

# Civil and Mechanical Engineering.

## WOOD-WORKING MACHINERY.

A treatise on its construction and application, with a history of its origin and progress. BY J. RICHARDS, M. E.

(Continued from page 21.)

THE circular saw for cross-cutting or "*butting*," represented in the last number, has, in common with all saws of its kind, the fault of cutting only at limited depths, and while it affords a ready and rapid means of cross-cutting small timber, such a machine would be of no avail in our American lumber mills, where logs of 40 to 48 inches diameter are not unfrequently met with, and the general range of timber would require saws of from 6 to 7 feet diameter.

The consumption of power, too, measured not with reference to the amount of cutting done, but by the time in which it is performed, is very great.

To pass a circular saw through a 30-inch stick in from ten to fifteen seconds, which its speed requires, would for the time absorb the power of a mill with a 20 horse-power engine, and of course derange other machinery. For these reasons, among others, we find the drag or reciprocating saw in general use for cross-cutting throughout the United States and Canada, as well as in most mills abroad.

The one in common use in the States is of the most simple construction, sometimes consisting simply of a crank wheel and pulley, with a rigid connection to which the saw-blade is fastened with bolts or rivets, but generally with a pendulum joint and a compound or jointed connection between the crank and saw-blade. The saw resting with the weight of one end of the connection on the log. When not in use, it can be raised out of the way and suspended overhead until again wanted, leaving the "log way" clear.

A saw of this kind making 75 strokes per minute will cut through a log of from 2 to 3 feet diameter in 3 to 5 minutes, consuming but little power, without any skilled attention.

In England the reciprocating cross-cutting machine is sometimes constructed in a more elaborate and expensive form, with metal

framing and guides at each end of the blade, the guides being mounted on saddles that move up and down upon cast iron pedestals, the main peculiarity of the machines being that the saw with its guides and straining devices can be lowered beneath the mill floor when not in use. The straggling character of these machines of every modification makes it impossible to furnish intelligible engravings within the limits of the *Journal*. Aside from the endless modification in the form of teeth for cross-cutting saws, there is perhaps but little of interest that can be said of them, except in contrasting the performance of reciprocating with circular or band saws.

The stroke of the saw, or rather the relation of the stroke to the depth of the timber, is a point about which there is much difference of opinion, even among practical sawyers; but this subject will be considered in connection with scroll-sawing machines in a future article.

Having considered modern log reciprocating sawing machinery for what may be termed "forest" sawing, we now come to machines for "re-sawing," as it is termed in this country, or "deal sawing," as it is called in England; and in order to judge of the adaptation and merits of the machines, which will be illustrated and described, it will be necessary to revert briefly to the "lumber system" of the two countries a point that has mainly determined the character of the sawing machinery employed. In contrasting the two systems, where they differ, it would certainly be greatly to our disadvantage should we fail to consider the bounteous provision of nature through which we have enough timber both to use and to waste. The reckless manner in which we cut our lumber both as to the waste of the kerf and the irregularity of dimensions has much to do with its price, which has become a subject of serious consideration, mainly in the Atlantic cities, where its cost is already enhanced by transportation from the Middle States.

Our lumber is nearly all forest cut, that is, reduced from the log to its lowest dimensions, while green, allowance being made in the thickness for seasoning, warping and the irregularity of sawing.

In sawing a "squared stock" into 1-inch boards, with a circular or Muley mill, about one-fourth is converted into saw-dust, at least one-eighth must be allowed for shrinkage, another eighth will be required to dress it down to the dimensions of the thinnest boards, and remove the dirt and grit collected in transportation, so that when it reaches the final consumer it rarely represents more than *one-half*

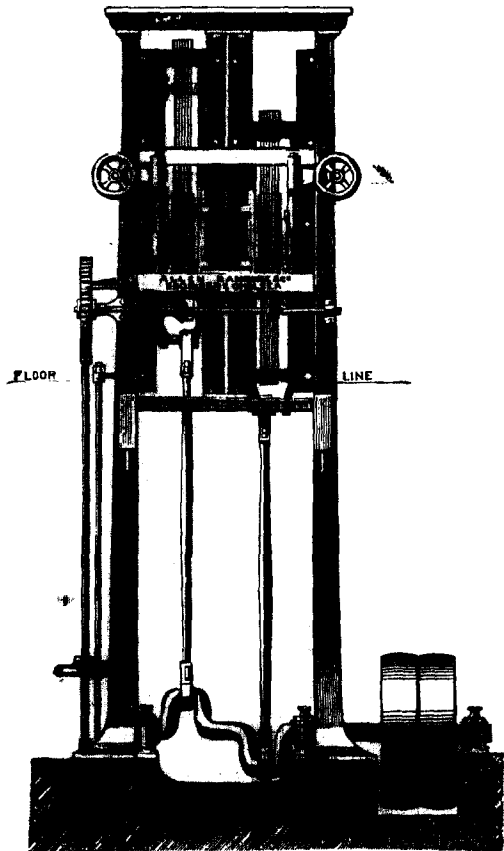
of the stock from which it is cut, or about two-fifths of log before sawing. In our more expensive kinds of lumber, such as walnut, cherry and ash, this waste is becoming a serious question, and has recently become the subject of much consideration among our lumber manufacturers and dealers. It is safe to presume that as the price increases and timber becomes scarce, we will do more deal sawing, making not only a great saving in the material but enabling lumber dealers to cut their bills to special order from deals or squared stocks, without covering a large lot of valuable ground with numberless piles of stuff from which to "assort sizes."

In England nearly every wood-working establishment has for its most important machines, the saws for re-cutting, or cutting out stuff, in fact 'saw-mill' is a common name for wood-working establishments. The timber comes from the Baltic or other parts of northern Europe and from Canada in the form of deals or heavy planks. When the log is not too large to be handled in transporting it is simply "squared," these deals are the lumber of commerce, and are re-sawed as needed into

boards of various thicknesses on deal frames, or, as we would term them in this country, "gang resaw mills."

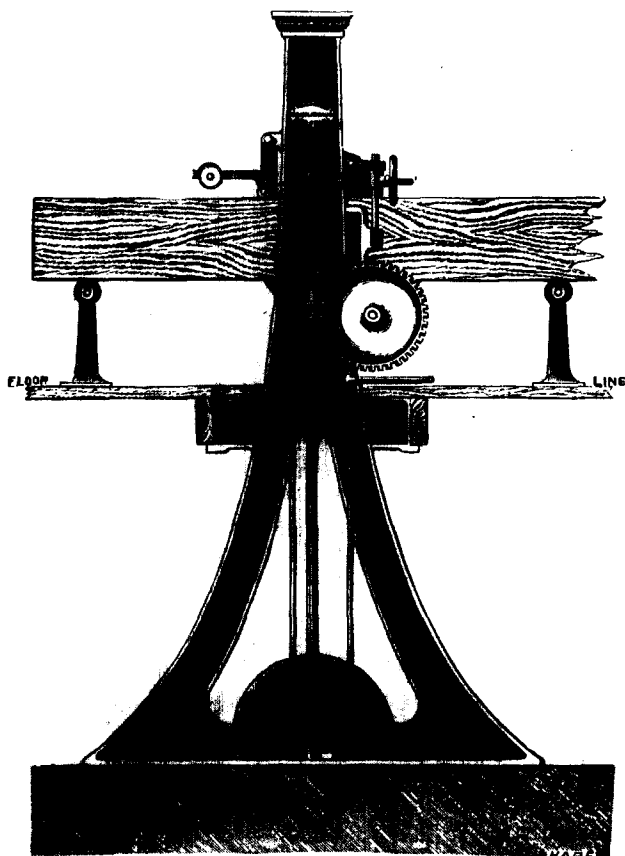
The saws used are of a thin gauge sufficient in number to reduce the whole deal at once passing through.

Fig. 1.—Front.



In Fig. 1 we give a front and side elevation of Fraser's patent equilibrium deal sawing machine, as improved and manufactured by Messrs. Allen Ransome & Co., which may be considered as a fair type of the most improved machines of modern times. The term equilibrium as applied to this machine relates to the compound saw frames moving in different directions at the same time by means of cranks placed at right angles with each other as shown in the engraving on page 91.

Fig. 1.—Side.



The plane of their movement is of course not the same, and although not quite amounting to a perfect counterbalance is an important improvement on the old machines with a single sash that could not be balanced in any degree to insure steadiness in the frame. This question of counterbalancing reciprocating saws will be considered

farther on, when the arrangement of this machine in this respect will be farther and more fully reverted to.

The weight of these machines varies from  $2\frac{1}{2}$  to 5 tons, carrying from 10 to 20 saws, and making from 140 to 230 revolutions per minute. The feed is continuous and variable at pleasure by means of the frictional disk seen in the side elevation. The writer has seen these machines making 250 revolutions per minute, with a feed of from 30 to 40 inches per minute, carrying 5 working saws on each side, in 12-inch deals, without any jar or vibration that would affect the machine, which performance, so far as any data in his possession could determine, was cheaper than any sawing we do in this country even in green timber, especially when we consider that the saws were of 14 gauge steel with but little set.

Fig. 2.—Side.

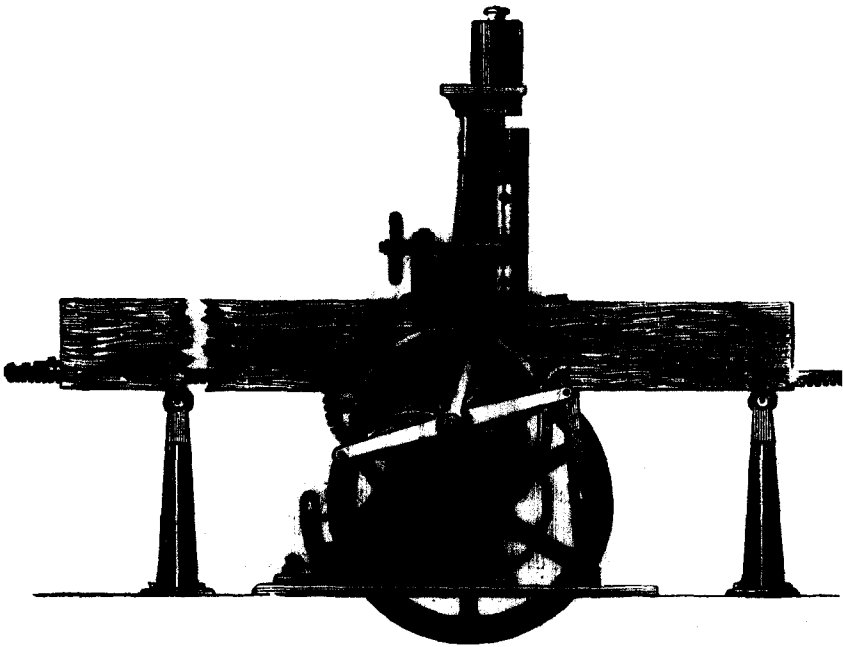
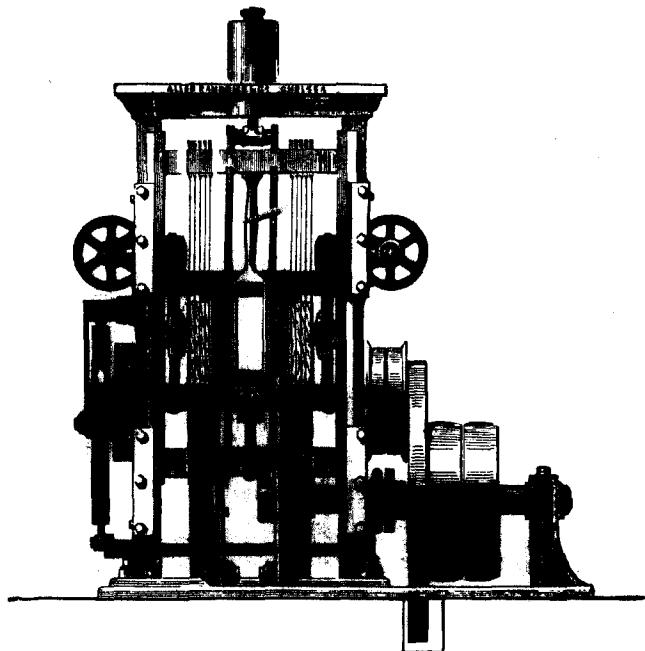


Fig. 2 is a true elevation showing two views of another modification of the deal sawing mill from the same manufacturers. It is what might within certain limits be termed a portable mill, having all of its parts above the floor-line. The connection is "forked" around the rack that feeds the timber, and attached to the top of the

saw frame; this gives it sufficient length, allowing the crank shaft to be placed above the floor as seen in the engraving. On the top of the frame will be seen a vacuum cylinder, which is fitted with an air-tight piston connected with the saw-frame.

The area of this cylinder is so proportioned as to balance the weight of the reciprocating parts of the machine making an elastic

Fig. 2.—Front.



cushion as it were on the down stroke, and dispensing with the counterbalance on the crank wheel, which is the main cause of horizontal vibration in such machines. The feed is intermittent by means of the silent clutch. The weight of the machine is for two sizes, 2 and  $2\frac{1}{2}$  tons, respectively. The frames are arranged to carry from fourteen to sixteen saws, and to cut two deals at once from 11 to 14 inches deep. The average speed is 200 revolutions per minute. There are not in common use in the United States any machines that correspond to these. The limited amount of re-sawing that is now done has not justified manufacturers in attempting to introduce them; in fact unless our lumber system is changed there is but little for them to do. Our re-sawing machines as now

built with their ponderous framing and single blade, are incapable of cutting lumber at a cost that can be afforded, and are only operated where they are a necessity. A discrimination in price in favor of 1-inch boards as against thinner lumber is all that enables them to be run with profit.

It is fair to presume that if we resawed our lumber to the extent that it is done abroad there would be many valuable improvements introduced to cheapen and simplify construction.

The native ingenuity of our lumber manufacturers in devising machinery of simple and cheap construction is recognized and conceded by all who have investigated the subject thoroughly. In fact, the wants of our country are so entirely different from those of any other, that it is not only difficult but impossible for any one to comprehend them unless by a very careful investigation of all the local conditions that affect them, but, as before said, when so investigated and considered by people from abroad, their adaptation has generally been recognized.

We have here, for instance, a continuous and rapid change of construction; a continual chain of improvements, following each other in such rapid succession, that the purchaser of a machine has no assurance that it will not in a year or two, be supplanted by a new modification, which, through competition, he will be compelled to adopt; hence he feels like limiting the amount of the investment to the lowest possible sum.

Again, the value of the investment is at least twice as much as in older countries. When money invested in manufacturing is worth ten per cent. per annum, and seeking other investments, it is not strange that we find in our saw-mills a rigid economy in the matter of first cost.

Another condition to be considered, and a very important one too, in connection with lumber-cutting machines, is the very general knowledge that exists of its care and operation in the United States. In our thickly populated districts (if we have any that can be so called), we are hardly ever out of the sight of the steam from saw mills. It is common for our largest farmers to use their portable engines for cutting their own lumber for building, fencing, &c., and it would be surprising to know how many of our people are acquainted with saws and saw-mill operations. This enables the use of machinery of simple construction, and small cost, which is

too often construed as exhibiting our inability to design and build that which is more durable and better.

A friend of the writer, traveling in Switzerland in 1867, investigated a saw-mill which he found there for cutting fir timber, which he describes as follows:—The water was spouted with wooden troughs to an overshot wheel of about 12 feet diameter. In the axis of this wheel there were inserted wooden lifters similar to those used for operating "Cornish stamps." The saw with its frame or attachments was lifted up by these lifters, and then "*fell down*" by its gravity in making the cut. To arrest the downward stroke and to determine the range of movement a strong beam extended down from the saw-frame, and came down at each stroke upon a bed of saw-dust and chips at the bottom. It is to be regretted that there was no sketch of this piece of engineering taken at the time, but from the description it is safe to assume that no such thing was ever seen in North America, nor any parallel for it. This is mentioned as contrasting with the general knowledge of saw mills existing here.

(To be continued.)

## **DISTILLING APPARATUS FOR STEAMSHIPS.**

*Editors Journal Franklin Institute:*

THE importance of a distilling apparatus, from which may be obtained an ample supply of palatable, wholesome water, is so great on board all merchant steamers making long voyages, as well as on our naval vessels, that I am confident that the following report upon the only apparatus of this kind which has yet fully met this great want, will be read with interest by all who have been or who expect to be called upon to make an ocean voyage, as well as by engineers generally.

R. H. T.

Naval Academy, June 8, 1870.

*"Mare Island Navy Yard, March 11, 1870.*

"SIR; \* \* \* \* \* The water obtained on shipboard by the condensation of steam from the boiler, being the result of pure distillation, is wholly unmixed with air, is quite warm as it comes from the condenser, and is unfit for use until after several days exposure in tanks. These tanks are situated in the hold of the vessel, and the air imbibed by the water is saturated