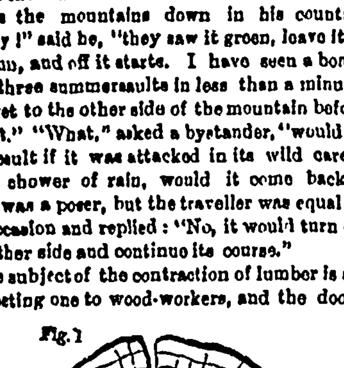
HOW LUMBER SHRINKS.

A story is told by the "Arkansaw Traveller," about the manner in which lumber was "hauled" across the mountains down in his country. "Why!" said he, "they saw it green, leave it in the sun, and off it starts. I have seen a board turn three summersaults in less than a minute, and get to the other side of the mountain before sunset." "What," asked a bystander, "would be the result if it was attacked in its wild career by a shower of rain, would it come back?" Here was a poser, but the traveller was equal to the occasion and replied: "No, it would turn on the other side and continue its course."

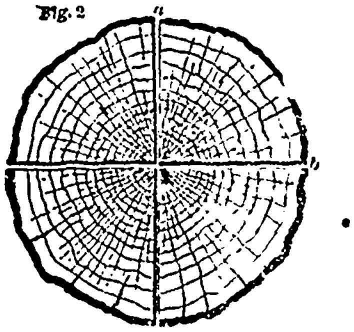
The subject of the contraction of lumber is an interesting one to wood-workers, and the doors

Fig. 1



and shutters in many of our mushroom cities are said to come off the hinges in retaliation of the persistent disobedience of the natural law of shrinkage. An examination of the end of an oak or beech tree will show the arrangement of its structure. It consists of a mass of longitudinal fibrous tubes, arranged in irregular circles that are bound together by means of radial strings or shoots, which have been variously named; they are the "silver grains" of the carpenter, or the "medullary rays" of the botanist, and are in reality, the same as end wood, and have to be considered as such, just as much as the longitudinal woody fibre, in order to understand its action. From this it will be seen that the lateral contraction or collapsing of the longitudinal, porous, or tubular part of the

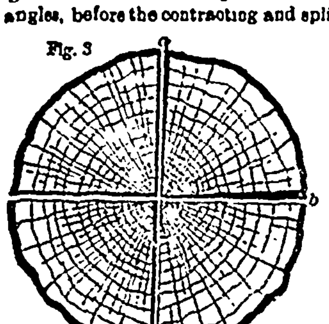
Fig. 2



structure, cannot take place without first crushing the medullary rays, hence the effect of the shrinking finds relief by splitting in another direction, namely in radical lines from the centre, parallel with the medullary rays, thereby enabling the tree to maintain its full diameter, as shown in Fig 1.

If the entire tubular fibre composing the tree were to contract bodily, then the medullary rays would of necessity have to be crushed in the radial direction to enable it to take place, and the timber would thus be as much injured in proportion as would be the case in crushing the wood in the longitudinal direction. If such an oak or beech tree is cut into four quarters, by passing the saw twice through the centre at right angles, before the contracting and splitting

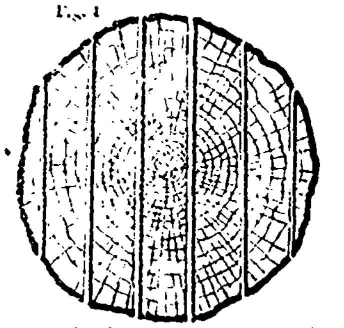
Fig. 3



have commenced, the lines *a c*, and *c b*, in Fig 2 would be of the same length, and at right angles to each other, or in the technical language of the workshop, they would be square, but, after being stored in a dry place, say for a year, it would then be seen that a great change had taken place both in the form, and in some of the dimensions; the lines *c a*, *cb*, would be the same length as before but it would have contracted from *a* to *b* very considerably, and the two *c a*, and *c b*, would not be at right angles to each other by the portion here shown in black in Fig. 3. The medullary rays are thus brought closer by the collapsing of the vertical fibre.

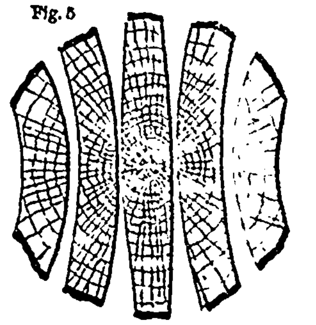
But supposing that six parallel saw cuts are passed through the tree so as to form it into seven planks, as shown in Fig. 4, let us see what would be the behavior of the several planks. Take the centre plank first. After due seasoning and contracting, it would then be found that the middle of the board will still retain the original thickness, from the resistance of the medullary rays, while it will be gradually reduced in thickness toward the edges for the want of support, and the entire breadth of the

Fig. 4



plank would be the same as it was at first, for the foregoing reasons, and as shown in Fig. 5. Then, taking the planks at each side of the center, by the same law their change and behavior would be quite different; they would still retain their original thickness at the centre, but would be a little reduced on each edge throughout, but the side next to the heart of the tree would be the reverse, or hollow, and the plank would be considerably narrower throughout its entire length, more especially on the face of the hollow side, all due to the want of support. Selecting the next two planks, they would be found to have lost none of their thickness at the centre, and very little of their thickness at the edges, but very much of their breadth as planks, and would be curved round on the heart

Fig. 5



side, and made hollow on the outside.

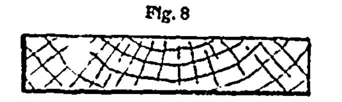
Supposing some of these planks to be cut up into squares when in the green state, the shape that those squares would assume, after a period of seasoning, would entirely depend on the part of the tree to which they belonged; the greatest alteration would be parallel with the medullary rays. Thus if the square was near the outside the effect would be as shown in Fig. 6, namely, to contract in the direction from *a* to *b* and after a year or two it would be thus, as Fig. 7, the distance between *c* and *a* being nearly the same as they were before, but the other two are brought by the amount of the contraction closer together. By understanding this natural law, it is comparatively easy to know the future behavior of a board or plank by carefully exam-

Fig. 7

ining the end of the wood, in order to ascertain the part of the log from which it has been cut as the angle of the ring grows and the medullary rays will show as in Fig. 8.

A plank that has it will evidently show to have been cut from the outside, and for many years it will gradually shrink all to the breadth. While the next plank shown in Fig. 9, clearly points to the centre or heart of the tree, where it will not shrink to the breadth, but to the varying thickness with the full dimensions in the middle, but tapering to the edges, and the planks on the right and left will give a mean, but with the centre sides curved round, and the outside still more hollow. These remarks apply more especially to the stronger exogenous wood, such as beech, oak, and the stronger firs. The softer woods, such as yellow pine, are governed by the same law, but in virtue of their softness another law comes into force, which to some degree effects their behaviour, as the contracting power of the tubular wood has sufficient strength to crush the softer medullary rays to some extent, and hence the primary law is so far modified. But even with the softer woods, such as are commonly used in the construction of houses, if the law is carefully obeyed, the greater part of the shrinking, which we are all too familiar with, would be obviated, as the following anecdote will serve to show: It was resolved to build four houses, all of the best class, but one of the four to be pre-eminently good, as the future residence of the proprietor. The timber was purchased for the entire lot, and the best portions were selected for house No. 1, but by one who did not know the law, and to make certain of success this portion of the wood had an extra twelve months' seasoning after it was cut up. The remainder of the wood was then handed over to a contractor for the other three houses, who had an intelligent young foreman, who knew the structure of wood as well as how to obey the law, and who, therefore, had the

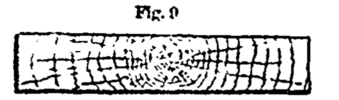
Fig. 8



wood for the three houses cut up in accordance therewith. The fourth house was built the following year by another man; but long before ten years had passed to the great surprise and annoyance of the proprietor it was found that his extra good house had gone in the usual manner, while the other three houses were without a shrinkage from top to bottom.

A similar want of correct knowledge of the natural figure and properties of the structure of wood, such as the oak, is constantly shown by the imperfect painting to resemble that wood, as exhibited on doors and shutters of many houses. If we cannot afford to have genuine wainscot doors as in France and other countries, but yet desire

Fig. 9



to have an imitation, it would surely be worth the trouble to have a block cut from the quarter of an oak tree, and to have each of its six sides planed and polished, in order to make plain their several features. The house painter would then see what nature really is, and thus save us from the ridicule of other nations, when we mix up "silver grains" and all the other natural features up in one side of a board or panel. This is a subject that should interest all wood-workers and builders and a great deal of attention should be given to the structure of the various woods. It is almost as necessary for a wood-worker to understand the anatomy of his tree, so to speak as a surgeon to understand the anatomy before he commences to operate. The importance of the subject is therefore obvious.

SUPPORTING THE SLACK SIDE OF AN OPEN BELT.

One of the simplest problems in belting is to make use of the open belt in connecting one line of shaft with another, yet how greatly mill men differ in this respect. One must have a belt at each end, with one in the centre large enough to drive the whole shaft. Many prefer a single belt at the head end of the driving shaft, where the power for the driven shaft may be taken at once without creating an extra loss of transmitting power any further than need be. And there are others who admire the idea of having the power for the farthest extremity pass down the driving shaft across to the other on a belt, where the slack on the under side will hang down in front of a doorway, and then back again very nearly opposite from where it started. Rope belts and bevel gears still take an interest in this problem and friction wheels in special cases are still recommended. A stiff connecting rod, with slip-bearing in the centre, has been patented in a number of forms for this very purpose, and the three tie connecting rods made from wire rope will work very well where the shafts extend in opposite directions from the wheels that must have three equidistant crank pins, and all for the purpose of accomplishing what an open belt will do to a nicety if the belts are anywhere near perfect. There is nothing that will cause a belt to switch and thrash so well as to lace in a piece of old belting that is of an entirely different grade of material, and yet how quietly they travel when every portion of the belt is similar throughout. When the shafts are supported on the same level, it is no doubt desirable to bring the slack side on the upper fold where the sagging of the belt will have a tendency to increase the hold on the pulleys, but mill men do not always have their choice in the direction that an extra line of shafting is to run, and where the distance is very great a supporting wheel must be called into play to help the slack side from sagging down into the way of the machinery. The shafts are up in the loft of the building where glass cutting and grinding is carried on, and the upper fold has none too much room to pass from one pulley to the other. In this method the three-quarter twist is made use of, which allows the lower stretch to be carried as much above the tight side as it would be desirable to have it below, which gives the belt all the advantage found in a crossed belt. The tight side comes perfectly flat in the centre of the fold where it is in need of all the room there is to spare. If the belt is inclined to brush together much in the crossing, the supporting wheel can be placed to favor it in this respect the same as in every case where three wheels enter into the system for a belt to travel in one direction and still retain sufficient lead in the pully to hold the belt in place while running in the opposite direction.—*Boston Journal of Commerce.*

LABOR SAVING MACHINERY.

Discussing a question which it is not easy to keep down, especially in times of labor agitation and discontent, the Washington *Post* says: "Every labor-saving machine is also a laborer-saving machine. It works for far less than men can, and yet, curiously enough, it oppresses nobody, and robs nobody of wages. On the contrary, it increases wages.

"When George Stevenson, fifty years ago, flung his railway track from Liverpool to Manchester, and whisked a train across it at twenty five miles an hour, all the stage companies held indignation meetings. When the Central Railroad crept up to Rochester, N. Y., farmers met and mobbed the 'new-fangled contrivance,' and drove off the workmen, on the ground that if it should succeed, 'horses wouldn't be worth $10 apiece.' What was the result? Horses that were worth $50 apiece before, readily sold for $100 as soon as the road was finished.

"When Patrick Bell set his reaper into an English wheat field, the excited sickle-reapers broke over the hedge, and captured and burnt up the machine. But those who lived ten years saw it was a blessing to all. The threshing-machine does the work of seventy men; the mowing-machine, tedder, horse-rake, horse-fork and portable engine, in agriculture, are almost equally as effective; yet the wages of farm hands have doubled since these auxiliaries were invented, and were never so high as now.

"Is the sewing-machine, which does the work of twenty women, a disadvantage to seamstresses? Of course not; for their wages are a great deal higher now than they were before.

"Is the automatic boom a disadvantage? No; the number of employed is proportionately less, but their wages are higher, and all the other works in the world are tremendously benefitted by the increased cheapness of fabrics.

"Does the gang-saw rob the lumberman who used to split out boards with wedges? No; for it has enabled men to live in houses, who before dwelt in shanties of bark or in cabins of mud. The workingman is the chief consumer of the products of work."