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ART OF SAW-FILING.

HOLLY.

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THE  
ART OF SAW-FILING,

SCIENTIFICALLY TREATED AND EXPLAINED  
ON PHILOSOPHICAL PRINCIPLES.

WITH

FULL AND EXPLICIT DIRECTIONS FOR PUTTING IN ORDER  
ALL KINDS OF SAWS, FROM A JEWELLER'S  
SAW TO A STEAM SAW-MILL.

ILLUSTRATED BY FORTY-FOUR ENGRAVINGS.

BY

H. W. HOLLY,

AUTHOR OF "THE CARPENTER'S AND JOINER'S HAND-BOOK."

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**THE**  
**ART OF SAW-FILING.**

12. 8. 11.

**ORIGIN AND UTILITY OF THE SAW.**

**THE** Saw is an instrument of somewhat ancient origin. We cannot ascertain precisely when the first saw was made; but it probably followed the more common and primitive tools—the hatchet, the knife, and the chisel. The first saw was, no doubt, a very imperfect instrument in comparison to those of the present day. Still, it seems incredible that such elaborate works of art as we read of among the ancients should have been constructed without the use of the saw.

The Greeks ascribed the invention of the saw to Dædalus, or his pupil Talus; but it is certainly more ancient, for it is represented on the obelisks of Egypt. It is a tradition that

the prophet Isaiah suffered martyrdom by the saw.

There is an ancient book, called the "Ascension of the Prophet Isaiah." It says: "Then they seized and sawed Isaiah the son of Amos with a wooden saw. And Manasseh and Melakira the false prophets, the princes and the people, stood looking on. But Isaiah said to the prophets who were with him, 'go ye to the cities of Tyre and Sydon, for the Lord hath mixed this cup for me alone.' Neither did he cry out or weep, but continued to call on the holy ghost until he was sawn asunder."

It may be in reference to this circumstance that St. Paul says of the early martyrs, "They were sawn asunder."

The ark, the temple of Solomon, and the ruins of buried cities lately exhumed, would seem to have been impossible without the use of the saw, although we know how much may be accomplished with very rude tools when time and patience are not spared.

We do not find the saw used by savage nations, as, without the tools and skill to keep it in order, it soon becomes useless.



The knife and the hatchet, more barbarous weapons, can be sharpened on a smooth stone; but sharpening a saw is a very different affair.

The first *saw-mill*, or saw driven by power, which we have any account of, was erected in the Island of Madeira in 1420; the next at Breslau, in Austria, in 1432. This was followed by many others all over Europe.

The saw is now an indispensable instrument, and is in more general use by all classes of mechanics than any other tool.

It is difficult to imagine how we could dispense with it for a single day—from the burglar who cuts off the bars of his cell with his watch-spring saw, to the builders of navies and cities, and the busy mills which quickly fashion the huge monarchs of the forest into shapes for the dwellings and conveniences of mankind.

## THE PRINCIPLE OF CONSTRUCTION.

THE saw is a series of knives set on a line; every tooth is a knife, and cuts a small portion of the material. Each is kept from cutting too deep by the tooth on either side; each tooth

should cut its allotted chip or slice of the material, carry it along, and drop it on the outside.

The perfection of a saw is to cut the fastest and smoothest, with the least expenditure of power. To do this, it is evident that each and every tooth should be so constructed as to do its own proportion of work; for if one tooth only is out of shape or out of line with the others, it is not only useless, but a hindrance and disadvantage to the others.

Every one who has occasion to use a saw knows that many times it would be very convenient if he knew how to put his own saw in order. To be sure to excel in this, as in everything else, requires practice, a correct eye, and steady hand. But we contend that any person of ordinary capacity can easily learn to file and set his own saw.

There never has been any theory or principle laid down by any good authority for this particular science. Each person has had a theory of his own, and followed that; or, more likely, has had *no* theory at all, and did it at random, sometimes one way and sometimes

another, never twice alike, but generally very unsatisfactorily to himself and all concerned.

Now there is always a right and a wrong way to do anything; and if we can establish a theory in this little book, and demonstrate its correctness from scientific principles, and a trial shall corroborate the demonstrations, then the object of the author will have been accomplished.

We find many very good mechanics that have always used saws, who frankly acknowledge that they never could file a saw satisfactorily to themselves, at least. The reason probably is, they never studied the principle of the action or working of the instrument. There is no reason why any man who knows enough to use a saw, should not be able to put it in complete order; although it is more of a science than many imagine—the putting in order of all kinds of saws, from the delicate surgeon's saw with which he takes off your limb, to the monster six-footer, with teeth like a dragon, that screams in the depths of the forest, devouring trees and logs with insatiate rapacity.

When we consider that there are nearly one hundred different kinds of saws of all sizes and shapes, it will not appear strange that we claim for saw-filing a place among the sciences.

It is astonishing what miserable saws are sometimes used by mechanics, or those claiming to be such. The only way they can be coaxed or driven through the wood is by having an enormous set, a liberal use of oil, and another lubricator called elbow-grease. The difference between the work of one of these saws and one in proper order is about the same as that between a hole bored by a sharp auger and one gnawed by rats.

It brings to mind the remark of the wood-sawyer, who, puffing and blowing from the exertion of using a bad saw, said: "Of all the saws I ever saw saw, I never saw a saw saw as this saw saws."

*Principle of the Action of the Cross-Cut Saw.*

There are several different ways in which saws act in relation to the material cut; the first we shall consider is the cross-cut saw, by which we mean all saws that cut across the grain. This is illustrated by the figure.

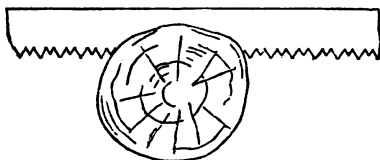


Fig. 1.

Fig. 1 represents a log of wood seen end-wise, looking at the ends of the grain, which consists of more or less minute fibres or threads which constitute the tenacity of the wood.

Our object with the cross-cut saw is to sever these fibres or threads; and as the material is non-elastic or unyielding, we must cut each fibre in two twice, so as to leave a small groove or *kerf* as we proceed, so that the material will not bind or pinch as the saw passes through the stick, owing to any inequalities in the blade of the saw.

Fig. 2 represents a section of several saw-

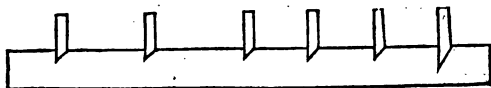


Fig. 2.

teeth of different bevels, showing the different

depth to which each tooth cuts. The next tooth to each of these on the saw being beveled the other way, will cut to the same depth, and form a groove as deep as the teeth reach into the wood, and so on in succession; each pair of teeth working independently, except as they keep each other from taking too deep a hold.



Fig. 3.

A saw should be filed so truly that it will show an angular groove along its whole length on the edge like Fig. 3, so that a fine needle will slide the whole length of the saw without falling off.



Fig. 4.



Fig. 5.

the saw is like Fig. 3, it must cut the groove square like Fig. 4 and not like Fig. 5, the shape of the saw's edge.

The cutting is all done with the outside edge of the tooth, so the real operation of the tooth is like Fig. 6; the wood crumbling out

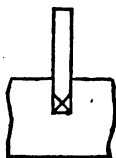


Fig. 6.

from point to point of each tooth as the saw moves.

Now the sharper each tooth is—that is, the more bevel on the point, as shown at Fig. 2, the deeper it will cut; but it must not cut any deeper than will crumble out across to the point of the other tooth. This is the difference between saws for soft or hard wood; if a saw for hard wood is too much bevel on the point, it will score deeper into the wood than it can carry out the chip, so that it will keep moving up and down in the same scores, and not accomplish anything.

It follows, then, that for soft wood we may file the back edge or point of the tooth quite beveling, while the harder or tougher the wood the less bevel we must file the back of the tooth; for we shall see that the bevel of the

back of the tooth governs the bevel of the point.

Let it be understood that the bevel of the cutting edge of the tooth is the same for all cross-cut saws. The *bevel of the point* is the idea, and is governed by the angle at which the file is held. This is illustrated by the following figures.

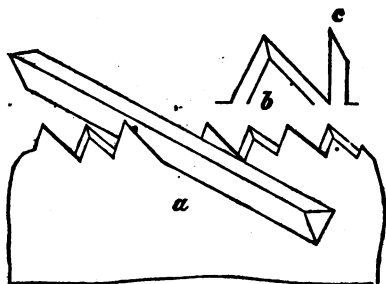


Fig. 7.

*a*, Fig. 7, shows the position of the file for a cross-cut saw for soft wood, such as pine, basswood, cedar, etc.

*b* Shows the shape of the tooth, and *c* the bevel of the point, consequent on the position of the file and bevel of the back of the tooth.



There is no difference in the *angle* of a large or small file; all the difference is in the fine or coarse cut of the file. We should prefer a good-sized file, not less than four and a half or five inches, if it was cut equally fine and sharp on the corners.

In all the following diagrams of saw-teeth, the point of the saw is supposed to be on the left hand.

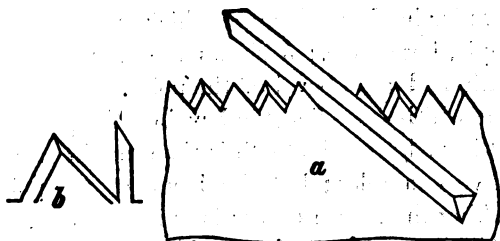


Fig. 8.

*a*, Fig. 8, shows the position of the file for saws for medium wood, such as chestnut, baywood, black walnut, cherry, etc.; *b* shows the shape of the tooth, and *c* the bevel of the point.

*a*, Fig. 9, shows the position of the file for

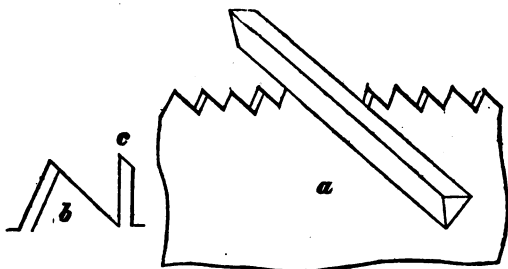


Fig. 9.

saws for hard wood, such as hickory, ash, oak, maple, beech, etc.; *b* shows the shape of the tooth, and *c* the bevel of the point.

It will be seen that the bevel on the pitch or cutting edge of the tooth is the same in all the above examples; but the bevel of the point looking the length of saw is quite different.

The next thing to be considered is the angle of the pitch or cutting edge of the tooth of a cross-cut saw.

Let *a*, Fig. 10, represent a board, across which we wish to make a deep mark or score with the point of the knife. Suppose we hold the edge of the knife perpendicular, as at *b*, it is evident that it will push harder, will not cut

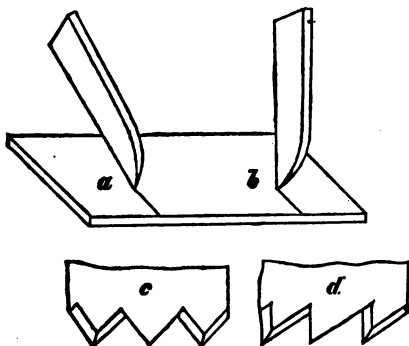


Fig. 10.

so deep or so smooth as if it was inclined forward, as at *a*.

It follows that the cutting edge of a tooth should incline forward, like that at *c*, rather than stand perpendicular, as at *d*.

This is a common fault with cross-cut saws, making the teeth too hooking, as it is called. The idea is that the saw *takes hold* better. This may be true, but it will be like the man's razor that took hold first-rate, but didn't let go worth a cent.

Having considered the bevel of the cutting edge of the tooth, the bevel of the point in

relation to the material to be cut, also the pitch or inclination of the cutting edge—if we combine all these we shall have a perfect tooth.

It will be seen by Figs. 7, 8, and 9, that we hold the point of the file towards the point of the saw. Many will contend that a saw should be filed towards the handle, giving as a reason that it prevents the feather on the cutting edge of the tooth. This feather edge is no objection, for every saw after filing should be laid down flat and both sides jointed or planed down, so that the cut of every tooth shall be exactly on a line.

This should be done with a long whetstone, or fine-cut file with straight sides. This takes off all the feather, makes a finer edge and more cutting surface; for if a saw is newly set, and not jointed on the sides after filing as above, all the cutting surface is the extreme point of the tooth, which only *scratches* and does not cut; it is like marking across a board with the point of a pin.

*a*, Fig. 11, shows the point of the tooth as it is left after filing; *b* is the same point after

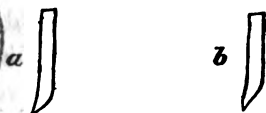


Fig. 11.

jointing the sides, making a real knife-edge, and not a mere scratching point.

And further, as regards filing towards the point of the saw. We cannot any other way get the bevel of the teeth, as shown at Figs. 7, 8, and 9, as will readily be seen; and still further, every one knows how much stiller, smoother, and with less vibration the file runs when filed towards the point of the saw.

#### *The Cross-Cut Hand-Saw.*

This saw is more common and in more general use than any other saw. They are of various lengths, from twelve to thirty-two inches.



Fig. 12.

This saw for soft wood should have about six teeth to the inch, and be filed about the bevel shown in Fig. 12.

Give the teeth a full set, and joint the sides thoroughly.

We would say here that the first thing to be done in filing these saws is to see that they are perfectly straight on the edge, or, if anything, a little the highest in the middle. This is very important; for if any tooth is shorter than the rest, of course that tooth does not cut at all, and is worse than useless, for it gives the next tooth more than its share of the work to do, and consequently it is imperfectly done.

Place the saw in the clamp, and with a fine single-cut file, not less than ten inches long, file the teeth squarely down till every one is touched. Next comes the setting; the principle of setting and the best set will be considered hereafter.

See that every tooth is bent to the full capacity of the set, for some of the teeth that are filed off a good deal in jointing, will want

a much harder blow than those that are only just touched.

The saw should be placed in a strong light, so that it will be easy to see when every tooth is brought to a point.

Be careful and not give a single stroke of the file after the tooth is brought to a point; that would be worse than useless. If you cannot get the right shape of every tooth in an old saw without filing too much, let it be till next time. It is better to let the imperfect tooth wait its time, than to spoil a perfect one in trying to make it correspond with the imperfect one.

*Cross-Cut Hand-Saw for Medium Wood.*

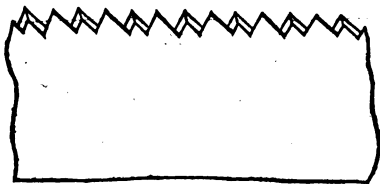


Fig. 13.

This saw should have about eight teeth to the inch, and the bevel shown in Fig. 13. This is about the thing for mitering soft wood ;

that is, the bevel. The teeth may be as coarse as Fig. 12.

It will pay to have a different saw for different kinds of work, both in wear and tear of patience, and excellence of workmanship. Those who attempt to do all kinds of work with the same tool, will find most of the time that they have not the right kind of tool for any work.

*Cross-Out Hand-Saw for Hard Wood.*

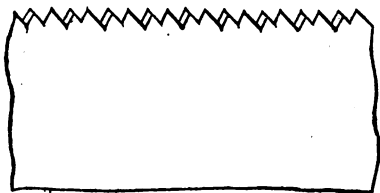


Fig. 14.

This should have ten teeth to the inch, and the back of the tooth filed square. It will mitre soft or medium wood well. The bevel on the pitch of all these saws, it will be seen, is the same. The difference is in the sharpness of the bevel on the point.

*Cross-Out Timber-Saw.*

This should have four teeth to the inch, and



filed about like Fig. 13, and should have plenty of set for wet pine or spruce timber.

*Back-Saws.*

A back-saw has no advantage over a hand-saw, except in the thinness and lightness of the plate; the back keeping it from springing or bending.

They should be thinner on the back, so as to need no setting.

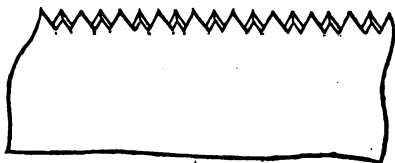


Fig. 15.

Fig. 15 shows the kind of back-saw for soft wood, ten teeth to the inch, same bevel as Fig. 12.

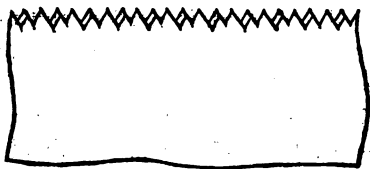


Fig. 16.

Fig. 16 is the back-saw for hard wood, twelve teeth to the inch. Same bevel as Fig. 14. Right for mitering soft or medium wood.

Sometimes a back-saw becomes crooked because the back is loose; if so, driving the back on firmly will straighten it again.

*The Fleam-Tooth Saw.*

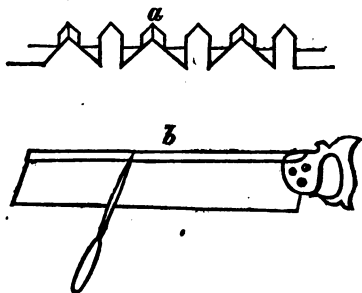


Fig. 17.

This saw is filed extremely beveling, so much so, that the saw must be laid down flat to be filed. No set is needed, and the blade must be thin and of the best quality and temper of cast steel.

The best way to alter an old saw to one of these, is to take off the old teeth clean, and begin new.

Fig. 17 shows the form of tooth, full size, and the position of the file and saw.

This saw is only fit for soft and clear wood, the edges being so thin that a knot, or hard wood, spoils them. It is very nice for trimming or clap-boarding, cutting very fast and smooth, and both ways alike.

*Billet, Wood-cutters', or Buck-Saws.*

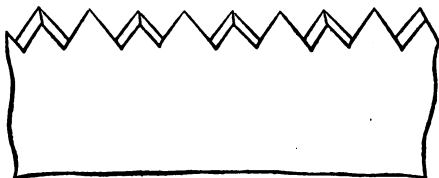


Fig. 18.

Fig. 18 shows the buck-saw for soft or green wood; four teeth to the inch, strong set, well jointed on the sides.

*Buck-Saws for Hard Wood.*



Fig. 19.

Fig. 19 is the buck-saw for hard or dry wood, five or six teeth to the inch; teeth square on the back.

Buck-saws should be well strained up, so as to ring sharp and clear when struck.

*The Too Common Saw.*

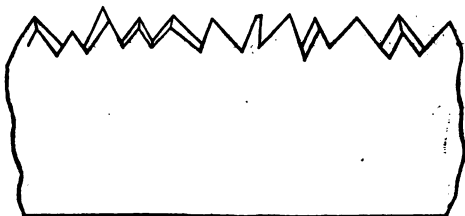


Fig. 20.

Fig. 20 shows the kind of saw too common to need a description. It is used in all parts of the country. We cannot recommend its adoption.

*Long Cross-Cut or Log-Saw.*

This saw is to cut equally both ways, consequently the shape of the teeth must be different from anything we have seen. This saw on the tooth edge is made the segment of a large circle or ellipse, because the motion easiest for two men in sawing, is a rocking or



Fig. 21.

swaying motion, bringing all the teeth successively into action.

For hard and dry wood, file the teeth less bevel; see that every tooth is in line with the others, whether the line is more or less curved.

*The Patent Hook-Tooth Cross-Cut Saw.\**

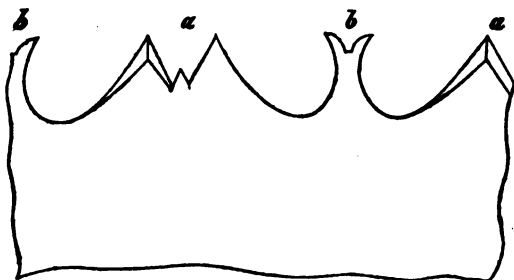


Fig. 22.

\* Manufactured by Wheeler, Madden and Clemson, Middletown, N. Y.

This saw is constructed on common sense principles. The two knives or fleams, *a*, to score into the wood; *b*, the hook or little chisel, follows and takes out the chip or shaving, carries it along, and drops it on the outside. It acts precisely like a carpenter's "dado plane," only it acts both ways. The action of the centre-bit also illustrates the principle of this saw.

It cuts very fast and easy, and is said to be rapidly superseding the old kinds in the localities where it has been introduced.

The cutting teeth, *a*, are first filed up square, and the hooks, *b*, are left nearly a sixteenth shorter. After the length of the cutters and hooks is made just right, file the cutters extremely beveling, but bring them to an edge only at the extreme point of the tooth, and then not so as to leave a feather.

#### *Cross-Cut Circular Saws.*

The same rule holds good in regard to the bevel and pitch of the tooth in the circular saw as in the hand-saw. The fibre or grain of the wood to be divided is always at right angles to the face of the saw.

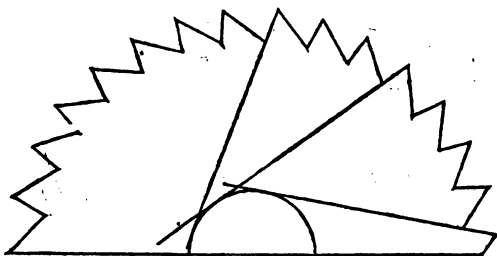


Fig. 23.

To get the proper pitch of the tooth of this saw, describe a circle whose diameter is one quarter the diameter of the saw ; a line from the point of the tooth touching the outside of this circle, as shown in Fig. 23, will give the proper pitch of the tooth.

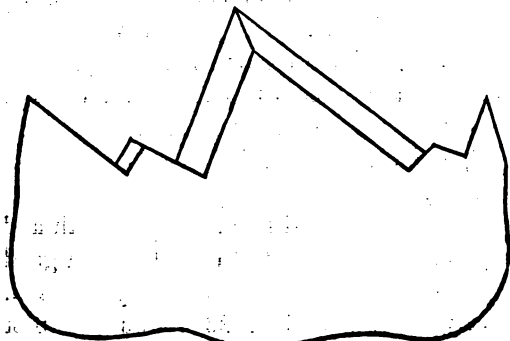


Fig. 24.

Fig. 24 shows the proper form of tooth for a large circular saw, for large sticks of soft or green wood.

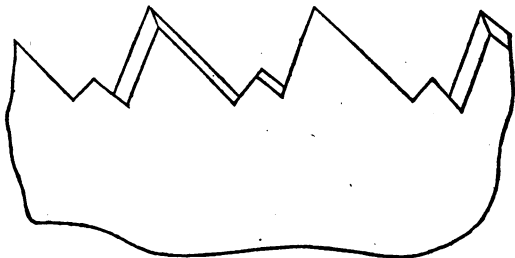


Fig. 25.

Fig. 25 shows the form of teeth for hard and dry wood. The points may be more bevel than for hand-saws. The greater velocity of the circular saw will throw out the chip.

Observe the same rules for small circular saws for finer work as for hand-saws at Figs. 12, 13, and 14.

#### *Pruning Saws.*

These are required to cut very smooth and keen, consequently the teeth must have a good deal of bevel, but about the same pitch as an ordinary cross-cut. Fig. 26 shows the best



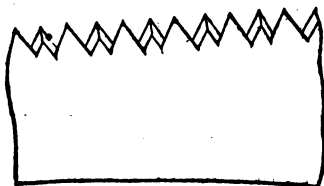


Fig. 26.

form of a pruning saw, seven teeth to the inch.

These saws are, or should be, made thin on the back, so as to require no setting; but must be well rubbed or jointed on the sides to take off the feather edge made in filing.

*Scroll, Web, and Compass Saws.*

These saws are for a mixed business. They have in turn to cross-cut, mitre, and rip, and the question is, what is the best average or medium to accommodate all these requirements.

Experience shows that they should be nearer the cross-cut than the rip, for a cross-cut will rip, better than a rip will cross-cut. A rip-saw makes terrible rough work cutting across the grain, while a regular cross-cut will cut lengthwise of the grain smooth but slower.



Fig. 27.

Fig. 27 shows the proper form of tooth for these saws, though they may be finer or coarser according to the material to be cut; finer teeth for hard wood.

Rather a short bevel on the pitch, which should be a little less than a right angle. All web saws should be ground thin on the back, so as to require no setting.

#### *Butcher Saws.*

These are for sawing bones, and generally very hard and dense ones. Cutting these is out of the question, so that this saw should partake more of the nature of the file. The form shown in Fig. 28 is the best for this saw.

The pitch should be not less than an angle of forty-five degrees, and the back the same, or nearly so.

File the teeth perfectly square across on the pitch and on the back.

Be very particular about jointing the edge,

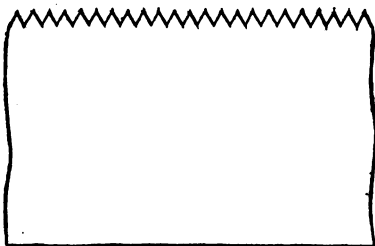


Fig. 28.

so that every tooth shall do its work. It need not be jointed on the sides.

*Surgeons' Saws.*

These must be filed somewhat different from the Butchers' saw, though some people class surgeons and butchers in the same category.

The human bone in a living body is somewhat porous and soft, consequently the pitch of the tooth may be somewhat sharp. Make

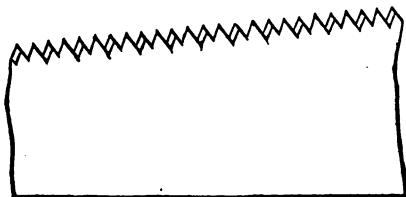


Fig. 29.

the teeth about the same shape as Fig. 28, but about the bevel in Fig. 29, the back being square.

Joint these on the side, as it is important to have the bone left perfectly smooth and clean.

*Hack-Saws, for sawing Iron, Brass, etc.*

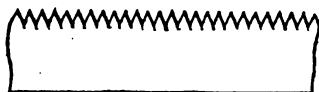


Fig. 30.

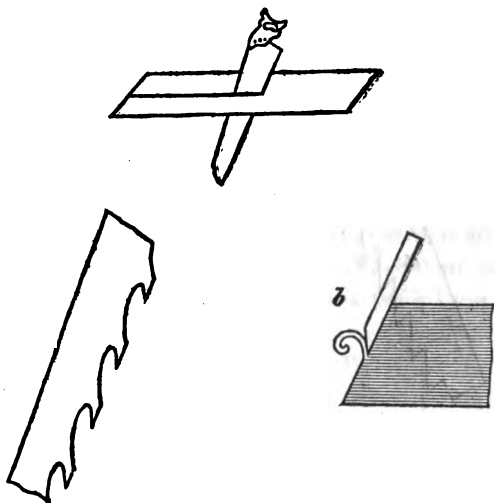
These should be the same as Fig. 28, as regards shape of tooth, pitch, and bevel, but the teeth should be as fine as possible; for, as was said of Fig. 28, they must partake more of the nature of the file; in fact, they are no more or less than a thin file, cut on the edge but not on the side. These need not be jointed on the sides.

*The Rip or Slitting-Saw.*

Having considered the principle of the cross-cut saw, we learn that its action in relation to the material cut is the same in all cases, that is, the grain of the wood is always at right angles to the face of the saw

In the action of the rip-saw it is quite different. There are three kinds—the hand-saw, the vertical or mill-saw, and the circular-saw. These all act differently in relation to the material cut, that is, cut their way into the wood on a different angle from the direction of the fibre or grain of the wood.

*The Hand-Saw.*



**Fig. 31.**

*a*, Fig. 31, shows the correct form of tooth

for a rip-saw for straight-grained stuff. It will be seen that each tooth is a small chisel, paring a regular shaving, and leaving a groove behind it the width of the chisel or tooth. *b* shows the actual form and direction of the point and shaving. It is easy to imagine the ease with which such a saw would pass through a board lengthwise. The whole being a succession of sharp chisels, would cut through a board with astonishing rapidity. The chips of this saw will not be dust, but short shavings.

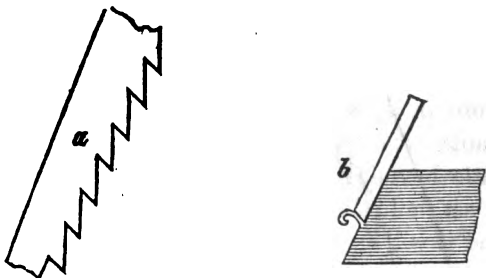


Fig. 32.

*a*, Fig. 32, shows the next best form of tooth for a hand rip-saw. *b* shows the true and

actual angle of the point of the chisel that does the cutting. The pitch of the tooth and the *line of the points* give the true angle of the cut, and not the pitch and the *back* of the tooth, as would seem to be the case at first sight.

We see a great difference between the cutting angle of this tooth, shown at *b*, and that at Fig. 31.

This saw will work very well. The trouble is, the teeth are too slender at the points, and are apt to tremble or chatter, especially if the saw is crowded too hard.

For straight-grained stuff this saw may be filed square across, but as we are sure to come more or less in contact with cross-grain or knots, it is best to file the pitch of the tooth a little beveling. For soft wood, after the saw is set, hold the file at right angles to the saw, and it will give a slight bevel to the points of the teeth.

For hard wood they should have a little more bevel still.

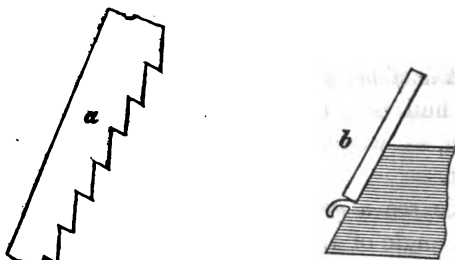


Fig. 33.

*a*, Fig. 33, shows the most common, and yet the worst form of tooth for a rip-saw. *b* shows the real cutting of the tooth, and the absurdity of this shape. There is really no cutting about it. The wood is merely jammed or scraped out with a very unnecessary expenditure of power.

It seems strange that workmen will persist in using this kind of saw, and yet, probably nine-tenths of the saws used are of this fashioned tooth.

#### *The Vertical Mill-Saw.*

There are three different forms of tooth used for the vertical mill-saw. This saw must necessarily run perpendicularly, and therefore



the action in contact with the grain of the wood is different from the hand-saw.

It is the same as the chisel in cutting down the head of a mortise.

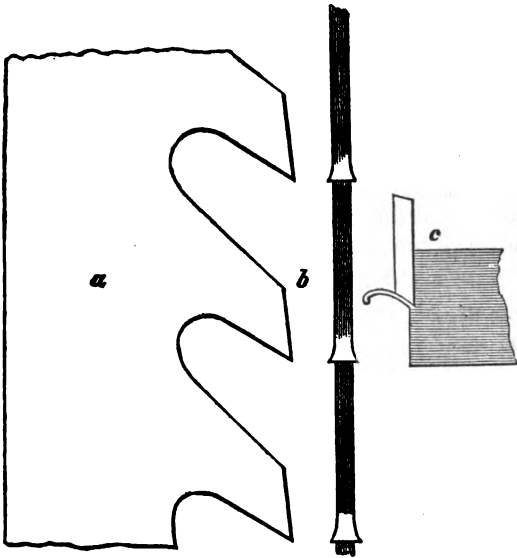


Fig. 34.

*a*, Fig. 34, shows the correct form of tooth

for a vertical mill-saw; *b* is the shape of the point of the tooth set with the crotch-punch described hereafter; *c* shows the actual shape or action of the cut of the tooth.

It is not enough that a saw cuts its chip or shaving. There must be space enough between the teeth to hold the shaving without crowding till it can be carried outside the stick and dropped.

This reason alone sometimes causes a saw to run very badly, consequently large saws have after a while to be gummed, or more space made between the teeth.

The saw-dust from this saw will be in square blocks, like the chips from a mortising machine.

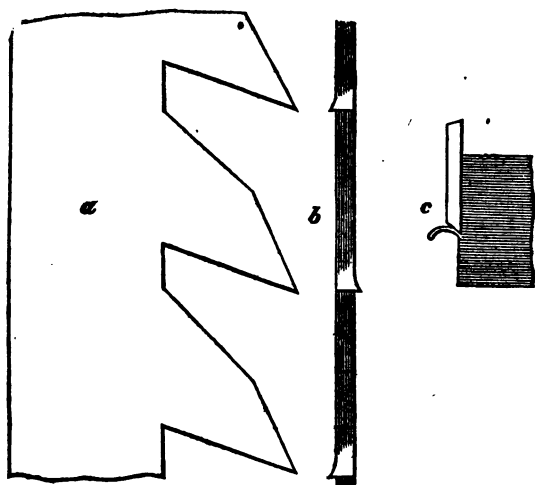


Fig. 35.

*a*, Fig. 35, shows the next best form of tooth for a vertical mill-saw; *b* shows the teeth upset on one side, with the crotch-punch without bending the tooth.

This saw is the connecting link between the old and new, the good and the bad, both in setting and in the shape of the tooth. *c* shows the angle at which the chip is cut from the

end of the wood. It is plain that this shape of tooth requires more power to cut its way through the log than that shown at Fig. 34.

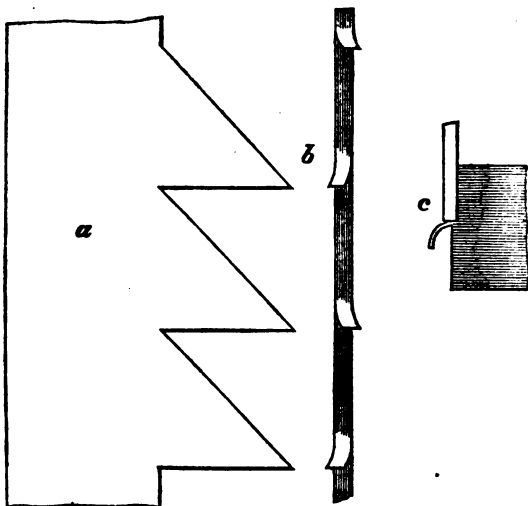


Fig. 36.

*a*, Fig. 36, shows the old, and still the most common shaped tooth for mill-saws; *b* is the style of setting or bending the teeth; *c* shows the cutting angle of the tooth. The sharp corner soon wears off, and all the sawing is

done by scraping and jamming with a great waste of power.

*Circular Rip-Saws.*

The circular rip-saw has a still different

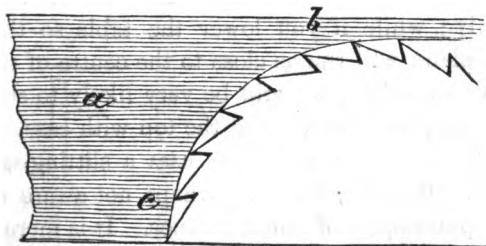


Fig. 87.

action in regard to the contact of the teeth with the grain of the wood.

It will be seen by the figure that each tooth has a different bearing on the grain of the wood as the saw revolves. *a* shows the log and the direction of the grain or fibre of the wood. It will be seen that the teeth at *b* are cutting almost directly on a line with the grain, while those at *c* are cutting almost at right angles, like the vertical mill-saw.

It requires much more power to cut with

these lower teeth than with the top ones. This is readily proved by sawing a plank with a large saw. Raise the saw-table till the saw just cuts through the top of the plank, and perhaps the saw will run through it very easily; while if you lower the table so that the plank will run as close to the centre of the saw as possible, it might be very likely to stop the saw, while it cut it at the top with ease.

Almost every one who uses a slitting-saw knows this fact, though perhaps not aware of the philosophy of the difference. It is merely the difference of cutting on a line with the grain or across it, of whittling a stick to a long point or cutting it square in two.

We find three kinds of teeth in circular rip-saws, as well as the other kinds previously described. We should style them as good, medium, and bad.



Fig. 38.

Fig. 38 is the correct and proper form. Fig. 39 will do, but is too light on the points, caus-



Fig. 39.

ing the teeth to tremble or chatter; while Fig.



Fig. 40.

40 is the old scraper of which we have heard enough already.

Almost any form of tooth can be driven through the wood by sheer force, but if power is of any consequence, we shall study to adopt that kind which uses the least; a circular-saw will last twice as long if made in the new way instead of the old, because it will not get hot and thus warped and sprung out of true so often. It is thought by good judges that the pitch of the tooth of a slitting-saw should not be less than an angle of sixty degrees.

Perhaps it will be well to explain here what is meant by an angle of sixty degrees.

Every circle, large or small, is divided into three hundred and sixty degrees; a degree be-



ing the acuteness of the angles of 360 lines, radiating from the centre like the spokes of a wheel, so that an angle of sixty degrees is the same on a small circle as a large one. The actual measurement of a degree on the outside of a circle is a different affair. A degree on the earth's surface is sixty-nine and a half miles.

If a circle is 360, a half circle is 180, and a quarter circle 90 degrees. All we want for our purpose is a quarter circle.

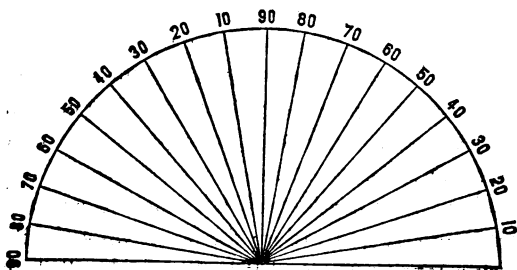


Fig. 41.

Fig. 41 shows a half circle divided into angles of ten degrees each. Counting from the horizontal, ninety degrees is perpendicular, or a right angle. If we want to ascertain the

angle of any object from a certain line we call that line one, and ninety degrees from that is a right angle.

When the sun is half way up to the meridian, we say it is forty-five degrees high; when a quarter up, we say it is twenty-two and a half degrees high, from the horizon.

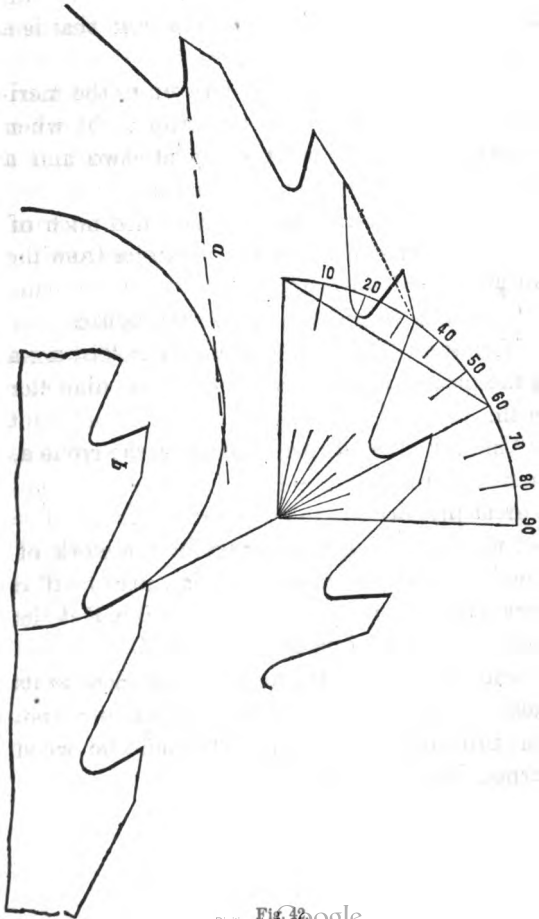
To return to the saw, we want the pitch of the tooth an angle of sixty degrees from the horizontal. This angle will form an equilateral triangle, as will be seen by the figure.

The same angle is formed by describing a circle whose diameter is one half the diameter of the saw, and drawing a line from the point of the tooth, across the outside of the circle as at *a*, Fig. 42.

#### *Saw-Setting.*

This is an important part of the work of keeping a saw in order; for a saw may be filed very scientifically, and if badly set it will do its work very poorly or not at all.

The object of setting is not to increase its cutting power, for a saw will cut faster if not set, provided it will pass through the wood without pinching or binding.



Many saws are being made latterly, ground thinner at the back, and we hope this practice will prevail; for if a saw is ground thin at the back, and ground even and regular, and filed scientifically, it will need no setting. Many a saw binds, not because it is not set enough, but because it is filed so badly that it cuts ragged and uneven, leaving the groove filled up with the half-severed fibres of the wood, like sawing through a bale of cotton.

The first consideration in setting is perfect uniformity. This is indispensable. The next is the proper form of bending or opening the teeth.

There are a great variety of saw-sets invented, manufactured, sold, and used; some are good; a great proportion are good for nothing. The old way of setting with a punch on a block of wood, is very far from the right way. It is impossible to strike every blow alike, and the wood being the fulcrum over which the tooth is bent, yields, and the tooth is bent clear to its base, which is very likely to kink the saw. One-third of a tooth is all that should be set or turned out of line of the blade.

A correct saw-set should be so constructed that the tooth *must* be bent just far enough, and at the same time *cannot* be bent too far, even by repeated blows. On a good<sup>r</sup> piece of steel sometimes one blow will have no effect, the tooth springing back again; two or three blows being necessary to make it stay where it should be.

On this account we think those sets that act like a pair of plyers, bending the teeth with the hand, quite objectionable, not being able to make the tooth stay set.

If one or two teeth in a saw are bent too far, they only scratch and make the work rough and waste power; while if not bent far enough they do nothing, and are drones in the hive.

We believe the best saw-set to be found for ordinary sized teeth is that known as the "Aiken set," represented by Fig. 43.

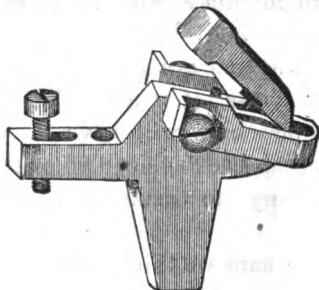


Fig. 48.

Although this set was invented many years ago, it has never been superseded.

Many spurious imitations of this set have been manufactured of poor material; so it becomes the buyer to be careful and get the genuine; for if the material is not perfect, they are worse than none at all.

We believe the principle of this set to be the correct one; it is impossible to set the tooth too far. The steel is condensed, and the tooth is drawn out, rather assisting the file than otherwise.

*Setting mill and other large saws, as at Figs. 34 and 35.*—Large and heavy saws are set now

with the crotch-punch, which is represented at Fig. 44.

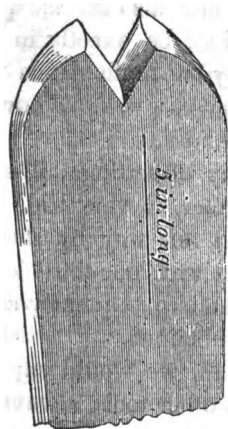


Fig. 44.

This punch is made of steel, and very hard in the fork, where it comes in contact with the point of the tooth. The teeth are not bent but spread out or upset, as shown at Fig. 33.

This is no doubt the best way to set large and heavy saws, it being very difficult to bend the teeth of a thick saw regularly. Great care must be taken with this set to have the teeth

spread even and regularly; and they should be jointed on both sides and tried with a straight edge, and also on the points, so that every tooth shall be exactly in line with the others. If only one tooth stands out more than the others, it causes a waste of power and makes rough work besides.

The old way of setting mill-saws, with an axe and hammer, is very bad. True, a saw will *saw* set in this way by sheer force; but if set the right way, one-third less power will do the work, and consequently one-third more speed may be obtained.

In conclusion, we would say in selecting saws, as in all other tools, always get the best, even at higher prices; a good tool will always give satisfaction to the buyer, while a poor one is dear at any price.















