almost the diameter required, then get the exact diameter, and finish by moving the carriage along. The tool cuts quite smoothly moved along in this manner, but not quite as well as the "arrow point."

Fig. 8 is a boring tool, and there should be one right and one left. We have used tools of this shape a great deal, and for deep boring know of nothing better. They also work equally well on outside work and are especially useful when the piece being turned is too large in diameter to slide the carriage along under it, for it can be placed in the tool-post in such a manner as to overhang a long distance, and work clear to its limit.

Fig. 9 is a nice tool for facing off segments and the surface of any disk which may be on the face-plate. It works quite well also when turning on the outside diameter, but is especially for facing.

Fig. 10 is a boring tool which is useful in holes of small diameter where the one shown in Fig. 8 cannot be conveniently operated. Fig. 11 shows a tool for general work, which is good for smoothing and shouldering down. It will be noticed that it has two cutting edges which can be used, and the top is shaped by the curve of the emery wheel something as in Fig. 7. The angle of the point should be less than a right angle, as, if so made, the tool can be set so as to be started in with the slide-rest, and then be stopped and moved along by the carriage. A much deeper chip can be taken with this tool when the carriage is moved than with the one shown in Fig. 7, as its action is more of a drawing cut.

We want to find a little fault with the spur and cup centers, as sometimes sent out by the makers with a new lathe, and will give our reason for it: The spur or point in each of these is apt to be too large. A very large percentage of work performed on a pattern-making lathe between centers is done in halves, and it is very important indeed that the lathe center comes exactly in the joint between the halves mentioned. In work of this nature it is the outer spur points of the live center and the ring of the cup center that, in addition to its other fastening, holds the work, and not the central point. The action of this latter is, if anything, to spread the pieces apart, and it is useful only as a guide in correctly placing the lathe centers in the piece to be operated on. For this reason they should be a little longer than the rest of the center, taken as a whole, and be slender points, so that they can be pressed easily between the halves of the work, and so that when removed the eye readily detects if they are out at all. In placing centers in work when in halves, it is safer to take each center and put it into the piece before placing it in the lathe, and then look to see if the slender point is exactly on the dividing line, and if it is, drive in the center with a blow from a lead hammer, and transfer to the lathe. This gives a chance for adjustment at a time when the work can be easily seen.

We actually knew of a spur center of the style shown in Fig. 12 being put out by a prominent lathe firm, in which the entering point was $\frac{1}{4}$ inch in diameter where it gives into the solid part of center, and tapered to a point $\frac{1}{32}$ beyond the ends of the four knife spurs, and the diameter of this center in the largest part was but $1\frac{1}{4}$ inches. It is really cruel to a small piece of work in halves, to force such a mass of steel between the pieces when it cannot help to hold them together in the slightest degree.

A cup center, Fig. 13, should be straight on the outside and beveled on the inside to a slender edge or ring. This form has the action of a pinch-dog to some extent, and helps somewhat to hold the two parts from separating. An oil hole should be provided as at *A*, and the center always be placed in the tailstock with this uppermost.

Face-plates having a shank in the middle for centering and chucking work, as shown in Fig. 14, are used in some places, and cannot be too highly recommended, especially on pulley and gear blank work, etc. The best form of this that we have ever seen is the threaded kind. The shank proper is standard size ($\frac{3}{4}$ inch diameter) its whole length, and should not project less than

$\frac{1}{2}$ inch nor more than $\frac{3}{4}$ inch, and around this shank or spindle is a very thin thread like a knife edge, at the rate of 8 to the inch, and the more like a knife edge this thread can be the better, for then it will not injure the hole in the work in the least, by throwing it out of center, or hurt it for receiving core print shanks or plugs of any kind. It is better to have this thread start at least $\frac{1}{16}$ inch back from the end, so that the hole in the work can be squarely placed before commencing to screw it back against the face-plate.

It will be found that a vast deal of work can be done without using any wood screws through the face-plate to help hold, relying only on the threaded shank.

Sometimes this centering principle is needed to be used in connection with some face-plate not fitted with this device, in which case have a lathe center made as in Fig. 15, with the end fixed exactly like the one in Fig. 14, so that it can be used equally well with all the face-plates belonging to the lathe, and projecting beyond them the same distance. When this latter scheme is employed, wood screws can also be used to help hold when the work is large, but of course must be put in and withdrawn while the face-plate is in the lathe, in its position against the collar on the spindle.

A knob cast or screwed on the end of a long rod, as in Fig. 16, is useful to have within reach for a rammer, to put through the spindle in removing centers. It is handier than a plain rod, and the additional weight gives it a more effective blow.

Finally, we would like to impress the importance of never hammering or pounding anything connected with the lathe, except with a soft hammer. A lead hammer of convenient size should always be kept about a lathe, as one of the accessories, just as much as the tools and face-plates.

TOOL-POST FOR THE PATTERN SHOP

The accompanying print shows a tool-post made for use in pattern and machine shops.

The point of this post is, that no matter what the position of the tool may be, the set-screw has a direct bearing, as can be plainly seen in Fig. 17.

This view shows the post complete with the tool set to the highest point, the dotted lines indicating the lowest position of the tool.

Fig. 18 shows the post without the nut, set-screw and tool. The post and nut in this case were made of cast iron, but could be much lighter, and the button *D* cast solid, if made of cast steel.

The nut *A*, Fig. 19, is free to find its own bearing when the set-screw is tightened, and the only finish required is to tap out for the set-screw. It cannot drop out when once put together — thus avoiding a bad feature of some posts, and has no pivot pins to wear. The nut could be made spherical, but in that case would have to be flattened on one or two sides to prevent it turning.

This post gives very good satisfaction, especially in the pattern shop, as it holds the tool perfectly tight and allows it to be neatly adjusted to the entire satisfaction of every crank of a wood butcher.

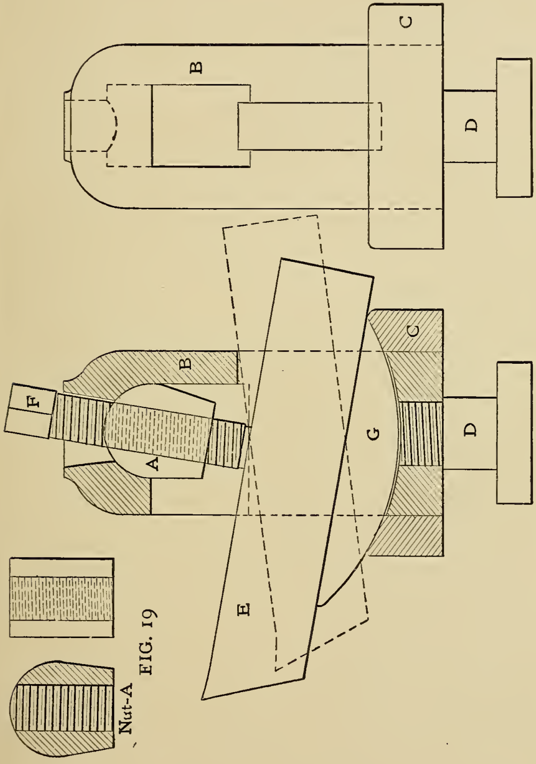


FIG. 18

FIG. 17

FIG. 19

Tool-Post for Pattern Shop Lathe.

A CORNER ROUNDING TOOL FOR PATTERNMAKERS

The sketch, Fig. 20, shows and practically tells all about a corner-rounding tool for pattern-

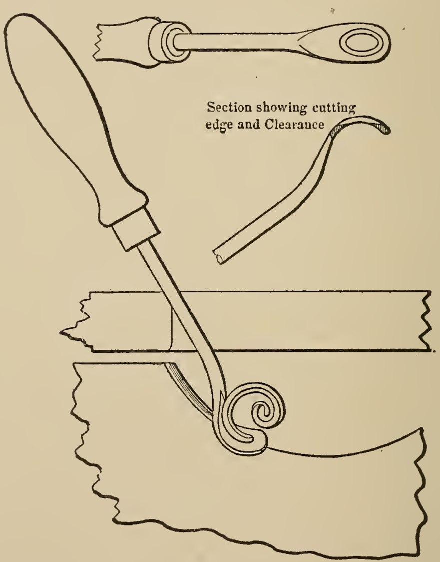


Fig. 20. — Tool for Rounding Corners.

makers. The cut can be taken from the heel, as shown, or from the toe — that is, by either pushing or pulling — and by tipping up or down the amount of cut is regulated. It is one of the most useful tools for a patternmaker's kit.

A HANDY TOOL-CHEST

In Fig. 21 is a sketch of a tool-chest that is very practical and convenient. The sketch shows

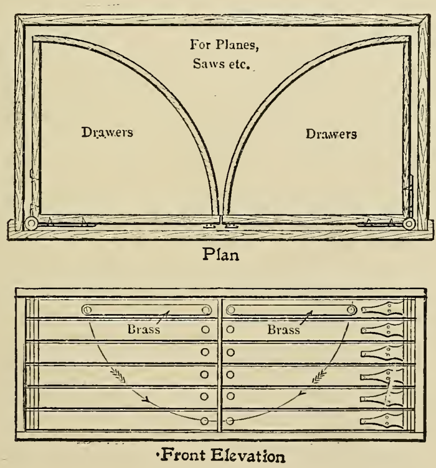


Fig. 21. — A Patternmaker's Tool-Chest.

how the drawers are shaped, made in quarter segment and just deep enough to hold the tools without putting one on top of the other. Each drawer has an ornamental brass hinge which also serves the purpose of a corner bracket. The hinges swing on a $\frac{1}{2}$-inch rod, which extends from top to bottom of box.

The drawer pulls, as shown, serve two purposes: to open one drawer at a time, or all at once. This latter is accomplished by a brass plate, as shown, which has a hole drilled near one end through which the pull in the upper drawer passes. The plate is made long enough to extend down to pull on the lower drawers. When in a vertical position the plate is under all the drawer pulls, which thus provides a means of opening all the drawers at once.

Before building the chest make a sketch of the drawers full size. This shows how large to make the chest, which can be put together according to the ideas of the maker. Opening in the front, the chest is intended to be placed on or under the bench as preferred. It should be large enough to hold all the tools a patternmaker needs, but no larger than necessary.

As shown in the sketch, all the planes, saws, etc., are put in the back of the chest and can be reached at once.

A PORTABLE CASE FOR PATTERN-MAKERS' TOOLS

Some patternmakers use a trunk as a tool-chest. This has a nice appearance to one traveling, but when moving around, a fellow does not always find all the modern conveniences, and quite often he has to use his tools right from whatever he brings them in, so he should have something easy to get at.

Fig. 22 shows a case of drawers which is handy. At the end of the bench it serves simply as a case, and if there is not room it will go under the bench out of the way, still being convenient. There is not so much trouble making one as in making a chest, and it does for case and chest combined. It is surprising how much can be gotten into a very small space without crowding at all, if calculated right. The top drawer is just the depth of the saws, the bottom one deep enough for a jointer, and all of them long enough for the longest saw. When traveling, the front is locked and screwed on, keeping everything in place. It is a most convenient arrangement for traveling patternmakers.

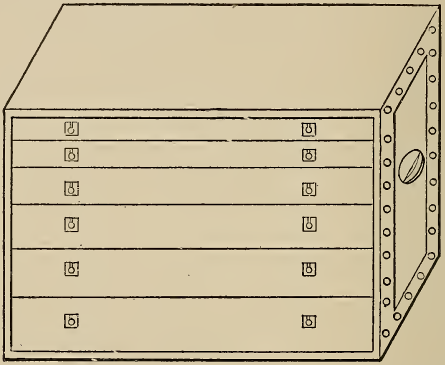


Fig. 22. — Portable Case for Patternmakers' Tools.

A PATTERNMAKER'S T-SQUARE AND SCRATCH-GAGE

Here is a sketch, Fig. 23, of a patternmaker's T-square head to use with a steel rule. At the end of the blade and at the right is shown a clip to be used in combination with the square as a panel gage.

The point on the clip comes up against the end of the rule, and it can be easily set to any desired size by the graduations on the rule. A

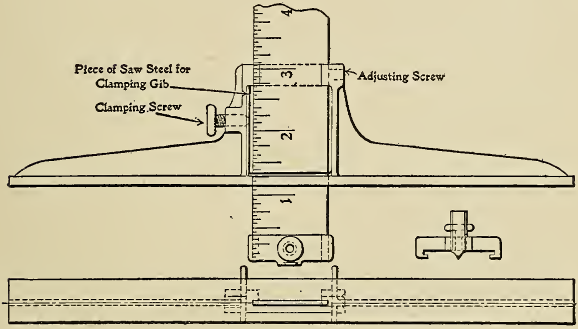


Fig. 23. — Patternmakers' T-square head and scratch gage.

clip of the same kind in combination with a Starrett combination square would make a very handy bench gage.

HANDY THINGS FOR APPRENTICE PATTERNMAKERS

While serving our time in a pattern shop we were always looking for handy as well as useful tools. Once when making a half-round core box about 2 inches in diameter, when it was sandpapered it was measured and found that a little too much had been rubbed on the edges and consequently it was not a true box and was out of size. Well, of course, a first-year boy does not always know just how to remedy a mistake, except to get out a new piece of stock. A journeyman working near saw the trouble and showed what he called a "blind center," and suggested in making one like it to lay out the ends again and plane the box deeper and dress off the top to correspond.

Fig. 24 shows the blind center. Take a piece of maple or cherry, say about 10 x $\frac{3}{4}$ by $\frac{7}{16}$ inch thick, and space it off in sixteenths. Next glue on a small piece at the middle the same thickness as the stick; about $\frac{3}{8}$ diameter is large enough. Then take a small point and prick a hole in the joint of the two pieces half-way from each end of the long piece. In using this, place the stick across the top of the box, being sure to get it in the center, then set your dividers in the center hole and you can scribe a half-circle on the end of the box.

Fig. 25 represents a very inexpensive depth gage. A piece of hardwood 5 inches long and $\frac{1}{2}$ inch square, and a 3-inch nail compose this very useful tool. Drill three holes, a very little smaller than the size of the nail, one about $\frac{3}{8}$ inch from each end and one in the center. The nail can be used in either hole, as the case calls for. When the nail works too loose, just get out a new piece.

Fig. 26 is a handle for "German" or "Diamond" bits. Take a piece of $\frac{3}{4}$-inch dowel, drill a $\frac{1}{4}$-inch hole equidistant from each end, and chisel a tapered square hole to fit the ends of the bits. This handle can be used in places too small for a brace.

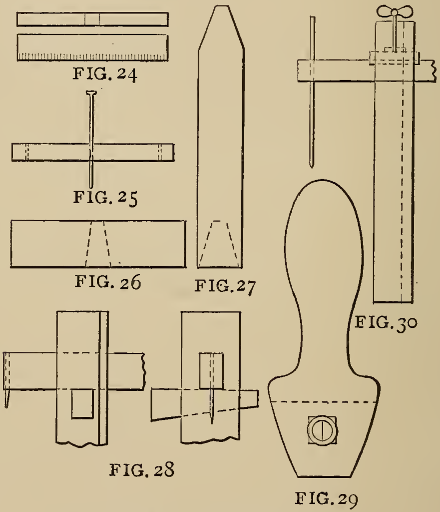
Fig. 27 is simply an extension for the shank of a bit to be used where a very long shanked bit is needed, and you have none. Take a $\frac{3}{4}$ dowel the length needed, chisel out the end to fit the end of the bit, and dress off the other end to fit the bit stock like an ordinary bit end. It is well to bind a piece of wire around the end which fits over the drill to keep it from splitting.

Fig. 28 represents a very handy marking gage.

A piece of maple $\frac{7}{8}$ x 1 x 5 inches makes the upright, and a piece $\frac{3}{8}$ x $\frac{5}{8}$ x $6\frac{1}{2}$ inches makes the arm. Lay out the hole for the arm about $\frac{3}{4}$ inch from the end through the widest side and cut out so that the arm can just slide through freely and not have a chance to twist. Then lay out on the narrow side the hole for a wedge of maple $\frac{3}{8}$ inch thick, tapering from $\frac{1}{2}$ to $\frac{1}{4}$ inch. Have the top of the hole just cut through the lower part of the hole for the arm. In making the wedge have the taper all on one side, leaving the top side straight. Use a piece of $\frac{1}{16}$ inch diameter tool steel for the scratcher on the end of the arm about an inch long. Sharpen this as you would a pencil, wedge-like, having the flat part parallel with the front of the upright. You can sharpen it so that when it is used it will cut a hair line. That is one of the points which show neat workmanship. Round the back side of upright for inside curves.

Fig. 29 is a small blade holder. It is very unhandy to have to hold small blades, such as small planes, spoke-shaves and scraper blades, in your hand while grinding and whetting. This handle takes the place of that and is very simple to make. Take a piece of maple about $1\frac{1}{2}$ inches square, 6 inches long. Turn the handle, leaving about $2\frac{1}{4}$ inches for the blade holder. Work this off on two sides to about 1 inch thickness, and then taper it down to $\frac{3}{16}$ inch. For the width you have about $1\frac{1}{2}$ inches, and taper this down to about $1\frac{1}{4}$ inches. Put a slit with the bandsaw in the width so that you can put in the blades. Next get a machine screw, nut and washer. Drill a hole through the holder at right angles with the slit, the size of the screw, then set in the nut on the under side and the washer on the top side. Put in the screw, tighten with a screw-driver and you have a neat and useful tool.

Fig. 30 is another monkey gage which is used a great deal. Take a piece of maple 2 x 1 x $7\frac{1}{4}$ inches, and with an inch radius make the end half round. Next cut a groove in the back $\frac{5}{16}$ inch deep and $1\frac{1}{2}$ inches wide, the length of the piece. Next take the center of your 1-inch radius and drill a $\frac{5}{8}$-inch hole through. Get a $\frac{5}{8}$-inch maple dowel about 9 or 10 inches long, and fit it so that it will just slide through and not twist. Take a piece of tool steel about 5 x 16 inch diameter, and sharpen the same as the other point. Put it through the dowel about $\frac{1}{4}$ inch from the end. Set in a loose shoe so that it will just rest on the dowel. For length have



Home Made Apprentice Tools.

it about $\frac{7}{8}$ inch long, so as to make a groove to keep it from sliding in and out when the arm is moved. Set in a piece of brass about $\frac{5}{16}$ inch square, $\frac{1}{16}$ inch thick, just above the shoe, which, by the way, should be made of boxwood or lignum-vitæ. Next get a thumb-screw long enough to set down on the shoe. Drill a hole through the top end of the upright as far as the shoe, then tap for the same thread as the screw. This makes a very useful gage where you have to scribe a line over a bead or other upward projection.

PATTERN SHOP WRINKLES

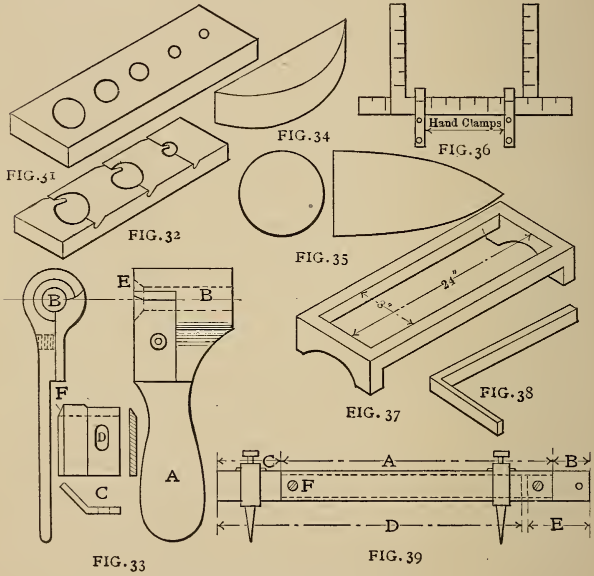
Figs. 31, 32 and 33 show methods of making dowel rods. In Fig. 31 there is simply an iron or steel block with holes, and the sticks, sawed and planed approximately to size, are driven through with a hammer. Fig. 32 is a piece of $\frac{1}{4}$-inch thick tool steel with lips filed out as shown, and then hardened. The wood pieces are held by one end in a chuck in the lathe, and the steel is held in the hand and pushed against the dowel stick. This is an improvement on Fig. 31, but not equal to Fig. 33. This latter shows a casting *A* which answers for any given size dowel by having the hole *B* drilled through it $\frac{1}{32}$ inch larger in diameter, for clearance, than the size of the work required. But one cutter, *C*, is needed for a whole set of these holders. The cutter has a slot *D* through which passes a screw, thus holding it in place on the handle. The holder *A* is countersunk at *E* enough to start square sticks easily, and the cutter must be adjusted by trial until the dowel comes out the exact size required. It will be seen that the knife is not flat, but angular, and the cutting is done by the edge *F*, which is ground so as to be slightly in advance. To operate, have the stick previously sawed square about $\frac{1}{32}$ inch larger than the finished dowel, and hold one end in the lathe. This is easily done by putting a block on the screw chuck, and making a square hole in the center to admit the sticks. Hold the cutting tool in the right hand, and push firmly against the stick as it is revolved by the lathe. This simple tool will be found to make very good dowel rods quite rapidly.

Fig. 34 is but a block of wood to hold in the vise when clamping wedge-shaped or tapering pieces of any kind. It can also be used against a curved piece of work, if the radius of the curve on block is less than that of the other. On straight work that has a taper, simply place it in the vise with the flat side of the block against the piece. The round part makes a contact with the jaw of the vise at the proper point without further thought, and the work is held easily and firmly.

Fig. 35 is a wood cone to fit the screw chuck in the lathe, and is covered with emery to use in sharpening gouges. These are commonly made with a straight taper, but, by making them something of a cartridge shape, like the figure, a slight concave is given to the tool while grinding.

Fig. 36 shows an improvised pair of calipers for heavy work, made by placing two large squares together. They can be held firmly by two small hand-screws, as indicated.

Fig. 37 is a rack to place beneath the pattern-maker's lathe. It should stand on the floor next the leg, and is to hold face-plates of all ordinary sizes. The first face-plate stands crossways of the rack, having two bearing points here, and the lathe leg itself does for the third. The other face-plates rest against each other in the same manner. A rack like this will accommodate



Wrinkles for Pattern Shop.

quite a number, and keeps them off the floor.

Fig. 38 is a handy rest to use in the tool-post of a patternmaker's lathe when using hand tools.

On many jobs the angle increases its usefulness to a large extent.

Fig. 39 illustrates an extending or telescopic trammel bar. The part *A* is a hollow brass tube rectangular in section. *E* is of wood fitted permanently to one end of the tube, the part of it shown at *B* being flush with the brass all around. *D* also is of wood shouldered at one end, and made to slide freely in the tube. It is ordinarily in the position shown and held by a screw. Part *C* is one end of *D* made flush with the brass the same as *B*. In striking an extra long radius, slacken screw *F*, extend the bar as much as necessary, then tighten the screw, and adjust points as usual with the thumb-nuts.

A THICKNESS GAGE FOR A BUZZ PLANER

The patternmaker often has to do side jobs not exactly in his legitimate line, but which are brought on by it. Ten years or more ago we had occasion to make a case of small drawers to go on an automatic silk-winding machine. There were quite a number of these drawers to be made, and $\frac{3}{8}$-inch stuff was called for on the case and all. As there was no cylinder — or dimension — planer in the shop, the only one being a buzz planer, we saw that the circular saw was to be followed by a large amount of tedious hand planing, and the thought kept revolving in the mind as to whether there was not some possible way in which the pieces could be brought to a thickness on the buzz planer.

So we began to experiment a little. Taking a piece of 2-inch hard pine, perhaps 4 inches wide and long enough to reach across the width of the planer, then nailing a strip $\frac{3}{8}$ inch thick across each end, we clamped down the whole affair to the planer table with large hand screws, the strips bearing on the table and leaving a $\frac{3}{8}$-inch space between it and the pine strip. The affair was clamped to the table just beyond the knives, a part of it being directly over the back table and a part of it over the cutters and throat.

The table in front of the knives was lowered as far as possible (about $\frac{1}{2}$ inch) and a piece of work to be planed to thickness was held entirely away from this, but firmly under the edge of the hard pine bridge above, and pushed ahead until the end had passed the knives and rested on the back table. Then trouble began. The piece would stick and object to going ahead. It was found necessary to cut away clearance on the under side of the bridge strip, leaving but a narrow portion of it, the given $\frac{3}{8}$ inch in hight,

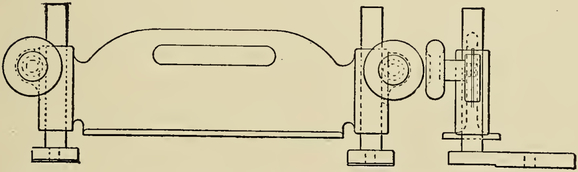


Fig. 40. — Adjustable Thickness Gage for Buzz Planer.

coming directly over the edge of the back table beyond the cutters. After this was done things worked nicely and the job was completed.

The success of the crude affair led to the making later of the device shown in Fig. 40, consisting of two posts clamped to the planer bed, just beyond the cutters, on which posts moved the bridge, which could be adjusted to any hight and securely held by two small hand-wheel tightening screws; the other two tightening screws, which were used to clamp the posts, being those ordinarily used to hold the fence in position.

Fig. 41 is a hight gage, being simply a piece of cast iron, about $\frac{3}{4}$ inch thick, with the bottom and large end planed square and having steps milled on the incline, running by sixteenths from 2 inches downward, with the different sizes

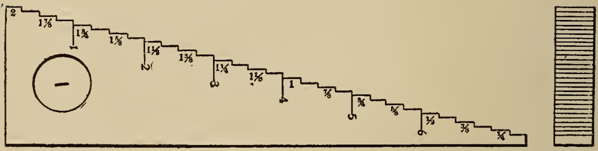


FIG. 41. — Cast-iron Hight Gage.

stamped on with steel figures opposite the steps. This was set on the planer table and slipped under the gate as a gage for any desired thickness of work. When the gage stood on end, it showed any hight by intervals of $\frac{1}{4}$ inch.

Now for a word of caution: This device is not intended as a substitute for a dimension or pony planer, when the work of a shop will warrant the latter; but it will help out for occasional use.

There is a knack in using it, and it may look a little dangerous at first, but the one just described was used as occasion required, for six or seven years to our knowledge, and no one was ever injured by it; it is probably still in use.

Short pieces less than a foot long should not be tried, neither do boards more than 8 or 10 inches wide work well, if very thin. One-sixteenth of an inch is the limit for a chip, and the planer must be stopped and the bridge lowered for each reduction in thickness.

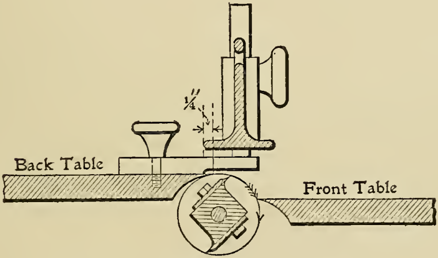


FIG. 42. — The Gage in Position.

To operate, first screw the device in place and set to the desired hight, Fig. 42, and lower the front table as much as possible. Then start the machine and hold the work level, with the front end of it firmly against the bottom of the gate and push it ahead. It now passes the knives and slides along the back table, and all the while the piece is being planed it must be held with a gentle pressure upward, so as at all times to be in contact with the bridge; for if it is not, it will be gouged into by the knives, and the work will become uneven in thickness.

When the back end of the piece approaches too near the cutters to be held safely, simply grasp the part already passed and draw it through. By this time there will not be enough left in front of the knives to sag and cause the trouble just referred to.

GAGES FOR PATTERNMAKING — FIXING UP A CASTING FOR A PATTERN

Fig. 43 shows a tool which proves in practice very useful for pattern shop and foundry work. The pillar is made of pear wood, about $\frac{3}{8}$ inch thick, with slot *c* cut in the pillar to allow the setting of arm *d* to any fractional part of 12 inches. This arm also is made of pear wood,

$\frac{3}{8}$ inch thick, the shoulder *a′*, together with pegs 1 and 2, sliding along the inner and outer edges of the pillar and keeping the arm at right angles. Slot *e* and sliding grooves *f f* are cut in the arm

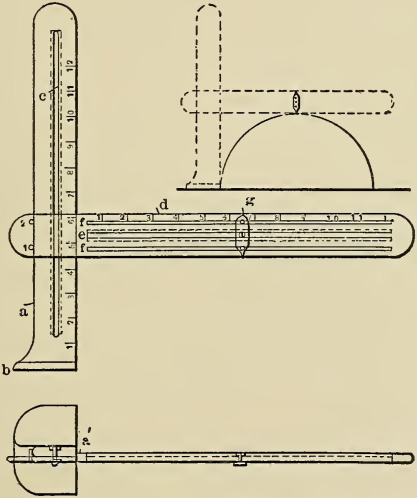


Fig. 43. — Patternmakers' Gage.

to allow the adjusting of scriber bar *g*, the point of which on the under side projects about $\frac{1}{16}$ inch below the arm, on the upper edge indicating the distance. We give one simple illustration of the manipulation of this tool. It is required to mark a center line along a 12-inch pipe pattern the half of which is shown. The half pattern is placed on the surface plate, the sliding bar and scriber are fixed in position, the base is brought in contact with the edge of the pattern and the gage is then drawn along the pipe to the required length.

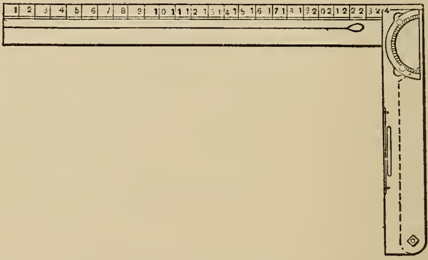


FIG. 44. — Combination Tool for Patternmakers.

Fig. 44 is a sketch of a tool made some time ago for general use in the pattern shop. It is found to be very useful for outside work, such as pipe work, templet making, etc. It is a combination of square, bevel square, plumb, spirit level, center square or radius finder, protractor and 2-foot rule.

Fig. 45 is a sketch of a bridle and plunger for a 10 x 12 inch pump. A short time ago it was necessary to have this plunger put in the lathe to be turned for a brass sleeve, but the first cut revealed a secret. Evidently the core at *a* had yielded to the pressure of the metal to within about $\frac{1}{4}$ inch of the surface. The stoppage was

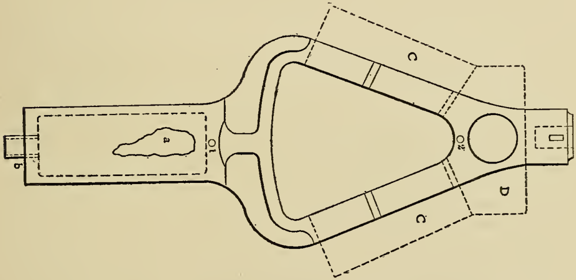


FIG. 45. — Casting Fixed up for a Pattern.

a serious matter, and making a new pattern was out of the question, so it was resolved to make the best use of the existing casting as a pattern.

The first thing was to drill and tap two $\frac{1}{2}$-inch draw-holes, 1 and 2. The parts on each side of the bridle were next blocked up and sufficient bearing allowed on each side for cores *c* and *d*, as indicated by the dotted lines. The plunger was next lagged with strips of wood, about $\frac{1}{2}$ inch in width and of the required thickness; these were held in place with a couple of thin wires. Drop print *b* was placed in position and the pattern was ready. The casting produced gave all satisfaction, and in less than thirty hours' time the pump was again at work.

A PATTERN LETTER MOLD

HERE is a sketch of a lead pattern letter mold. In making the mold use good, clean-cut letters — brass letters preferred. The wood part or mold frame is made of cherry wood, and the mold of sifted plaster of Paris. Make the frame good, true and strong and you can have at any time on short notice a mold that will turn out very satisfactory lead letters. Don't ask an apprentice boy to make the mold frame or mold, but when the mold is made you can keep him busy pouring the molds and trimming letters.

In Fig. 47 *A* is a cherry board, 1 inch thick, perfectly true on the letter face; *C*, a stiffener on

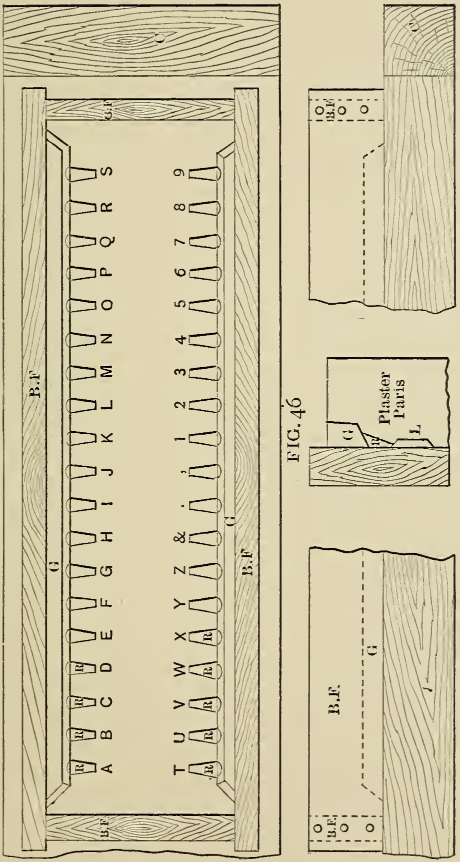


FIG. 46

FIG. 47

FIG. 48

FIG. 47

Mold for Lead Pattern Letters.

the end. Shellac *A* and then put the letters on in the usual way. *B F* is a box frame, the sides about $\frac{1}{2}$ inch from the edges of the letters and 1 inch deep. *R R R* are runners from gates *G* to the letters. Cut the runners in with a chisel after the mold is made, about $\frac{3}{16}$ inch wide at the gate, tapering and just large enough at the letter to allow the mold to fill without chilling. If the mold does not fill, the cause is that the runner is not large enough. Place a piece of wood, as in Fig. 48, tight to the face of the mold and pour in melted lead, then shake out and trim. To melt the lead use a large spoon and heat with an alcohol lamp, placing small pieces of lead in the spoon. A little frame to hold spoon and lamp can be made and kept for the purpose. If the lead does not melt fast enough, put a small piece of wax in the spoon. After the lead is melted skim off the dross and then pour.

SMALL PLANES FOR PATTERNMAKERS

Having run across a number of small planes of the dimensions shown in sketch, Fig. 49, a wide-awake patternmaker took them to the shop and planed the bottoms to the radii, as shown, and from an old file made blades or knives to

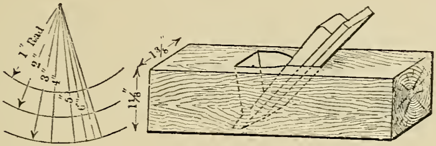


FIG. 49. — Cheap Planes for Patternmakers.

suit. These worked so well that he ordered five more at his hardware store. Now he has a neat set of core-box planes which take up little space in his tool-chest.

ROUND-SOLED PLANE FOR PATTERNMAKERS

HERE is a sketch of a round-soled plane for patternmakers that was devised some years ago. The plane is of cast iron, and the wooden soles are removable, being of different radii to suit requirements, the "iron" also being changed with the sole. The sketch, Fig. 50, readily explains itself. The large portions of the slotted holes *a a* are big enough to clear the heads of the wood screws *b b*, thus allowing the sole to be slipped off and on. When driven home, the taper on the heads of the screws *b b* tends to keep

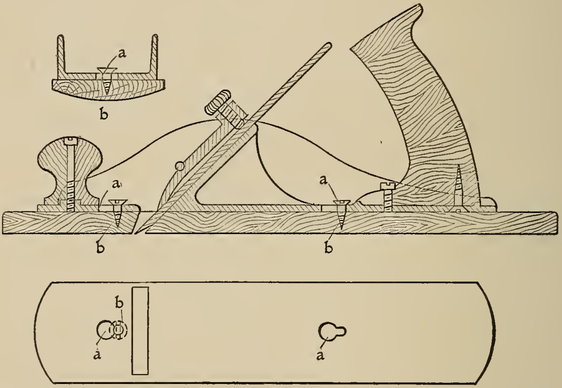
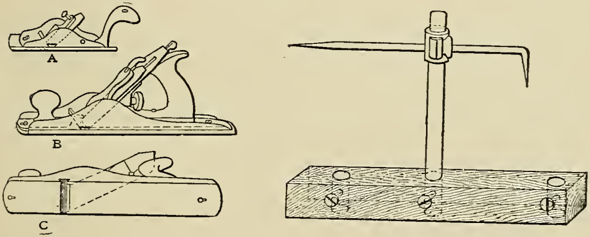


FIG. 50. — Round-Soled Plane with Changeable Soles.

the sole snugly in place. If desired, a plane like this can be improvised out of an old wooden jack plane, by inserting in the bottom of the jack plane and flush with it plates having holes corresponding to *a a*.

COMBINATION TOOLS FOR THE PATTERNMAKER

The patternmaker's combination tools shown in these sketches cannot be carried in the vest pocket and still leave room for a dollar watch. They have some virtues, however, that will commend them to the itinerant members of our craft, and perhaps to some of the "fixtures."



Figs. 51 and 52. — Combination Tools for Patternmakers.

Fig. 51 shows how two sizes of iron planes can be made to each serve a dual purpose, the smallest block plane *A* and the jack plane *B* and *C* being converted into sole planes for use on curved work — such as lags and circular core boxes — by filing out a dovetail at the mouth of and clear across the face of the plane, to allow space for the shavings to pass freely when used as a sole plane. It will be found that the angle of the plane iron makes it necessary to provide additional room, hence the width of the dovetail is determined by the thickness of the soles used, which should never be more than $\frac{5}{8}$ inch on the jack plane and $\frac{5}{16}$ inch on the block plane of the size shown. At *C* is shown the dovetail fitted with a piece of cast iron or steel so that the plane can be used as originally intended. The "tadpole" holes shown at the ends, and used to fasten the soles to the body through the medium of button-head screws, are not of sufficient size to cause trouble when "jacking" stock. In making the soles, leave enough stock at the ends so that after fitting to match the tadpole holes, lines can be scribed to conform to the shape of the plane outside, and to the width and length of the mouth inside.

Fig. 52 shows a tool that also is a space saver, as it can be used as a surface gage, straddle gage, depth gage for lathe work, panel gage and router. The body or base is made of hardwood $7\frac{1}{2}$ x 2 x 1 inches, with three $\frac{1}{2}$-inch holes drilled through, one in the center, one $\frac{3}{4}$ inch from one end, and one $1\frac{1}{2}$ or 2 inches from the other. The purpose of spacing the end holes differently is to provide for the innate cussedness of inanimate pattern work. The sketch shows the tool as used for a surface gage. Without dismantling it will prove itself a straddle gage as well, for scratching lines on surfaces inaccessible to the ordinary scratch gage, by using the upper face of the body and adjusting the scriber bar to the desired clearance for hight. If a fine adjustment of the scriber point is wanted, bend the bar slightly at the center; then, by turning the same around by the aid of the right-angled end, almost any adjustment can be obtained. By slipping off the sliding clamp, a depth gage for turning deep work of small diameter results, and by substituting an extra long beam for a panel gage, and with the usual shaped cutting tool for a router set in either of the three holes. It will be seen at a glance that this is a handy tool to own. The gage beams should be made of $\frac{1}{2}$-inch brass pipe, and ordinary slotted head steel wood screws are good enough to clamp the same to the body.

A FACE-PLATE FOR WOOD-TURNING LATHES

The sketch, Fig. 53, shows a face-plate for wood-turning lathes which has been found very useful in making patterns and core boxes for such goods as globe and angle valves, cocks, etc. It consists of a face-plate which screws on the lathe spindle in the usual manner, with the addition of another plate fastened to the first by

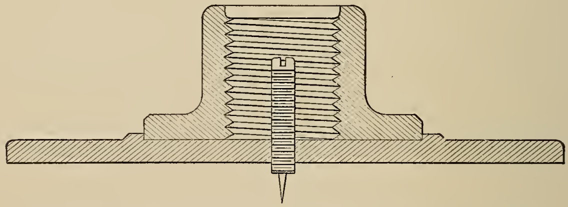


Fig. 53. — Face-plate for the Wood-turning Lathe.

screws and held true by the rim on the back side which is bored to fit closely on the first plate.

The front plate is drilled and countersunk as usual, and has a long screw fitted accurately in the center, which screw is pointed as shown, and is used in centering work on the plate. It can be screwed out some distance from the plate to center pieces from their center lines. The outer plate can also be removed and small work be centered to it much more accurately than is possible with the ordinary face-plate.

PATTERN PLUG CUTTER

WHEN patterns are put together with screws the heads being sunk in to allow for plugging with wood plugs. Fig. 54 shows a plug cutter and method of using it.

The cutter can be made of a straight piece of tool steel to be held in the chuck, or the shank can be made taper to fit the hole in the lathe spindle. Some patternmakers attempt to cut plugs from any old place on the face of the board without any thought as to clearance for cuttings or sawdust; this is a mistake. Rip a piece *A*, about 1¼ inches thick, 3 inches wide and any convenient length, and place this on block *B* which rests on the bed of the lathe and is high enough so that the top edge of *A* will be in line with the hole in the cutter; this provides a clearance so that sawdust may fly off when the teeth pass out of the wood at the upper edge. After cutting the plugs to the required depth, say $\frac{3}{8}$ or $\frac{1}{2}$ inch, along the upper edge, or, if

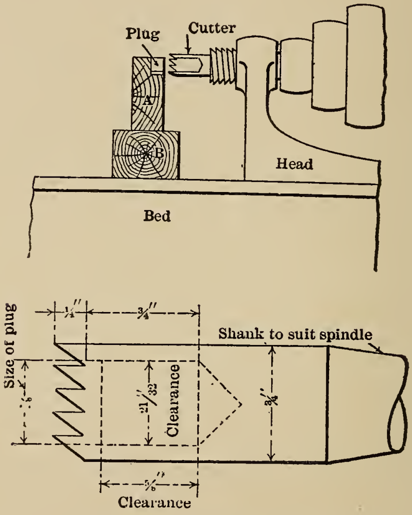


FIG. 54. — Pattern Plug Cutter.

desired, along all four edges, take the rip saw and cut off and put away in an old screw box for future use.

A SHAVING BOX

With a cheap shaving box, as shown in Fig. 55, heaps of shavings around a wood planer and scattered all over the shop can be avoided. It answers two purposes: to catch the shavings and as a table for lumber. It is mounted on wheels

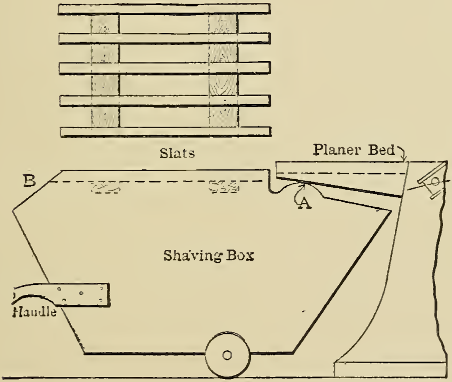


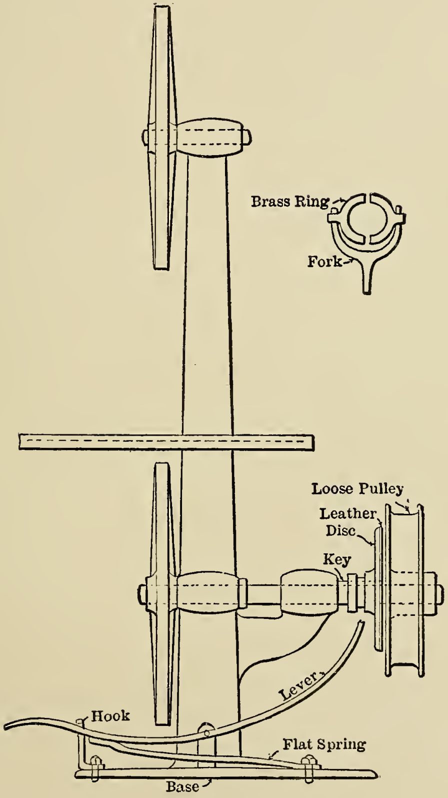
Fig. 55. — A Box for Shavings.

so placed that the handle end is the heaviest; this keeps the other end up to the planer bed at *A*, and it is free to move up or down with the bed. The slats are made of hardwood $\frac{5}{8}$ inch thick and $1\frac{1}{2}$ inches wide, spaced to allow shavings to drop through and leaving an opening at *B* for shavings scraped along with the lumber. When sweeping up the shop the slats can be removed and the sweepings can be put in the box and carted away.

FRICTION DRIVE FOR A BAND-SAW

In the pattern shop or in any wood-working shop where a band-saw is used, the starting and stopping, or in other words the shifting of the belt, is a nuisance and is laborious, particularly when this is done several times each day.

Fig. 56 shows a change made on an old band-saw for the sake of an experiment, which gave good results. The tight and loose pulleys were removed and in their place put a sliding friction disk and loose pulley. The disk was shifted by a lever under which was a flat spring, the spring being powerful enough to force the leather face disk into contact with the pulley, thus driving the saw. The disk was kept out of contact when not in use by a hook at the front



FIGS. 56 and 57. — Friction Drive for a Band-saw.

of the machine; a downward pressure and side movement of the foot releases the lever and allows the spring to act at once.

Fig. 57 shows the yoke end of the lever fitting over the hub of the disk. This ought to interest band-saw manufacturers.

PUTTING A RUBBER BAND ON A BAND-SAW WHEEL

The following directions for putting a rubber band on a band-saw wheel may be of interest to some. First drive a hardwood pin *A*, Fig. 58, the size of the hole in the wheel, into the bench. Fit the $\frac{5}{8}$-inch pins *B* into the bench outside the rim of the wheel. Cover the rim of the wheel and the inside of the band with Le Page's glue, shellac or sticky varnish. Stretch the band evenly over the pins B, then draw them out, letting the band back to the rim of the wheel. Now take a piece of round steel of small diameter, like a carpenter's scratch awl, and draw it around between the band and rim. Let the wheel stand over night. If canvas-back bands are used, the pins *B* must be placed nearer the rim of the wheel than if rubber bands are used.

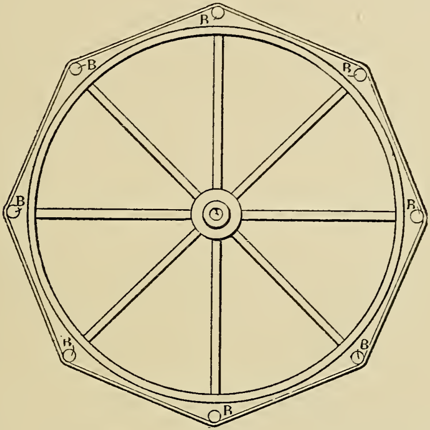


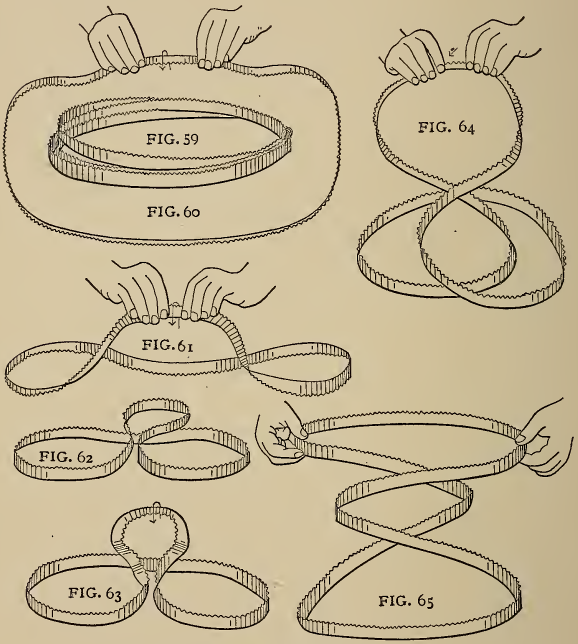
FIG. 58. — Putting a Rubber Band on Band-saw Wheel.

HOW TO FOLD A BAND-SAW

EVERY man who ever uses a band-saw, and every man who may have the job to braze a broken one, should know how to fold it. Simple as the trick is, it is not an easy thing to discover for oneself, and it is equally difficult to find it out by watching another man do it, especially if he wishes to mystify the one who is watching him. There is nothing equal to a practical demonstration for explaining things of this sort, but we have tried here to make it as clear as possible with a number of illustrations, and with these and a band-saw to practise with the trick should be mastered in a few minutes.

Fig. 59 shows a saw which has been folded as required. Fig. 60 shows the beginning of the operation with the saw open and in position for making the first twist. The lower part rests on a clear space on the floor at a convenient distance in front of the operator, who stands holding the upper part as shown by the hands. It will be noticed in Fig. 59 that there are three folds, and that of course they cannot lie level all around as a broken saw can be rolled. In Fig. 60 the saw is twisted in the direction of the arrow, and it will be noticed in all the views that the twist is always in the same direction. Supposing that the saw is held with the teeth away from the operator, the first twist turns the part in the vicinity of the hands with the teeth towards him. If the entire saw is allowed to spring freely while twisted in this way, this has the effect of throwing the lower part of the saw into two loops as shown in Fig. 61; although this really goes a step beyond this stage and shows the next twist commencing. Fig. 62 shows that the effect of the first twist can be very simply obtained by merely laying the saw on the floor and drawing one part over the other; but nevertheless in folding a saw it is easier to obtain this effect by a twist as in Figs. 60 and 61. Fig. 63 shows how the saw is to be twisted after it has assumed the Fig. 62 position. This final twist when completed allows the saw to fall easily into three coils. The two first loops form two coils which turn one over the other when the third is formed. The third coil is formed as soon as the remaining part of the saw is twisted completely over. The rings then will adjust themselves and will not open again unless untwisted. Untwisting can very easily be done by any one, although it is seldom that a person can discover by carefully opening a saw how to fold it again.

Fig. 64 shows the operation practically completed. The two lower loops are overlapping each other with their teeth uppermost, and the upper loop still has its teeth toward the operator



Coiling a Band-saw.

and merely requires to have them turned upward and the loop allowed to fall and adjust itself with the other two. Fig. 65 shows the saw completely folded but with its coils raised vertically to show how they lie.

Saws not in use can be handled and stored much more conveniently when folded in this way than if they are kept at their full diameter. A broken saw can easily be rolled up and tied by any one, but an endless saw cannot be rolled and there are plenty of patternmakers and others who only know how to deal with broken ones. In fact, there are plenty of men who will spend a great deal of time in trying to fold a saw and then only result in breaking it. It's a handy thing for any patternmaker to know.

GRAIN OF LUMBER IN PATTERNS

One thing that few patternmakers seem to understand about lumber, and one of much importance, is, how the grain of the wood can be placed to make the pattern most serviceable. When quarter-sawed lumber is spoken of, it is generally supposed to apply to oak or other hard woods, and is understood as meaning a method only of showing the markings on the face of the board.

But there are quarter-sawed boards in pine or any other kind of lumber. A quarter-sawed board is one that is cut from the log radially, as in Fig. 66. To cut all boards quarter-sawed would waste too much of the log, which is the reason that only a few boards from each log are sawed radially.

A quarter-sawed board will stay practically straight during many changes of temperature or humidity. So if you have a thin pattern to make that has no ribs to hold it straight, select, if possible, a quarter-sawed piece, which can be easily done by looking at the grain on the end. You may waste a little stock to get such a piece, but just consider the convenience of having the pattern stay the way it was made. We remember an instance of making new patterns to replace some that were badly warped. Cleats were ordered put on the new patterns, to be afterwards stopped off. The patterns were sent to the foundry without cleats, with word that when they became crooked, to send them back and we

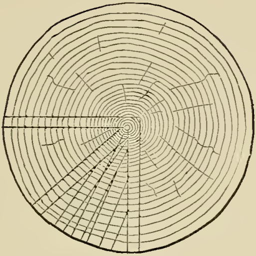


FIG. 66

FIG. 67

FIG. 68

FIG. 69

FIG. 70

Grain in Lumber.

would put the cleats on. But we never saw them again.

A board like Fig. 67 will not stay straight long — which reminds us of the boy who tried to plane such a piece straight; the more he planed the worse it got, until it began to look as if there would be no board left. The boss told him he didn't plane fast enough to keep ahead of the warping.

When gluing two thicknesses together, it is better to place them so that the grain will lie as in Fig. 68, because the warp of one piece will counteract that of the other, and the joint will not open as readily on the edges as if placed like Fig. 69 or 70.

If you glue one piece across another you will get the effect of Fig. 71, unless the glue lets go or one piece splits in shrinking. The pull of board *A* in shrinking is often powerful enough to bend board *B* in its length. Cross grain is only effective with absolutely dry material of four or more thicknesses.

A pattern like Fig. 72 is more serviceable if made with the length of the bottom piece running

FIG. 71

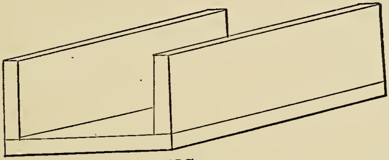


FIG. 72

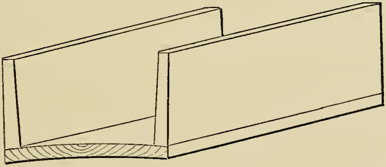


FIG. 73

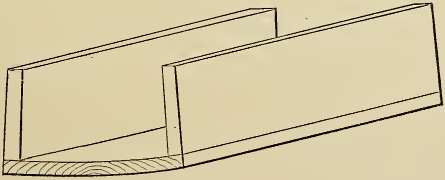


FIG. 74

How it Affects Patterns.

from one rib to the other, as the bottom will stay straight and the ribs will always draw. If made like Fig. 73 or 74 you get the effect shown, which will distort the ribs so that the pattern will not draw.

If the grain of the wood can be put in pattern in the same direction as the line of draft, a slight warping will not affect the drawing of the pattern. This cannot always be done, because patterns so made would be weak in vital parts. Distribution of the grain of wood in patterns is as much a study as the distribution of metal, both equally affecting the utility of their respective constructions.

JUDGMENT IN PARTING PATTERNS

Figs. 75, 76 and 77 show three views of a machine frame to be cast. It is about 30 inches high, which will give a sufficient idea of the sizes. The common way to part symmetrical work is along the axis of symmetry, and this does very well with rectangular sections up to a certain size, and up to any size with circular sections.

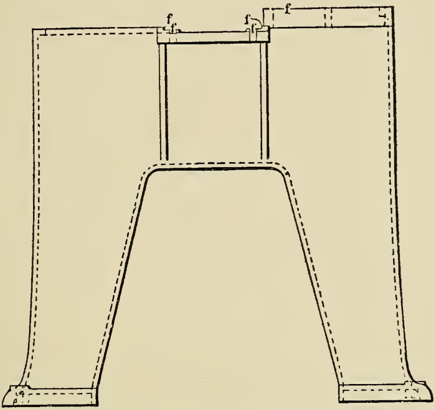


FIG. 75. — Front Elevation of Casting to be Made.

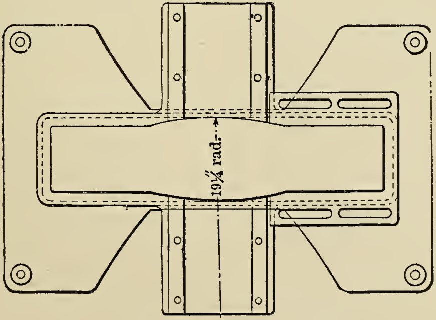


FIG. 76. — Plan View.

With the former, the limit is reached with a cope of from 4 to 6 inches depth, when a core has to be set making thin sides of from $\frac{1}{4}$ to $\frac{3}{8}$ inch in thickness. Under these conditions some other method of parting should be sought. Undoubt-

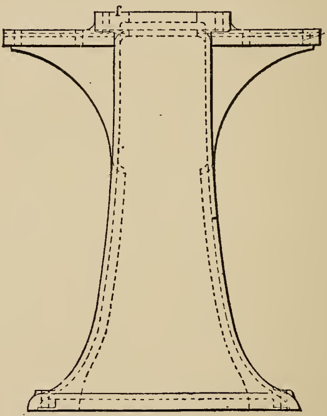


Fig. 77. — Right Hand End Elevation.

edly, many pattern shops would part the frame here shown along the axis *A B*, with the result that when the cope was put on it would have to be lowered by the crane at least 10 inches, with every possibility of dirt being knocked into the mold, nobody knowing how much; neither can

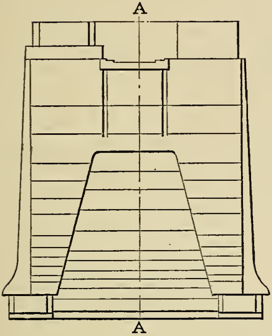


FIG. 78

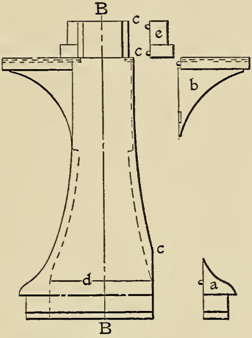


FIG. 79

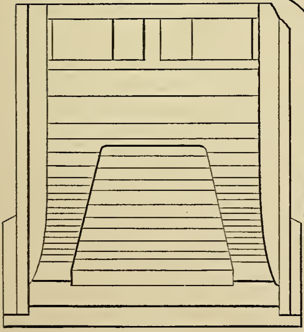


FIG. 80

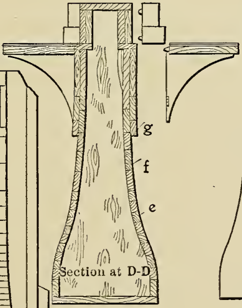


FIG. 81


FIG. 82

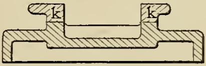


FIG. 83

Parting a Pattern.

the thickness of metal left on either side of the core be known.

Figs. 78 and 79 show the pattern as built to help the molder. The parting line is along *c c c c*, with the pieces *a*, *b*, *e* loose and molded in the cope. A half-core box, of which Fig. 80 is a plan, was made covering *d* with separate boxes for *a* and the corresponding parts of the nowel. After the pattern is drawn the small cores in the nowel are set, then the main core; any dirt which may be accidentally knocked into the nowel can now be easily removed, the thickness of metal on the sides may be observed and the thickness of stock above the core determined without putting on the cope. The cores for *a* are hung in the cope.

This construction is open to the criticism of entailing additional loose pieces, with their attendant troubles; but the certainty of clean castings of uniform thickness justifies the extra care necessary in keeping account of these pieces.

The anatomy of this pattern is shown pretty clearly by Figs. 81 and 82. Pieces like Fig. 82 were first got out, and to them were nailed *e*, *f*, *g*, etc. These *e*, *f*, *g* were also glued and nailed to each other, as they were built up. It will be noted that all stock is so attached that the pattern draws with the grain of the wood.

Another source of much trouble is not having castings come to size in the improper and insufficient means by which loose pieces are often attached to the main part of the pattern. We recently had a pattern sent to our foundry by a customer a section of which was like Fig. 83, with the pieces *k* loose and without dowel pins. It must be evident that these pieces could not be held in their proper places without pins. Could every patternmaker spend six months in the foundry many of these little oversights would be avoided and much trouble would be saved for all concerned.

FILLETING WOODEN PATTERNS

It would be difficult, perhaps, to find anything like unanimity of opinion among patternmakers regarding the real value of the fillet. Still this much may be affirmed without hesitation, that the majority believe in and make free use of it in their work. In well-nigh every reputable shop a piece of work would hardly be looked upon as finished if the corners were left unfilled; and certainly only a slouchy, careless workman would allow a pattern to leave his hands in such condition.

Many reasons may be assigned for this time-honored practice, but the main one is that it is a great accommodation to the molder, and also ensures a cleaner and more finished casting. Leave the corners of a pattern unfilled and the chances are that the sharp corners of sand become ragged, resulting very often in rough and unsightly castings. It is always best to fill in the corners, unless there be some special reason, as sometimes is the case, for not doing so. It may be added also that sometimes the fillet is used for strengthening purposes. The addition of more metal in the corners, be it ever so small, greatly increases the strength of a casting. Every experienced patternmaker can testify to the importance of the fillet in this particular.

For all straight surfaces the wooden fillet answers the purpose very well, providing one has nothing better at hand. It is very annoying, however, when a person is in a great hurry to finish a job, to be compelled to turn aside and sometimes spend considerable time in making fillets. Then one is tempted to wish that he could buy a stock of ready-made fillets, and thus obviate both the annoyance and the delay.

To meet this long-felt want, and at the same time do away with the inconvenience, different kinds of filleting material have been placed on the market, notably the lead and the leather fillet. The former has never met with a kind reception because it gives too much trouble in tacking, does not lie closely to the wood and rarely makes what is called a finished job. The latter, on the other hand, has met with hearty approval as the best thing of its kind in the market. It can be easily adjusted to any kind of surface, curved as well as straight, is easily fastened to the wood by either shellac or thin glue, adds to the strength and gives a finished appearance to the pattern. In fact, when the surface is shellacked, it affords a mahogany effect.

On curved surfaces it lies as snugly and smoothly as on straight. And considering the moderate cost of this new device, together with the great saving of time which its use secures, it certainly pays to keep a good supply of it always on hand.

If we dared venture to recommend the best filleting material for constant use in all kinds of pattern work, we would give preference to the leather kind.

How to Apply Them

Leather fillets are not new, but how to apply them so that they will stick for keeps is sometimes a problem. Some advocate the use of shellac or thin glue, which is at least safe advice, considering the fact that most patternmakers have not free access to the jealously guarded office mucilage bottle.

Wood fillets, if for use in right-angled corners, should be planed to 93 degrees angle, and are so made and sold, and if a real good job is desired, put the filleting in a fillet board and curl over the edges by sandpapering with a cylinder somewhat larger in diameter than twice the radius of the fillet. By adopting this little kink very little rubbing is necessary, provided good, stiff glue is used immediately after moistening the outer edges only, and it will be found that, when perfectly dry, the edges are there to stay and without exposing the usual irregular streaks and patches of glue at that.

As to leather fillets, there is only one way to fasten them properly, and that's with glue. After dampening the outside, not too much, and spreading the glue as evenly as possible, get to work with your little steel ball p. d. q. until everything is lovely.

And now just a few "don'ts" on this question:

Don't saturate a leather fillet with water from the grindstone keg *before* gluing.

Don't saturate a leather fillet with water from the glue pot after gluing.

Don't slobber glue on a fillet; enough is a genteel sufficiency.

Don't ever use shellac on a fillet; it's a waste of good material.

Don't ever use lead fillets with the idea that they are the ancestors of the "lead pipe cinch" family; it is not so.

"X-RAY" PATTERN WORK

The men in the shop called it the "X-ray" trick. We were making a number of pulleys with five, six or seven arms. Each pattern was made in halves for the molding machine, only one half pattern was made, and this had to be very accurate, so as to reverse. We made the pattern as nearly as possible correct, but the foreman had a slight doubt about it, and he told us to lay it on a piece of drawing paper and cut out the arms and see if it would reverse. We did this with a number of them and found it a great lot of trouble to get the paper arms cut out exact, and when the cut paper was left over night it would change its shape. Then we thought the thing over to see if it could not be done some other way. We took a piece of ordinary drawing paper, placed it on a flat surface and then placed the pulley on the paper and traced the arms and rim. After tracing, the paper was taken to one of the windows and put up flat against the glass and then the pulley pattern on the paper. In this way we could do in two minutes what before took a quarter to half an hour, and with far better results. Now all match patterns are tried in this way.

PATTERN REPAIRS — WAXING

Much time and considerable money are spent every year in most establishments in pattern repairs; a number of years spent in the pattern shop of a large foundry have proved that to me most effectually in one item at least, viz., the waxing of patterns.

Where the vent wire has left its marks, and in some cases mighty good sized ones, from constant use, instead of wax use plaster of Paris; and if it is applied in the proper way it will be found more durable, cheaper and quicker to apply than wax. Have the pattern brushed clean and apply a light flowing coat of yellow shellac, which will run in the holes and crevices, and allow it to dry. Take a block of wood 5 x 5 x 2 inches thick, bore a 2-inch hole $1\frac{1}{2}$ inches deep, and you have your receptacle for holding and mixing your plaster. Fill two-thirds with plaster, pour in your shellac and mix until a thick paste is formed. It is now ready to apply. Work well into all vent holes and cracks, smooth all off, and allow 30 minutes to 1 hour to dry. Sandpaper what projects above the surface, and your pattern is ready for varnishing. You will be surprised at the finish and durability of your pattern, besides a big item in reduction of expense.

A QUICKLY MADE FLY-WHEEL PATTERN

We were asked to make a wheel of about the design and dimensions as shown in sketch, Fig. 84. The man wanting the wheel did not wish to expend much money on the pattern, as it was only for an experiment and might not be used again. For the rim we used lead pipe, which was filled with sand and bent around an old boiler shell; the spokes were made of 1-inch dowel pins, laying in the mold pieces of 1-inch wrought iron in their places, and the hub was sawed out on a band-saw. For a cheap job it worked quite well.

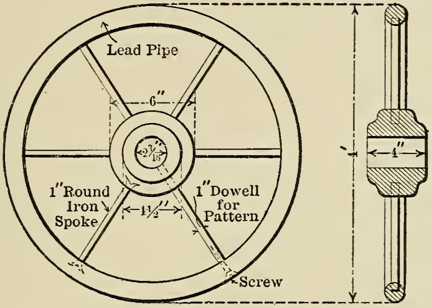


FIG. 84. — A Quickly Made Fly-wheel Pattern.

PLANING TAPER CORE BOXES

WE had a taper core box to make of wood, the other day, and after putting it in the hands of the patternmaker we watched his preparations with interest, which increased when he reached the planing stage, and, as his plane and method were both new to us, and may be to others, we will describe them, so that those who are unfamiliar with the scheme may profit by his example.

His plane is made with an angle of 83 degrees 16 minutes, instead of the regular 90 degrees of a right angle, and in practice he lays out the semicircle of the core box and the ends, and fastens upon it, with brads, strips of hardwood having straight edges upon the inside and touching the points where the ends of the semicircle cut the edges of the blank. The thickness of these strips must be $\frac{1}{16}$ of an inch or fractional parts thereof for each inch in diameter the core box is to be.

By this method he secures a finished core box, with good sharp edges, which result is accurately obtained without the use of templets or other instruments. All the wear of the plane comes upon the hardwood strips, which save the edges of the core box from becoming rounded, and it is especially of value in generating the surfaces of taper core boxes, in which case he makes his hardwood strips the same taper in sixteenths which he wishes the core box to vary by in inches of its diameter.

It is evident that any fractional basis may be assumed which is most convenient for the work generally handled, so that instead of adding guide strips of a thickness in sixteenths equal to the diameter in inches, they may be assumed of a thickness in tenths equal to the diameter in inches, and this would put the calculations in decimals. Of course the angle of the plane for such a fractional basis would have to be calculated, and, as the value of the fractional basis was increased the angle would decrease.

The sketch in Fig. 85 gives an illustration

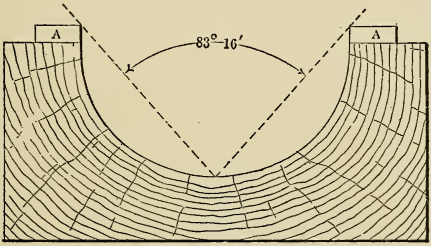


Fig. 85. — Planing Taper Core Boxes.

of the adaptation of this old proposition, in which *A A* are the strips of hardwood and the angle of the plane sides is shown by the dotted lines.

PATTERN SHOP WRINKLES

Fig. 86 may represent any core box of considerable size, having a loose piece or bar running across it even with the top, this piece having to be removed before the box is turned over and lifted away from the core. Bore two $\frac{3}{4}$-inch holes *A A* at an angle and $\frac{3}{4}$ inch or more deep, when the size of the bar will admit of it, to accommodate the coremaker's thumb and finger when taking out the piece. This saves driving a draw spike into the part.

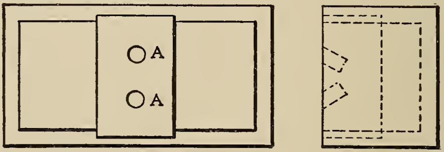


Fig. 86. — Thumb Holes for Drawing a Loose Piece in Core Box.

Fig. 87 shows a handy form of hanging box for brads. It is made of tin, about 7 x 4 x 1 inch. When a row of these hang back of the bench, labeled with the different sizes, the wire nails are out of the way, and the box containing any length wanted can be placed flat on the bench while being used, and then be returned to the hanging position without any danger of spilling.

Fig. 88 shows a face-plate having three holes, $\frac{3}{8}$ inch or more in diameter, drilled into a suffi-

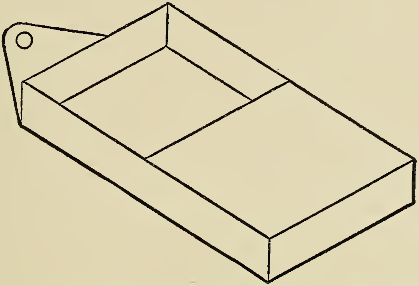


Fig. 87. — Nail Box to Hang up or Lay Down.

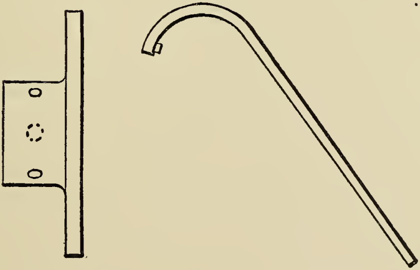


Fig. 88. — To Unscrew Face Plate of Wood Lathe.

cient depth, at equal distances in the hub, and a spanner is made to fit, about 18 inches in length.

This is handy for removing, when a little too tight to start by hand, and yet not "dead set," as we say.

Fig. 89 illustrates a case where a web to go in a large pattern, which may be either circular, rectangular or otherwise, according to circumstances, is to be made in strips set about $\frac{1}{8}$ inch apart, to

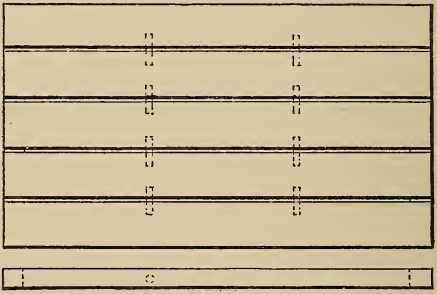


FIG. 89. — Gluing up a Web for a Large Pattern.

counteract as much as possible the tendency to shrink or swell. Instead of gluing the short separating pieces at intervals through the middle of the pattern, as it is necessary to do at the ends, use pieces of doweling as shown by dotted lines, and no glue. This will keep the strips in the same plane and at the same time allow them their freedom if subjected to extremes of moisture or dryness.

When a loose piece is used, it occasionally happens that some means must be employed to have it keep absolutely in its exact position while being rammed, without any possibility of shifting, as there is when wires are used to hold it, especially when the piece is long in proportion to its bearing surface. Fig. 90 shows an idea sometimes used in shops on a particular piece, for this very purpose.

It consists of a clamp *A* and two plates *B B*, Fig. 90, which can be round, square or rectangular, according to circumstances. When the nature of the work will admit of it, round ones are preferable, for they fit a hole made by an extension bit. The part *d* of clamp *A* is threaded a short distance, and the length from end to shoulder must be made to fit any particular case, being enough longer than the loose part on pattern, to screw into the plate having the tapped hole; the other plate has a drilled hole just the diameter of *d* beyond the thread. The other portion of *A* is of any convenient length. Sometimes it is made

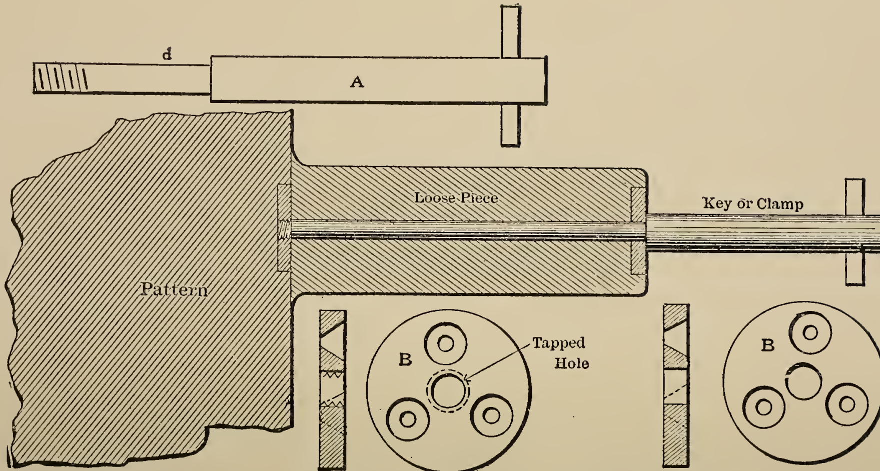


FIG. 90. — Holding Loose Pieces on a Pattern.

long enough to stick through the outside of the flask.

The section view in Fig. 90 shows the method of using. One plate is screwed flush into the pattern, and has a hole tapped to fit the key or clamp. The other plate is screwed flush into the loose part and has a plain hole. This hole is continued through the loose piece. When the clamp is screwed up, the shoulder binds against the plate on the loose piece and presses it so firmly against the pattern that no amount of ramming will disturb its position, and when the sand is thoroughly packed against the part it can be easily unscrewed without disturbing anything. This arrangement is, of course, intended to be used only in special instances.

Fig. 91 is a block in which to rest a flat chisel while turning a piece of some length to a given diameter, if it is necessary to have it very smooth.

A patternmaker, when holding a pair of calipers in one hand and a flat chisel in the other, gets a scraping cut, but a little block like the cut causes the chisel to lie at an angle and makes a smooth, drawing cut. Chisel and block are to be held together in the hand against the rest as one piece.

It is hard to clean the machine tools in a pattern shop with a brush, especially a lathe having a carriage, and for removing sawdust, shavings, and turnings from the irregular outline

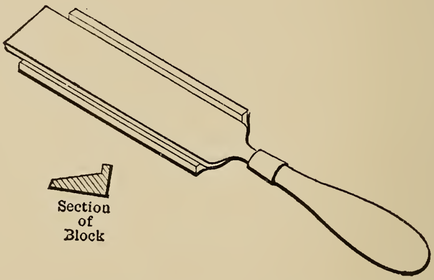


FIG. 91. — Block to Guide the Flat Chisel in Wood Turning.

of wood-working machines a pair of bellows works to perfection, and makes the particles jump from behind the corners as if by magic.

A quick way of getting the number of feet in a piece of inch stock for a pattern is to multiply the product of the length by the breadth in inches by 7 and point off three places, instead of dividing by 144. This is not absolutely accurate, but near enough for all practical purposes in measuring small amounts.

For example, take a board 18 inches long and 8 inches wide: $18'' \times 8'' \div 144 = 1$ square foot; $18'' \times 8'' \times 7 = 1.008$ square feet. The error is .008 of a foot when using the multiplier 7.

Again, take a board $7\frac{1}{2}$ feet by 16 inches: $90'' \times 16'' \div 144 = 10$ square feet; $90'' \times 16 \times 7 = 10.080$ square feet. This time the error is ten times as much, but still only .08 of a foot out of the way in a 10-foot board.

When measuring thicker stock than 1 inch by this method, multiply the length, breadth, and thickness in inches together; then use 7 for a multiplier, as before, pointing off three places. In effect this method is expressed thus: Cubic inches $\times$ .007 = square foot board measure.

In many shops the backs of all loose pieces are painted red, and the corresponding place on the pattern painted to match. When these loose parts are circular in outline, with one wire or wooden stick of doweling through the center to hold them in place, the shape can be instantly transferred to the pattern by first painting the back of the loose piece, and, while it is still moist, placing it in position on the pattern and turning it around a few times with a light pressure. Even if these round bosses do not bear fairly against the pattern over their entire surface, if they touch on the outer edge the shape is printed and the center can be easily filled in without especial care, but to follow a line exactly with a brush without a rest for the hand is difficult for most persons.

Sandpaper can be used for truing an oilstone when emery cloth or loose sand is not handy, but it works very poorly when dry. Place the sandpaper on a board and keep it wet with water, rubbing the stone vigorously at the same time. The water seems to keep the sandpaper from clogging up, and it cuts the stone much more rapidly, but a single sheet will not last very long, as the water loosens the sand and softens the glue, so the stone must be washed off as soon as ground true so that no glue may remain.

CIRCULAR PATTERN WORK

Many different shapes and sizes of circular patterns may with advantage be prepared for the molder's use by the method about to be described. This method is of equal value as a time-saver whether 6 or 1000 castings are wanted from the pattern made. It has also the advantage of providing directly for the molders' use a pattern equal in every respect to a plate pattern, and which may in many instances be worked by comparatively unskilled labor. Fig. 92 is a plan and section of a casting of which 1000 were wanted. Fig. 93 shows section and plan of the drag part of the pattern, which is prepared by first truing up a suitable board and chucking the same in the lathe. The convex side of the pattern is fastened on to the board and turned down so that the board serves as a joint when used in the molding shop.

The pattern used to form the concave side or top part of the mold is prepared similarly to the drag, with the exception that the board is made sufficiently thick to allow the contour of the pattern to be turned out of its face. At *B* is shown in section the top part of the pattern. *C* is the drag part of the pattern complete. The pin guides *A A* are set on the center line and at

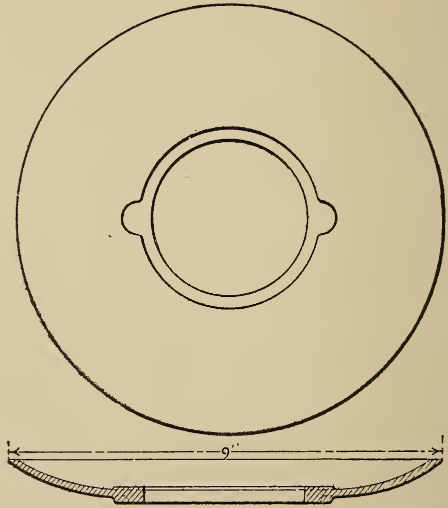


Fig. 92. — Sample Circular Casting.

equal distances from the center of the pattern board. These guides fit corresponding pieces on the snap flask used to make these molds, and similar guides are fitted to the top part of the pattern board. To make a mold, the two pattern boards are placed side by side and both drag and cope are rammed up together. The drag is turned over, the pattern rapped off, and the top

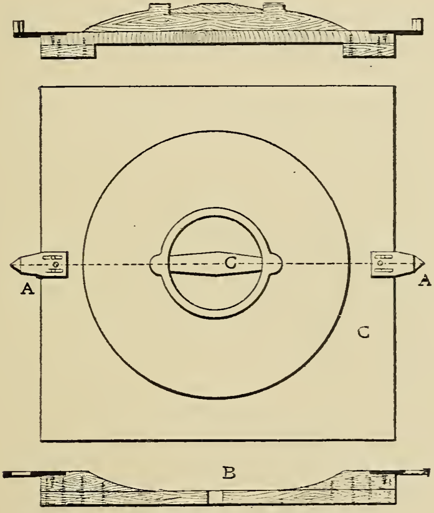


FIG. 93. — Plan and Section of Pattern.

part is lifted off the pattern and placed on the drag. The flask is next taken off the mold and the weight is placed on the top. This leaves the mold, as in Fig. 94, ready for pouring.

A PATTERN MAKING ITS OWN CORE

THE sketch, Fig. 95, is for a brass casting for which a pattern was made. The way in which the pattern was made and the molding will be of interest, though to some it may be an "old joke."

Four castings were wanted in a rush. The boss molder was consulted and he said, "If you make the pattern for a two-part flask I will have them for you this afternoon." He instructed us to make the pattern as here shown, with parting and core prints and core box. This was done and the castings came true to pattern and on time. The pattern was placed on a board, cope side down, and the drag was filled with sand and rammed up to line *A B*. Next *C* (part of pattern and print) was lifted out of the sand, and in place of the core print a dry sand core was placed, after which the drag was filled, struck off and rolled over. The cope was placed on, rammed up, lifted off, the pattern was drawn and the cope then replaced.

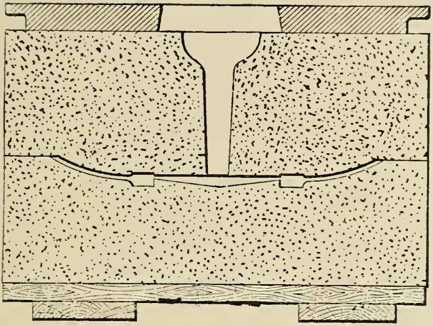


Fig. 94. — Section of Mold Complete.

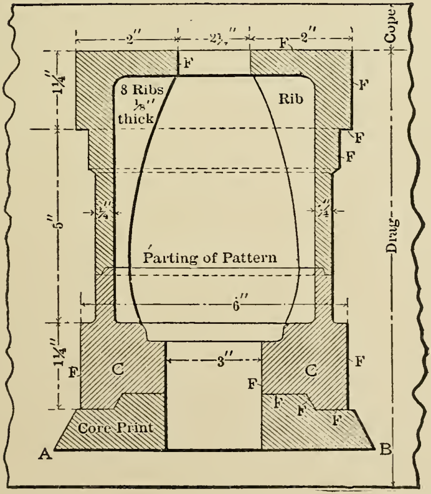


Fig. 95. — Pattern that Makes its own Core.

CONE PULLEY PATTERNS

THIS method requires only a stock core through the hub. It will save time to use two face-plates, building up part way on the first, having the remainder on the second plate, and finally removing the latter piece and fastening it to the first. The complete core is shown in Fig. 96.

On segment work calculation should be made so that when the job is turned there will be no layer so thin that it will peel up in the damp sand. This is easily avoided by deciding on the thickness and number of the layers in the first place, as indicated in Fig. 97. Build up from the small end as far as *d d* on one face-plate, and turn the inside to the correct dimensions. On the outside, just rough-turn nearly to the size, and detach. The reason we advocate two face-plates is that all segments can be gotten out at the same time, and while the glue on one layer is setting, another layer can be worked on the other with no lost time.

Fig. 98 shows the cuts on the three pieces to be framed together for the arms. They are all cut at an angle of 60 degrees with the edges of the pieces and tangent to a circle of a diameter equal to the width of the stock. Gage both edges of each piece into three equal divisions, and describe a circle in the center on both sides of *A* and one side of *B* and *C*, then lay out the lines tangent and make the cuts as indicated. *B* and *C* are exactly alike. Have them fit loosely before gluing, as, when tight joints are made, the pieces *B* and *C* invariably spring outward from the plane in which they should lie.

In order to get fillets on the ends of the arms, cut them a little short, and then fasten on pieces of hardwood, as shown in Fig. 100, with the grain running in the opposite direction for strength. By attaching the arms just mentioned to a small face-plate not greater in diameter than the hub, the taper of the spokes on both sides and the fillet on the under side can be turned. Doing this in the lathe insures all the arms being in the same plane, so that they lie flat when in position. Also square off the ends to the right diameter, allowing at least $\frac{1}{8}$ inch to fit the pockets to be cut on the inside of the second step of the cone, as they must be loose. Before taking the face-plate out of the lathe, after turning the inside of

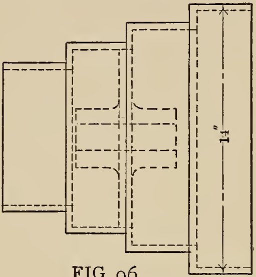


FIG. 96

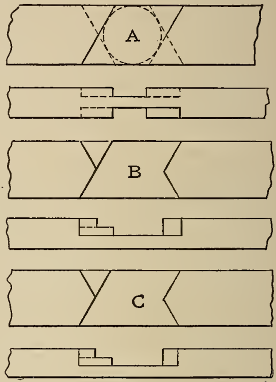


FIG. 98

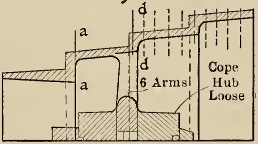


FIG. 97

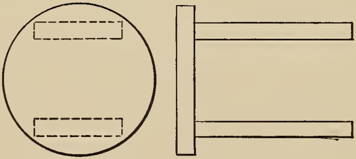


FIG. 99

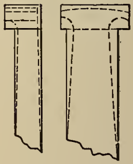


FIG. 100

Making a Core Pulley Pattern.

the first two steps, strike a circle the same diameter as the ends of the spokes were turned, in order to place them correctly.

The outline of the spokes or arms previously framed together should now be laid out and sawed. Then place in position in the pulley, and use it as a guide to mark the width of the places to cut out. It is easy to cut them now, before the last two steps are added. After they are ready to receive the arms, glue on the last two steps previously laid up on the second face-plate, remembering to break joints, and set the whole on a level surface, large end of cone downwards, and place a weight on the top of the face-plate still adhering to the small end of the cone, until the joint is set. In turning, observe the draft in Fig. 97, somewhat exaggerated. The inside of the small step is tapered the other way. Two degrees taper on the inside of the steps and one degree on the outside gives a very liberal amount. The hub on the cope side (towards the large end of the pulley) should be loose and fit the arms with a standard size spindle or shank.

It is considered good practice on nearly all kinds of pulleys of any size to make all hubs interchangeable and to have a standard sized hole through the center of the web or arms, as the case may be, to fit the shank on the hubs, and also a hole in the hubs themselves, to accommodate different core prints. Some shops have $1\frac{1}{4}$ inches as a standard for the spindle or shank on all hubs, and $\frac{3}{4}$ inch for all core prints. Some standard should be employed, as it is so great an aid in changing core prints and hubs to accommodate different conditions.

To facilitate molding, saw out a round piece of board and nail a couple of strips to it, as in Fig. 99, making the hight equal to X on the cone. The cone is set on the mold board, large end downward, with the arms removed, and the piece K inside, reaching a a, Fig. 97. Then the nowel is rammed, after which turn the flask, remove K, and complete the ramming. The next parting will be on a level with the spokes, and this section of sand has to be lifted with a crab.

The cope extends downwards as far as the spokes, and meets the division of sand just mentioned. The loose hub comes up with the cope; then the spokes holding the nowel hub can be drawn, next the sand cake on the crab, and lastly the pattern itself.

MAKING CAM PATTERNS

Having been at one time in a locality where great numbers of cam patterns were made for automatic machinery, such as wire-forming machines, hook machines, etc., where in some instances quite a large number of cams would be needed on the same machine, all varying somewhat but each of the same general type, we will attempt to describe the practice as there employed.

Fig. 101 illustrates the style of cam referred to, often called a face cam. When not over a foot in diameter these patterns are of simple construction, nothing being done, in the way of narrow strips or segments, to prevent warping and shrinking; for the castings are machined all over or very nearly so, and a liberal finish is left on the patterns.

Each pattern consists of three pieces of wood until after the lathe work is done: one for the hub and two for the body. The disks for the bodies are band-sawed from the plank and planed on one side on the buzz planer. The disk *a*, Fig. 101, is attached to the face-plate, and faced off to *x y*. Then disk *b* is screwed to *a*, and both pieces are turned as one. The hub *c* is of course separate, recessed into *b*, making a loose piece as it is cast in the cope. A templet, cut with scissors from very thin metal known as "button covering," accompanies the drawing and is the exact outline of the inner edge of the cam groove. This templet later goes into the machine shop, and is used there in laying out the shape on the blank former which goes in the cam-cutting machine. The patternmaker places the templet in the right position on the face of the blank just turned, and holds it with a few fine wire brads. Wherever in the templet outline there is an arc of a true circle, the fine center point is still visible which was used in laying it out. This now comes in play as the position for the divider leg. The dividers are set, leaving a radius at least $\frac{1}{8}$ inch greater for finish for the inner curves, and $\frac{1}{8}$ less for the outer curves of the slot or groove. Wherever no true radius comes, set the dividers $\frac{1}{8}$ open and scribe around the templet,

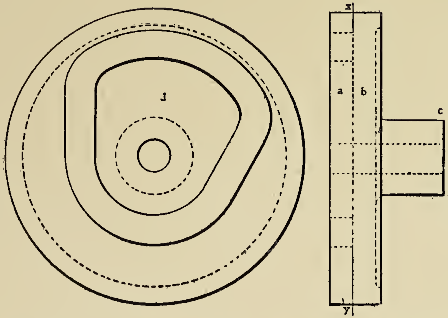


FIG. 101. — Making a Face Cam Pattern.

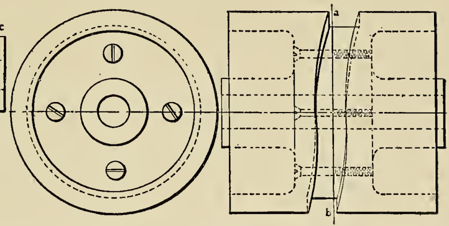


FIG. 102. — Making a Barrel Cam Pattern.

then spread them properly for the other outline, and use as before. At least two brads must now be placed within the outline of *d*, long enough to locate it on disk *b*. The part *a* is still in one piece, and is next marked for replacing, and unscrewed from *b*, and the internal face of the groove in it is band-sawed and smoothed up. Usually a large part of the edge of *d* can be finished on the sandpaper disk wheel when one is available.

The body of the cam is now assembled in its former position, the screws and brads locating it, and this time it is fastened permanently, the place made by the saw blade being filled with a little spline. This completes the pattern proper, all except shellacking, etc.

A very cheap blank pattern, about $\frac{3}{4}$ inch in thickness, is next sawed out, the shape and size of the metal templet, with finish added. This makes the form to go in the cam-cutting machine in the machine shop and is fastened to one spindle, and the cam itself is attached to another, while both turn in unison as the cutting progresses.

Fig. 102 shows a method of making the common barrel cam, having the groove cast in, which is sometimes adopted on cheaper grades of work. The pattern work consists of two separate patterns, the castings made from them being fastened together by screws on line *a b*. This allows the groove or slot to be cast without a core, and saves milling out the slot from the solid when a core is undesirable.

Cams made in this manner can be used with the cam surfaces just as cast, or they may be finished, according to circumstances, and this form admits also of taking up wear by facing off a trifle on *a b*.

A PATTERN FOR A STRAINER

Having received an order to make a pattern for a strainer, 24 x 12 x 12 inches, and put in it as many ½-inch holes as possible, the metal to be ¼ inch thick (Fig. 103) the most particular part of the job was that it had to be made cheaply and in a rush. Also the holes were to be cored through, so as to avoid any extra chipping on the casting. We made a box out of 1¼-inch pine;

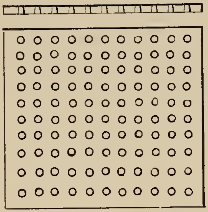


FIG. 105

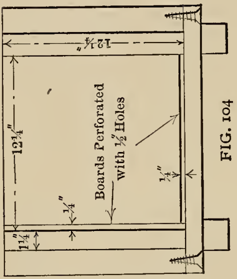


FIG. 104

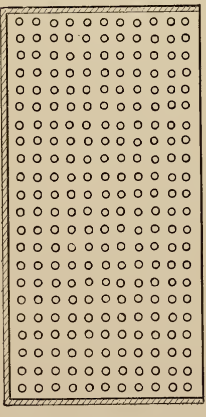


FIG. 103

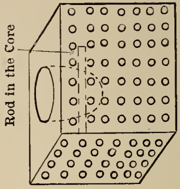


FIG. 108 Core Box

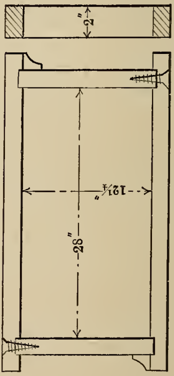


FIG. 107

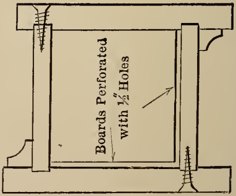


FIG. 106 Top View of Cubic Core Box

Making a Strainer.

inside dimensions were $12\frac{1}{4}$ x $12\frac{1}{4}$ x $12\frac{1}{4}$ (Fig. 104) and made three pieces out of $\frac{1}{4}$-inch stock 12 x $12\frac{1}{4}$ inches, and perforated them with $\frac{1}{2}$-inch holes, seeing that all holes had plenty of draft (Fig. 105) We fastened them in the box, one at the bottom and one at each of the adjacent sides (Fig. 106).

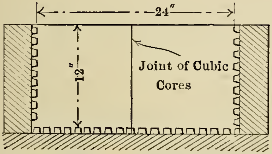


FIG. 109 Sectional View of Cores Placed on Swept up Bed

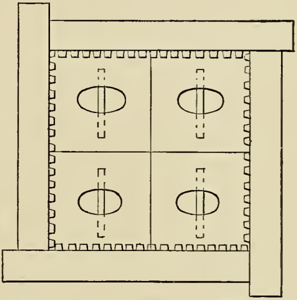


FIG. 110 Top View of Cores after being Placed in Mold

Making a Strainer.

Notice that the core box comes apart at the corners, and also the bottom board is separate, which enables the coremaker to dry the core on the plain side. He should also see that he places a rod in the top part of the core so as to form a hook, enabling the molder to handle it easily. We made a core box 28 x $12\frac{1}{4}$ x 2 inches (Fig. 107).

After four cores are made out of each box, all the molder needs do is to strike up a bed in the sand and place the four cubic cores together, seeing that the plain faces come on the joints and on the top of the mold. After placing cores properly, place the cake cores around the cubic cores; then ram green sand around the outside, and the mold is completed with the exception of striking a plain cope to place on top.

ENLARGING AN OLD FLY-WHEEL PATTERN

The sketch, Fig. 111, shows a fly-wheel whose rim is to be enlarged $\frac{3}{8}$ inch all around. Now, there are two ways of doing this work. One is to find the center of the wheel, rechuck it upon a face-plate in the lathe; then, facing the outside surface of the rim, glue thin segments all over it. These may later be turned down to the required thickness. To follow such a method involves too much outlay of time and labor, to say nothing about whether the work can be satisfactorily done in this way. One thing is sure: it would be a most difficult task to re-chuck a large wheel so as to have the rim run half-way true. The tendency would be to wabble badly.

Unquestionably the quickest and most satisfactory method is to take the old wheel just as it

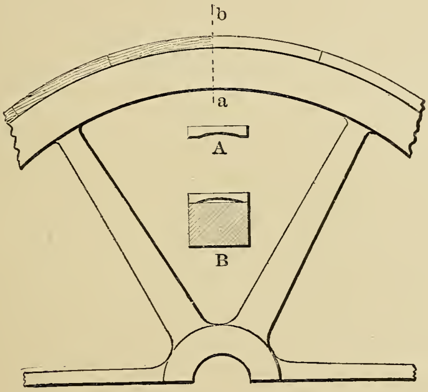


FIG. 111. — Lagging up an Old Fly-wheel.

stands and nail on the surface pieces of thin slab of pine or white wood, say $\frac{3}{8}$ inch thick, 9 inches wide and of the same length as the width of the rim. This can be easily done and should any trouble be experienced at all it is liable to come in bending the thin slabs over the surface.

Sometimes these are apt to split, particularly if the curve is a little sharp. Let the slabs be hollowed out on the under side as at *A;* then they can be easily nailed on the surface of the rim, as shown in cross-section at *B*, without the least fear of splitting. They bend with the utmost ease. To hollow out the slabs pass them sideways over a circular saw in motion and but few minutes will be required to do it. With this hollowing-out process there is absolutely no need of a gouge or round plane, the circular saw will do the work quicker and better. Slabs thus treated become quite pliable, and when firmly nailed can be trimmed off even with the sides of the rim. Then the whole may be sandpapered and varnished, making on the whole quite a respectable job.

RIG FOR BORING OUT LARGE CORE BOXES

We had to have a large number of barrel cores ranging from 17 to 22 inches in diameter and about 6 feet long. It was very essential that the cores should be just the proper diameter and perfectly cylindrical.

We had been using wooden half core boxes made in the usual way. These were constantly getting out of shape from the severe handling by the coremakers, swelling of the wood, etc. It was finally decided to make a cast-iron core box as shown by the sketch, Fig. 112; this was made large enough to allow for lagging up inside with wooden staves. The cast-iron box was planed off true on the upper side. As there were continually different sizes of cores wanted ranging as stated above, we concluded to get out a rig for boring out the box. The rig when once fitted to the box was easily taken off and put on again, the straps bored out to form bearings for the bar being held in place by cap-screws, and the bearings being so fitted that they would bring the boring bar exactly in the center of the box. The bar consisted of a piece of cold-rolled shafting $1\frac{15}{16}$ inches diameter and about 8 feet long. On one end of the bar was fastened a grooved collar to which the feed lever was attached; both collar and lever were taken from an old friction clutch

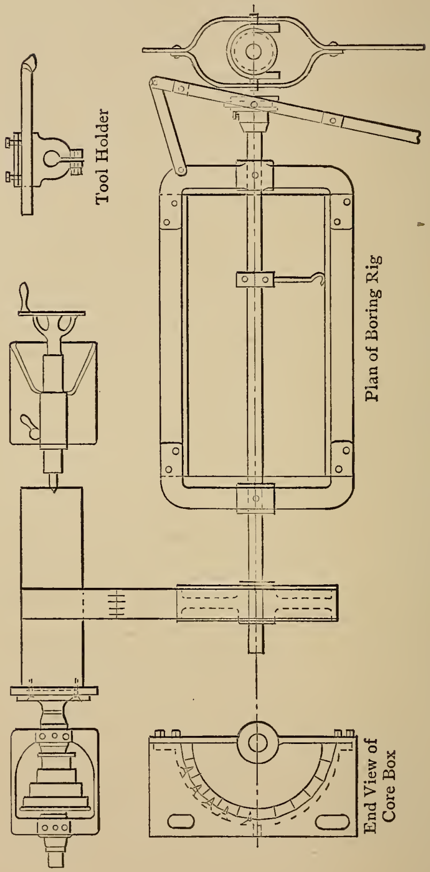


FIG. 112. — Rig for Boring Core-boxes.

countershaft found in the iron shed. On the other end of the bar was mounted a pulley about 14 inches in diameter and 4 inches face. On the bar, between the bearings, was placed the tool-holder which was so constructed as to permit it to be easily clamped at any point on the bar. With this arrangement we could bore a length of about 18 inches, then would draw the bar back, move up the tool-holder and cut another 18 inches, and so on until the full length was finished. In order to drive the bar, we set the core box and rigging on trestles in front of the patternmaker's lathe, and drove it by a belt from a roll mounted in the lathe and which was about 8 inches in diameter and 2 feet long. The belt moved along on the roll as the bar was fed back and forth. In this way we could get any speed desired from the cone pulley on the lathe.

The rig worked very well, made a very accurate core box and took only a fraction of the time which would have been required to work it out by hand. When a different size box was wanted we simply took off the ends, removed the old lagging and put in new, put on our rig and bored it to the required diameter.

STOPPING OFF A PATTERN

Here is a sketch, Fig. 113, showing how we made a 5-foot casting off a 9-foot pattern in a 6-foot flask without cutting the pattern. We first took the pin off one end of the cope, as, the top being a flat surface, a slight shift would not matter; or, to avoid this, we could have bored a

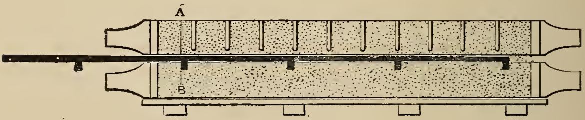


Fig. 113. — Molding Piece Shorter than Pattern.

hole through the pattern to clear the pin. The pattern was rammed up in the usual way, only the drag was raised from the board the thickness of the pattern, and the pattern projected from the end of the flask. After the cope was taken off and the pattern drawn, we stopped off as marked by line *A B*. We did not want to cut the pattern, and we did not have a spare flask long enough to take all the pattern, so this was a case of necessity.

STOPPING OFF AND SAVING PATTERN WORK

The term "stopping-off," as used in the pattern shop, means that some part or parts appearing on the pattern itself are not to be reproduced in the casting. An understanding of this principle of stopping off will often save a number of dollars in the pattern shop, when a special job is required similar to some pattern already made, and yet unlike it in some particular. Quite often the expense of a new pattern is saved by a little study along this line. It is our purpose to illustrate a few cases, beginning with the simplest and leading up to one or two a little more difficult.

The part of a pattern to be stopped off may be either some supplementary portion, used for strengthening or other purposes, or it may be some part of the pattern itself; but, in all cases, the term implies a filling up of some part of the mold as made by the pattern, which is the real "stopping off."

The very simplest examples possible are those where some part of the mold is filled up level, as indicated by patterns in Figs. 114 and 115. The first figure illustrates a thin pattern requiring battens to hold it in shape. The second is thin work also, but it has a stop-off block, to accommodate good-sized screws for holding the draw plate. It is perfectly plain that any hub or boss on a pattern can be left off the casting in this manner.

Different pattern shops have different signs to indicate to the molder what is to be stopped off. Some paint the part a different color, some cross hatch the part with parallel lines in another color with the shellac brush, others simply paint the words "Stop Off" on the part, while still others will cross line the part with chalk. Chalk is very commonly used where the part to be stopped off is some part of a regular pattern and only used once in this special manner.

Fig. 116 is an example of a pattern to be parted on the line *A B* and having a thin piece

C on the cope side attached with dowels. If it were not for the stop-off brackets *D* to steady the piece, it would be sure to be rammed out of place in molding. It will be seen that the cavities left in the mold by the brackets must be filled up even with the parting line, and at the same time a piece of board must be lowered into the cavity made by the wing *C* on the pattern, and held opposite the bracket opening as a backing for the sand while filling up, for it is only the bracket places that are to disappear.

Fig. 117 illustrates a principle very often used, and may represent almost any pattern where we wish to use a plain round stock core at a considerable depth from the parting line *A B*. The "heels," or sometimes called "finger prints," *D D*, reach from the desired position of the core to the parting line and make an opening in the mold to admit and sustain the core. A board *E*, called the "stop-off piece," must be used in this case, as in Fig. 116, but here we cut a semicircular opening in the bottom edge to rest over the core, while filling in the places made by the prints *D D*. If this were not done, the bottom edge of the piece *E* would rest on the top of the round core, and as the piece is placed inside the body of the mold on the line *x y*, covering the space *D*, there would still be an opening around the core for the sand to fall through into the body of the mold.

Fig. 118 is a familiar example of a pipe pattern which is to be stopped off to a shorter length. To do this, simply nail on a temporary flange to each half, as per the dotted lines, and make the stop-off piece shown below at *A*, to place in mold, the part *c* being the same size as the core print on the pattern, and the flange part *d* the diameter of the temporary flange fastened to the body of the pattern. With this piece in position the part of the mold which represents the flange on the end of the pattern is filled in, and also what would otherwise have been a part of the pipe body between it and the new flange. It will be noticed that the same core can be used without any changing for the different lengths of pipe.

Frequently it is desirable to make a leg casting for some special machine shorter than the regular pattern on hand, and at the same time not injure the pattern by cutting it. Much the same principle is involved here as in the pipe example mentioned above. Attach new feet temporarily at the position desired, and make a stop-off piece, just the size of one of the new feet, for the molder to place in the mold while filling up the part beyond it that is not wanted.

Fig. 119 shows how to make a pulley or a wheel of a smaller diameter than the original pattern without injury to it. Turn up a rim of the diameter required, fit it over the spokes as shown by the dotted lines, and saw a curved board, shown in section at *A*, for a stop-off, to place in the mold to fill up the spokes, or arms projecting beyond the new rim, the outside radius of *A* matching that of the new pulley.

Fig. 120 shows a somewhat different case than either of the preceding. It is a bushing pattern, 18 x 6 inches, with a straight 4-inch core, and we wish to stop it off to produce the casting shown at *C*, which is 12 x 6 inches, having a chambered core 4 inches diameter with ends 3 inches diameter. The requirements are, to use the pattern and core box *A* and *B*, without injury to either.

We simply need a piece *D* for the mold and two semicircular shells *E*, one for each end of

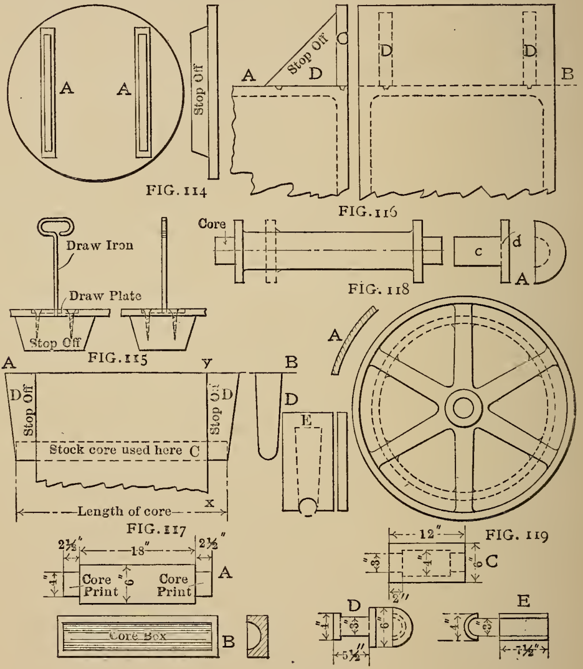


FIG. 120

Stopping off to Save Pattern Work.

the core box, to reduce the diameter to 3 inches.

The left-hand flange on *D* is the diameter of the core print on the pattern, the right-hand one the diameter of the body of the pattern, and the intermediate portion that of the holes in the ends of casting *C*. This piece will have to be placed in the sand four times to fill against — once in each end of each half of the mold. The thickness of the flanges is immaterial, but the diameters and the lengths, $5\frac{1}{2}$ inches, must be preserved.

The left-hand flange of *D* leaves the mold larger than the end of the core, but this makes no difference, as it comes at the extreme ends, and there will still be plenty of support for the ends of the core.

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