

extensive. In the town of Stowe, Vt., there are five of them, each one of which consumes from 16,000 to 20,000 bushels of potatoes yearly, and produces about 8 lbs. of starch to the bushel.

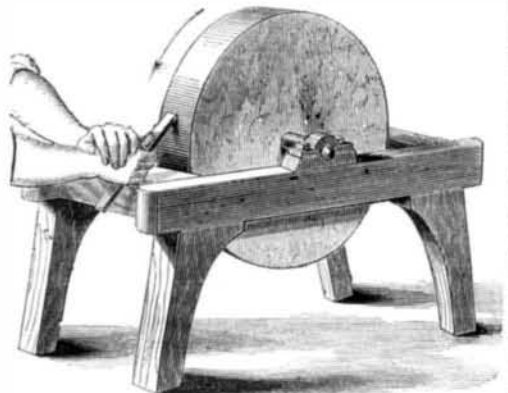
The corn used for starch is the white flint kind. Received at the factory, it is hoisted to the top of the building, winnowed to remove foreign substances, and then transferred to vats, where it is long soaked before grinding. It is run through troughs with water to the mills, and when ground the mixed meal and water is conveyed in a similar manner to the tubs in which the separation of the starch is effected. The gluten fluid that flows from these has a musty and disagreeable odor and appearance in the troughs, and the substance lumps when concentrated the consistency of wheat gluten, not "rising" like it in fermentation by the expansive action of the carbonic acid gas generated in this process. Its only value is for feeding horses, cattle and swine. The starch fluid is conveyed through troughs to great vats in the basement of the building, where the water is partially removed, and then it flows into smaller wooden vessels from which a portion of the surplus water drains away through a cloth laid in the bottom of each. The mass of starch, then tolerably solid, is placed upon shelves made of loose bricks, when more moisture escapes by absorption and evaporation. Kiln drying finishes the process and the starch is obtained in prismatic forms ready to be put up in papers or boxes for the market. †

TURNING TOOLS.

PART SIXTH.—THE END.

As grinding a tool and keeping the edge in proper condition is very essential to success, it will not be amiss to state a few facts of importance in regard to it. Inexperienced turners always go on the wrong side of the stone to grind; that is, when it runs from them. Every tool, no matter what its character, should be ground with the stone running toward the workman, as in Fig. 28—the direction of motion be-

Fig. 28.



ing shown by the arrow. The reason for this is apparent to any one who thinks for a moment. It is this—viewed through a magnifying glass the edge of every tool presents a serrated or saw-tooth appearance.

When the tool is ground with the stone running from the operator, all these fine threads, or filaments of steel, are drawn off toward the outside or upper edge, so that it forms what is known as a wire edge; the first application to the work breaks these off, and in a little while the tool is as dull as before it was ground. If, on the contrary, the tool be held against the face of the stone on the running side, as shown previously, the metal will be cut downwards, and a keen sharp edge produced, which will last much longer than when ground on the other side; it only requires an oil stone rubbed over it to remove the asperities and render the edge uniform. As the tool comes from the grindstone it is invariably rough, however smooth it may appear to the naked eye, and it is a good practice to touch up the edge preparatory to putting it in the tool post. It is this rubbing with the oilstone that gives that incomparable finish to wrought iron when the tool is sharp. Such a polish is more durable than any that can be imparted with emery or oil, superior in appearance and cheaper to produce; cardinal points in favor of using a sharp turning tool.

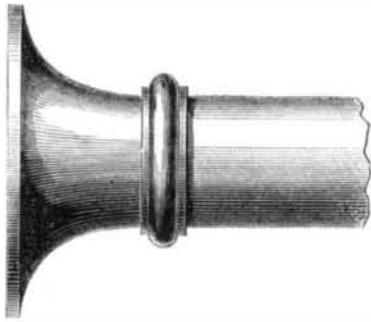
There are many tools which cannot be ground upon the stone without destroying the shape. Tools for forming beads or moldings are of this class, but as they are generally used on cast iron; they are intended to scrape rather than cut, and the faces can therefore be ground flat. It is generally easier to file the tool to the required shape and grind it when dull.

Tools that are filed have two disadvantages which make them inferior to those tempered and ground subsequently. When a tool is tempered, the smith dresses the edge by repeated blows, and compacts

the metal at that point very closely, thus making it tougher and finer in grain. The hardening process is also an advantage, for the edge is less apt to be wiry than when the metal is fibrous; which is the case with annealed steel. A tool that is to be filed into shape must necessarily be soft previously, and though the workman may be an adept, he is very likely to slur the fine edge over in forming it, and make it rough and dull, instead of sharp. When the edge of a filed tool is tempered it is apt to crumble, and is, in many other respects, inferior to one that is ground.

For turning a molding or bead on a side pipe, or cylinder head, such as the one shown in this figure,

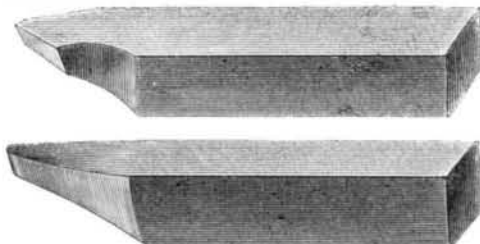
Fig. 29.



it will be found convenient to make the beading tool on the spring plan, illustrated in Fig. 18, current volume. By this method it is less likely to chatter or leave ridges or cut roughly.

Of tools other than those used for cutting wrought and cast iron, there are few which are materially different in external appearance. To this statement there is one exception. Brass cannot be cut by the same tools that are used for iron. Below, in Fig. 30,

Fig. 30.



we give examples of tools for turning brass. It will be seen that they are perfectly straight on the upper faces, and have no lips or acute edges. It is not possible to cut brass with a drill, or any other tool, that has a cleaving edge. Such edges draw in to the metal and throw it out of the lathe or else jam and break off. There are compositions of copper and tin, zinc and copper, and others, which can be cut by common tools, but these are not brass, which consists of specific portions of certain metals. One of these tools—the round nose—is used for light cuts, and the other where larger amounts of metal have to be taken off at once.

In turning wrought iron very many turners make their tools quite hard and cut the metal dry or without water; preferring to absorb power rather than soil the lathe with sloppy combinations of iron and water. With proper care but little "muss" will be made, while the gain in time, by using water, is very apparent. Not less important is the power required to drive a given number of lathes. Those which run dry require more than tools used with water, for the simple reason that the friction is greater. Any one can test this to his entire satisfaction by putting a tool in a lathe, starting the cut, and driving the machine by hand. It will be found that when the chip is of such a size that the arm can hardly turn the lathe dry, the addition of water will free it immediately, and the lathe can be driven with ease. If the shears be well oiled previous to beginning a job, the water can be wiped off without injury to them, even though the work be days in progress.

This article concludes the series on this subject. The skilled turner will perceive many cases not laid down in the several papers under this head which might have been alluded to, but it is obviously impossible in the limits of a newspaper to detail every minute manipulation a lathe is capable of. Special instruction on particular points has not been aimed

at, but a general and familiar treatise on the tools used in turning.

SEASONING AND DRYING LUMBER AND TIMBER.

[For the Scientific American.]

A COMPARISON OF SUPERHEATED STEAM WITH OTHER MODES OF SEASONING, AS IT REGARDS SPEED, THOROUGH WORK AND CHEAPNESS.

It seems to be a great mystery to the uninitiated how lumber, and other substances, can be dried while in direct contact with steam.

All understand that steamed lumber will dry in the open air, more rapidly after, than before, it is steamed—though all do not understand why it does it. They notice that the lumber comes from the steam in a very wet and soaked state, and the general impression would be, that it would require a longer time to dry than before it was thus soaked.

The fact however that it does dry more rapidly, has induced many to adopt this mode, when they were in haste for some dry lumber, even though practical tests have shown that such steaming injures its beauty of finish, as well as the strength and durability of the lumber and timber. The reason for this will be seen.

This steaming and soaking process extracts the albumen, which if properly coagulated and retained, is a preservative to the lumber. It also expands the pores of the lumber, so that they never shrink again to their smallest size, and do not often return as tubes, but shrink into angles; thus injuring the strength as well as beauty of finish. If these improperly shrunk tubes were placed under a powerful microscope, they would look like hills and valleys and very high ones.

This albumen is somewhat difficult to dry in the pores of the lumber, by air drying, for it does not part with its moisture readily, and when dried in the outside pores of the lumber, it nearly hermetically seals the inside, as it becomes nearly impervious to moisture.

Many attempts have been made to get rid of this albuminous substance in the lumber, for even after it has been once dried, it will ferment, if water be added, and this fermentation produces eramacaous or dry rot, which destroys millions of dollars' worth of railroad timbers, ties, and bridges, per year, as well as timber in buildings, ships, &c.

Kyanizing, paynizing, burnetizing, and other similar processes, are only modes used to coagulate or chemically change this albumen, by using the various kinds of salts, such as corrosive sublimate, zinc, copras, &c. Many of these modes have been found to be valuable for preserving the timber from the dry rot. But since these processes are usually performed by soaking or steeping the lumber in a solution of these salts, much of the albumen passes out, to the injury of the lumber; for when all of the strength and beauty of finish is desirable, the albumen should be coagulated and retained in the pores of the lumber. Of course the lumber comes from all these processes as well as in steaming, boiling, or soaking in water—in a wet and soaked state, and must therefore be used in the wet state, or afterwards dried by the air, either naturally or artificially. In either case, the outside of the timber is dried first, and forms an enamel, which will not further shrink, as the drying progresses, and therefore the timber cannot be brought to its smallest size, even though the drying process be continued forever.

Air drying we must remember always commences on the outside of the lumber, and its tendency is to close up its own way, and check materially its own progress, forming an enamel with dried albumen, and by closing the pores of the lumber on the outside first. The further therefore the drying extends into the lumber by this process the slower must be the future drying, for the passage of the moisture from the inside is the more strongly resisted, the thicker this enamel becomes. Is it any wonder, therefore, that the center of thick lumber is rarely ever dried. Comparatively small sticks of oak timber have been used for a fire piece for at least sixty years.

Many millions of dollars have been expended in experiments to season and dry lumber. The result has generally proved to be drying without seasoning, and seasoning without drying. But when both seasoning and drying have been attained by subjecting the lumber first to one process and then to the other, the result has usually been a sacrifice of the strength and

durability of the lumber, as well as its beauty of finish, to say nothing of time and expense.

In contrast with the foregoing plans we will now examine the new mode, that seasons and dries at the same time, by what is called superheated steam without pressure, or with the simple pressure of the atmosphere. No other mode known to science has ever accomplished this, and yet the process is a very simple one, as I shall attempt to show, though I may fail to make it fully understood in an article that would not be too long for insertion here. If the principle, however, should still be obscure to any one they can inquire by mail.

Suppose a room 14 feet high be divided so that the lower room shall be 8 feet and the upper one 6 feet high. The lower we will call the fire steam room, and the upper the lumber or drying room. The division, however, between these rooms is only the joist on which the lumber is piled, or that sustains the cars on which the lumber is dried, and on which it is passed into and out of the dryer. The two rooms are, therefore, virtually one.

A stove or other heater, with long radiating or smoke pipe, to save all of the heat from escaping into the chimney, as well as to generate heat rapidly, is placed in the fire room, with the door of the stove opening out to supply fuel. This stove and the radiators are placed quite at the lower part of the fire room, which avoids the direct heat of the stove on the lumber, and also to occupy the coldest part of the room, which is the most favorable for obtaining all the heat of the fuel.

A steam generator may be so arranged at a small expense, in connection with the heater, that steam will be generated just in proportion to the heat made.

This steam, whether generated in this or in some other convenient way, should be just sufficient in amount to fill both the fire and lumber room, with no steam to pass off to waste the heat. As soon as the rooms are filled with steam the air is excluded and the steam takes its place for conveying caloric. Steam will convey heat by convection 90 to 300 times as rapidly as air.

This steam atmosphere is not one that can be seen but one that can be felt. It starts a free perspiration from all of the pores of the skin when you go into the kiln. It does the same thing to lumber, for it never wets or swells the lumber as by common steam, but the first act is a drying one, as the tendency of the moisture of the lumber is all outward; let us see how this is accomplished.

Steam as soon as it is generated rises. As soon, however, as a particle of steam meets a body colder than itself it instantly imparts its heat to that body and is condensed. This particle of condensed steam descends by its own gravity to the fire room. Here it comes into contact with the stove or radiators, and is re-converted into steam, and carries its heat to the lumber and descends again in its condensed form for more heat. This one particle of steam may carry up heat in this way a million times, and yet it has imparted no moisture to the lumber, as it has returned with its moisture in the shape of condensed steam. If by any accident this one particle of steam is absorbed or lost, the steam generator supplies another particle to take its place, and thus preserves a constant steam atmosphere among the timber, not only to convey heat but to shut out the air.

It is worthy of note in this connection, to state that a particle of steam will instantly receive as many degrees of heat as there are degrees in the heater with which it may come in contact. If for instance the stove should be red-hot, and the particle of returning or condensed steam should come in contact with the red-hot iron, this particle of steam would instantly receive at least 900 degrees of heat. This 900 degrees of heat would be carried to the lumber, and the condensed particle of steam would return for more heat in the same time as though it carried only 212 or any other number of degrees of heat.

It is also worthy of note that the tendency of steam is to fly to the coldest place to impart its heat. If, for instance, a ball of ice were suspended at the ceiling of a room, and some water should be thrown upon a hot stove in the room the steam thus generated would go continually to the ice until it was melted. Thus as an equalizer of heat steam has no equal

This superheating and condensing of steam in particles goes constantly on in the kiln, and with a rapidity just in proportion to the amount of heat generated by the stove or heater. All of the heat which the stove makes the steam will absorb and convey to the lumber. If heat is generated rapidly the steam will convey it rapidly to the lumber. Inch lumber has in this way been thoroughly seasoned in six hours.

This mode of heating and condensing progresses until the lumber is so hot that the aqueous or watery portion of the sap is changed into steam.

Up to this time you will notice all of the heat we have made is yet in the kiln, for there has been no means of escape to waste it, nor have we made the lumber wet or damp by the steam since the steam has only imparted its heat and not its moisture or condensed steam.

But when the lumber is all so hot as to generate steam rapidly from the water it contains, then there will be more steam than the kiln can contain, for it was full of steam before. This excess of steam must pass out of the kiln or the kiln would burst and the lumber would never become dry.

When this surplus heat passes out it escapes through sawdust or a similar device to retain the heat while getting rid of the steam. This sawdust should be of such a thickness as to balance the steam, retaining a full steam atmosphere inside, while the surplus steam passes out, taking with it the moisture from the lumber. As there is a steam atmosphere at all times surrounding the lumber to be dried, it cannot dry the outside first and form an enamel, as in the case of air drying.

The nature of steam is so penetrating that it finds the center of the lumber, before the drying has made any considerable progress. After the drying commences steam generated from the lumber is constantly flowing out, so that the pores of the lumber cannot close until the moisture is principally out of the lumber, and then the center must dry first, for the steam must leave the center before it leaves the outside.

When the aqueous portion of the sap has all been converted into steam and passed out of the lumber, it creates a vacuum which the pores of the lumber close to supply. When this is done the lumber has shrunk to its smallest size, or to as nearly a solid as drying can make it.

But as there is moisture in red-hot iron, so there must be some moisture left in the lumber after the pores close and after the shrinking is all done. Indeed if the moisture was all removed the lumber would be ruined for charring commences long before the moisture is all out.

By gaging a piece of timber in the kiln from day to day, it is quite easy to ascertain when the shrinking is all done. When the shrinking of the lumber is completed there is no further advantage in drying, but a positive injury, as far as the strength and toughness is concerned, for the more moisture there is left in the lumber and timber after the shrinking is all done, the better. If desired, however, the lumber may come from the steam in a dryer state than the air can ever make it.

I am admonished, however, that this article will soon be too long for insertion in the SCIENTIFIC AMERICAN, and I will reserve, perhaps for No. 3, the degrees of heat necessary to coagulate albumen in lumber at its different stages of drying, and perhaps say something of the degrees of this kind of heat desirable in the drying of fruit and vegetables, and also show why we may use a higher degree of this kind of heat than of air in drying delicate fruits, milk, etc., and still not injure them. I have dried apples in a heat of 239° and still they showed no indications of being cooked by the process, but came out very white and beautiful.

But before I close I will bring into juxtaposition superheated steam and other modes of drying, in order to show the advantages of superheated steam by comparison.

The air dries only. Superheated steam seasons and dries at the same time. The air dries slowly—steam quickly. The air produces decay and wastes heat while drying. Superheated steam adds strength and beauty of finish and saves heat. The interest on lumber while air drying must be for years—steam for days. Air can never shrink lumber so thoroughly

that steam can not shrink it more, either in size or weight.

Common steaming, kyanizing, paynizing, and burnetizing, all season lumber, but swell it to its utmost capacity, and leave it wet and soaked. It would require more fire to dry this soaked lumber by the hot air process than to season and dry it from the green by the new mode. If the lumber is to be immediately shipped the difference in weight will be from 1400 to 2000 pounds per thousand feet board measure.

One month's stock of lumber for a manufacturer having a proper steam dryer will give him better seasoned lumber than a four years' stock in the air, thus saving the interest on stock, storage, checks, splits, warps and decay, incident to open air drying. The interest at 10 per cent on lumber costing only 40 cents per M. will be \$16 while air drying for four years, and then that same lumber is not fit for good work unless kiln dried. It can be seasoned and dried by superheated steam, in a better manner than any other, at a cost of 50 cents to \$1 per M., according to the expense of fuel. H. G. BULKLEY.

CLEVELAND, OHIO, Jan. 9, 1865.

VALUABLE PRACTICAL RECIPES.

To Etch Alabaster—Cover every portion of the model or cast, except the portion to be etched, with a mixture of one part of white wax, dissolved in four parts of oil of turpentine, thickened with finely powdered white lead. When this coating is set, immerse the article in pure water, and allow it to remain for from twenty to fifty hours, according to the effect intended to be produced. Then take it out, remove the superfluous water, wash off the varnish with oil of turpentine, and carefully brush the etched parts over with powdered gypsum.

Alabaster, to Join.—Ornaments of alabaster or plaster may be joined together by means of a little white of egg, thickened with finely-powdered quicklime, or by a mixture of newly-baked and finely-powdered plaster of paris, mixed up with the least possible quantity of water.

Almond Paste.—Blanched almonds 4 oz.; white of 1 egg; spirit of wine and rose water, q. s. Beat the almonds to a smooth paste in a mortar, then add the white of egg and enough rose water, mixed with one-half its weight of spirit of wine, to give the proper consistence. Use as a cosmetic, to prevent chapped hands, etc.

Amber is Joined and Mended by smearing the surfaces of the pieces with linseed or boiled oil, and then strongly pressing them together, at the same time holding them over a charcoal fire, or heating them in any other way in which they will not be exposed to injury.

Amber is Worked in a lathe, polished with whiting and water or oil, and finished off by friction with flannel. During the operation the pieces often become hot and electrical, and fly into fragments, to avoid which they should be kept cool, and only worked for a short period at a time. The workmen are said to suffer considerably from electrical excitement, often experiencing severe nervous tremors of the hands and arms.

Bell Metal.—Melt together, under powdered charcoal, 100 parts of pure copper, with 20 parts of tin, and unite the two metals by frequently stirring the mass. Product very fine. Another method is to take of copper 3 parts; tin 1 part, as above. Some of the finest church bells in the world have this composition.

Popular Remedies for Coughs.—Sirup of poppies, 1 dessert-spoonful; antimonial wine 20 drops; mix for a dose, to be taken in a little warm tea on going to bed. Another—Laudanum 80 drops, vinegar and honey, of each a dessert-spoonful, ipecacuanha wine 25 drops; mix for one dose, as last. Another: milk of almonds 4 oz., sirup of squills and tolu, of each, 1 oz.; mix. A tablespoonful every two hours.

Furs may be preserved from moths and insects by placing a little colocynth pulp (bitter apples), or spices—as cloves, pimento, etc.—wrapped in muslin among them; or they may be washed in a very weak solution of corrosive sublimate in warm water, 10 or 15 grains to the pint, and afterwards carefully dried. Furs, as well as every other species of clothing, should be kept in a clean dry place.

Portable Lemonade.—Tartaric or citric acid, 1 oz.,