O. Marland,

2 Sheets, Sheet 1.

Bending Wood.

No. 111,855.

Patented Feb. 14, 1871.

Fig. 3.

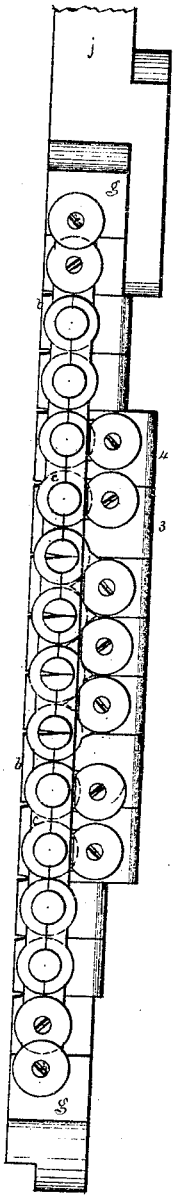


Fig. 2.

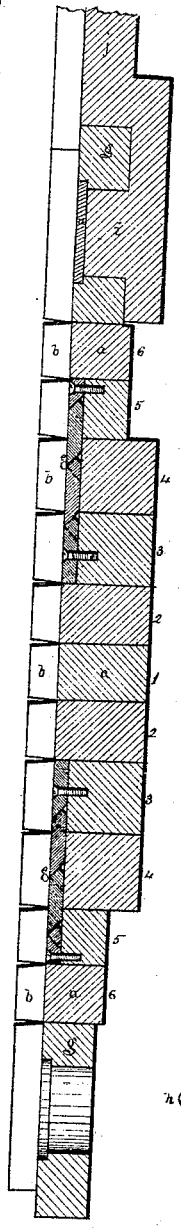
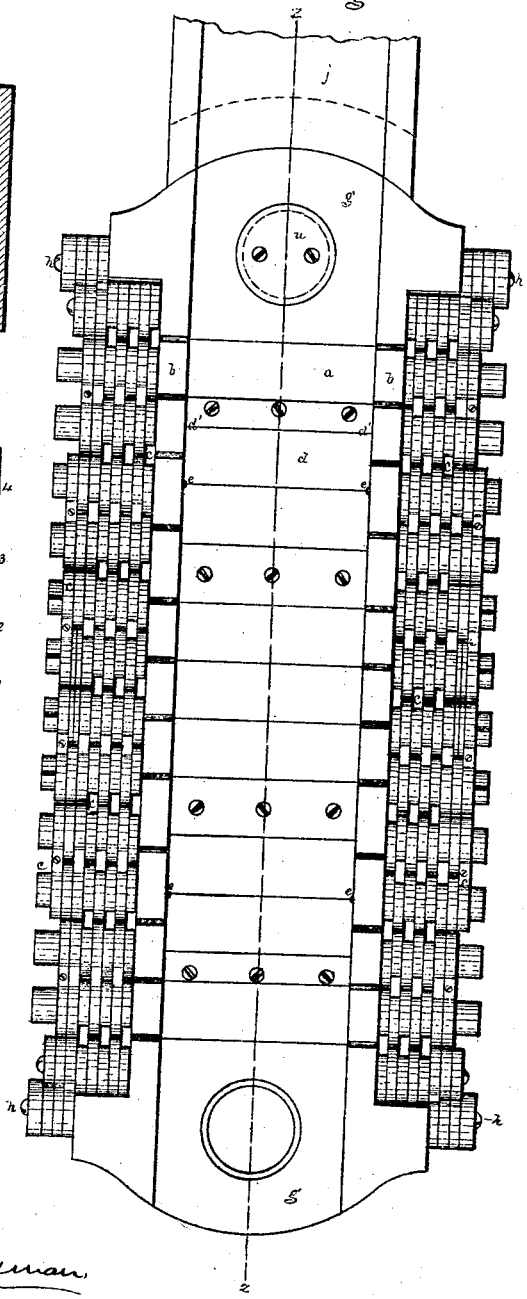


Fig. 1.



Witnesses

J. C. Crosman

W. B. Crosby

Obadiah Marland

2 Sheets, Sheet 2.

O. Marland,

Bending Wood.

No. 111,855. Patented Feb. 14, 1871.

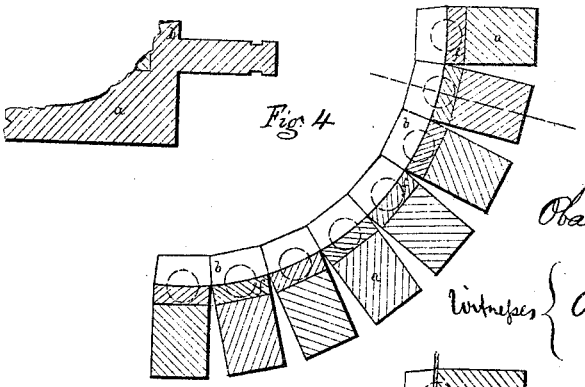


Fig. 4

Witnesses: J. L. Crosman, W. B. Cosby

Radcah Marland

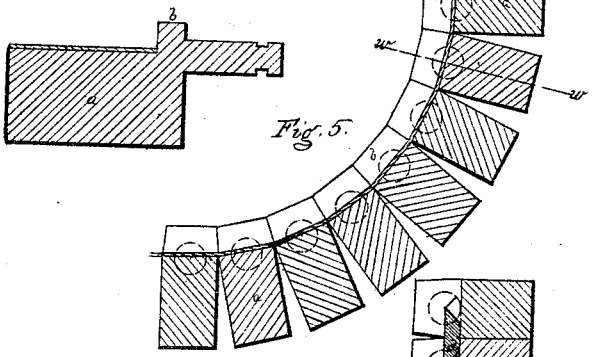


Fig. 5.

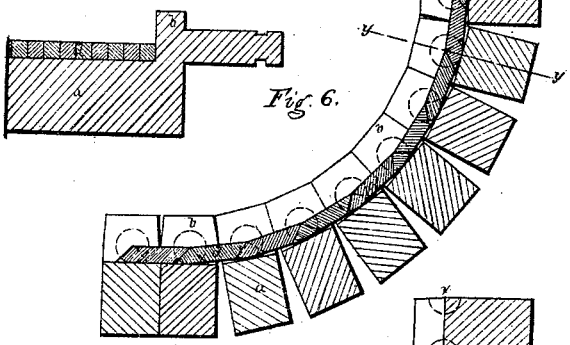


Fig. 6.

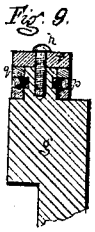


Fig. 9.

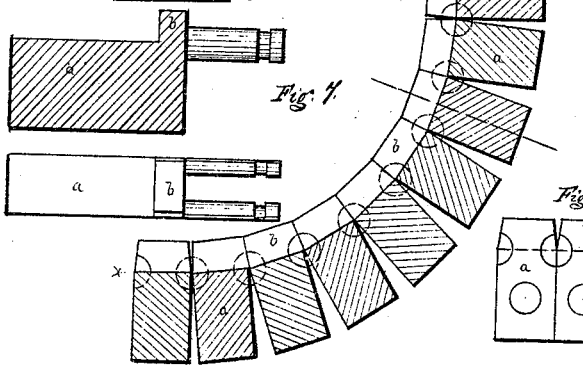


Fig. 7.

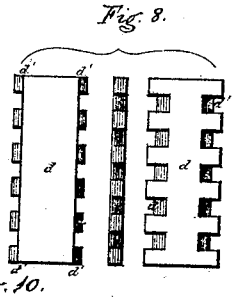


Fig. 8.

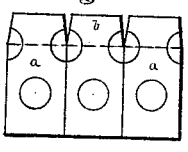


Fig. 10.

United States Patent Office.

OBADIAH MARLAND, OF BOSTON, MASSACHUSETTS.

Letters Patent No. 111,855, dated February 14, 1871.

IMPROVEMENT IN MACHINES FOR BENDING WOOD.

The Schedule referred to in these Letters Patent and making part of the same.

To all whom it may concern:

Be it known that I, OBADIAH MARLAND, of Boston, in the county of Suffolk and State of Massachusetts, have invented an Improvement in Chains for Bending Wood; and I do hereby declare that the following, taken in connection with the drawing which accompanies and forms part of this specification, is a description of my invention sufficient to enable those skilled in the art to practice it.

Prior to my invention wood has been bent by first confining it to a flat band of iron or to a flat thin chain, the band or chain having thereon at one end a chock, and at the other a piece with set-screws, which were adjusted tightly against one end of the timber, forcing the other end solidly against the chock; then both the timber and the band or chain were bent by suitable application of force.

In bending timber the end sought is to keep the fibers of the extrados of the wood while flexing, and when flexed in their natural condition as to extension or compression, as if they are extended they will rupture, and if they are compressed then the amount of compression will be injurious and unnecessary.

When two pieces of material in parallel straight lines are bent into parallel curves, with their ends so secured together that they cannot move relatively to each other, the tendency will be to elongate the outer lines of the combination and to shorten the inner lines, and there will be one line between the extrados and intrados of the curve which will remain of the same length which it had before bending, which line may be termed the neutral line.

Now when, as before my invention, a flat metal band or a flat chain has been used the neutral line has been about in the center of the thickness of the band or in line of the pivots of the chain, and the timber has been compressed on the extrados, though not of course to the same extent as at the intrados, and the exteriors of the band and chain have been elongated and their interiors have been compressed, resulting in breaking the band and in shearing off the chain-pivots.

In practice I am informed that chains so applied have been destroyed at the first bending with a timber, and the bands break upon the second or third bending.

My invention consists in details of construction and arrangement, hereinafter described, of chains for bending timber, in which chains one surface of each link-bar bends or turns practically in a line or surface coinciding with lines drawn across the back or outer surface of the timber to be bent.

Of the drawing—

Figure 1 shows, in plan, a timber-bending chain illustrating my invention.

Figure 2 is a central longitudinal section of the same, the section being taken in the plane of the line *z z*, fig. 1.

Figure 3 is a side view of the chain.

Figures 4, 5, 6, and 7 are sectional views of portions of chain embodying my invention as they appear when bent or curved, each view exhibiting a modification in the detail of construction, though all of them shows that the bending takes place in lines coincident (or substantially so) with the back of the timber to be bent, in combination with the chain.

Included with each of figs. 4, 5, and 6 is a longitudinal sectional view of one end of one bar of the chain.

Figure 7 includes a plan as well as a longitudinal sectional view of one end of a bar.

Figure 8 includes three views of pieces used with the chain, as shown in fig. 6, which pieces I term spanner-bars.

Figure 9 shows a detail of construction.

Figure 10 shows, in end view, three bars of a chain, each with a half pivot on each side, and with a whole reinforcing-pivot located near the back and in the central longitudinal plane of the bar.

The chain shown at fig. 7 corresponds, substantially, with that part of the chain shown in fig. 2, where marked 2 1 2.

The chain shown in fig. 6 corresponds, substantially, with that part of the chain shown in fig. 2, where marked 3 4 5.

The chain shown in fig. 5 corresponds, substantially, with that part of the chain shown in fig. 2, where marked 6.

In practice I prefer to make the bars of my chain of uniform width, as seen in figs. 4, 5, 6, and 7, and not as seen in figs. 1, 2, and 3, where the variations in width were made merely to enable me to pass in one chain from bars of one kind to bars of another kind while keeping radius links, *c*, of the same length.

The bars *a* are made with flanges, *b*, on each end, projecting beyond the neutral place or the draft-plane toward the centers of the curves to be formed, these flanges serving to keep the timber from spreading sidewise as it is bent; for if the timber is too narrow to fill the space between the flanges, then side pieces are driven between the flanges on one side of the chain and the side of the timber.

The chain has secured to it, at suitable distances apart, two stout chocks or clamps, one or both of which are provided with set-screws, so that by adjustment thereof no endwise movement of the whole timber, with relation to the chain, can take place.

This is not shown, as it does not differ from the provision heretofore used with metal bands for the same purpose.

Each bar, *a*, is made with projecting pivots, by which it is secured to the bars adjacent by suitable links.

The bars 2 1 2, in figs. 1, 2, and 3, and the bars seen in figs. 7 and 10 have on each edge a half pivot, the axes of which are in lines formed by the inter-

sections of the sides of the bars with the timber faces thereof, and it will be seen that all parts of my chain, wherever shown in the drawing, which project beyond the timber-face or the neutral or draft plane, are cut away on radial planes extending from the joints between the bars toward the center of the smallest curve into which the chain is to be bent.

As two half pivots are not equal in strength to one whole pivot of the same size, I may add to each bar having half pivots a whole pivot at each end, centrally located near the back of the bar, and then connect the whole and half pivots by diagonal links, as seen in fig. 3, to strengthen the chain when used for heavy work.

It will be seen that the line *x x*, which is in the timber-face of the chain and is the neutral line and the line of draft, is of the same length whether flexed or straight.

The chain shown in fig. 6 is substantially the same as that part of the chain shown at 3 4 5, fig. 2, except where the construction in fig. 2 is modified to enable me to pass from one form to another.

Here, the flanges *b* extend further from the bodies of the bars *a* than they do in fig. 6. This enables me to make use of spanner-bars *d*, which span or break the joints between the bars *a*, and are of such thickness that they form the timber-face in the line of the axes of the pivots, which pivots are whole and are located with their axes in the central planes of each bar denoted by the line *y y*.

Where heavy bending is to be done, two pivots may be made on each end of said bars and united by links, as seen at 3 and 4 in fig. 3, for the purpose of strengthening the chain.

The spanner-bars *d* are made on the timber-face, between the lines *d' d'* of a width equal to the distance of the pivots apart, and are so located on the bars *a* as to bring the lines *d' d'* into continuation of the axial lines of the pivots.

The edges of the spanner-bars are beveled and notched, as shown most clearly in fig. 8, and the parts projecting beyond the lines *d' d'* are curved on the opposite surfaces to a radius equal to the thickness of the spanner-bars, as seen best in fig. 6.

The spanner-bars are kept up to the bars *a* by any suitable devices, such as the projections seen at *e*, and the edges of the end spanner-bars abut against suitable formations in or on the chain, as seen in fig. 2, so that the spanner-bars do not move relatively to the length of the chain.

The chain shown in fig. 5 is made up of bars substantially like those shown at 6 6, fig. 2.

The pivots on these bars have their axes at or very near the intersections of the faces of the bars between the flanges *b*, and sections taken in planes indicated by the line *w w*.

With a chain so made, a thin metal band may be laid between the timber and the bars, where it will, if carefully proportioned as to thickness, with reference to the curve to be bent and the exact relation of the axes of the pivots to the faces of bars *a*, average the spaces between the angles of the polygon formed by the bars *a* and the inscribed curve.

This band does not receive either compression or extension in the act of bending, as its ends are not fixed, and as it is simply flexed it will last almost indefinitely.

If used for heavy bending, the bars may be made deep and with reinforcing pivots and connecting-links, as before described.

The chain shown in fig. 4 is like that seen in fig. 6, except that spanner-bars are not used, and on each bar a filling-piece, *f*, is used, the face of which is brought into the line of the axes of the pivots.

These pieces *f* may be curved on the face to suit the curve to be formed on the timber, and chains so made, or as shown in fig. 5, are best adapted to light work.

The pieces *f* can be changed for others having faces to suit larger or smaller curves, and by slight changes in the thickness may be changed slightly in position with reference to the turning points of the bars.

A thin band of metal may also be introduced between the faces of the pieces *f* and the back of the timber, as shown in fig. 5.

Bent timbers are usually needed with a straight part or arm at each end of the curve, and hence the chain is connected at each end to parts which merely receive and support the timber, which parts are not arranged to be flexed, and to said parts are secured the chocks, clamps, or pieces which take the end-thrust of the timber when it is bent.

The end bars at 6 6 in fig. 2 have their pivots connected by links, *c*, to pivots on the pieces *g*, which pivots are strengthened by connecting-links taking hold of their outer ends and extending over other short pivots or studs formed on said pieces *g* at *h*.

In the center of each piece *g* is formed a bearing for a trunnion, *i*, which is made on the piece *j*, which may extend outward beyond the trunnions as far as required for convenience in manipulating and securing the timber.

It is to these pieces *j* that the clamps, which secure the timber ends, are fixed, and as the pieces *j* can turn on their trunnions it will be obvious that the strain will thereby be equalized between the pivots and links on both sides of the chain.

The outer lines of links *c* connecting the pivots are made in halves, and enter grooves turned near the ends of the pivots, and said halves being screwed together prevent all or any of the links *c* from becoming detached.

In fig. 9 is seen one of the short pivots on the piece *g*, seen at *h*, fig. 1, showing a convenient way of securing the link on the pivot.

In the pivot a groove is turned beyond the link, into which groove half rings, *o*, are placed, which half rings are secured by an outer ring *p*, the space between said outer ring and the cap over the end of the pivot being filled by the ring *q*, the cap *r* being secured to the pivot by a central screw.

The trunnion *i* is secured in place by a cap, *u*, which fits in a recess turned to receive it, the cap being held to the trunnion by screws entering it, or by bolts passing through the trunnion.

I claim—

1. The combination of bars *a*, by means of half pivots and links, substantially as described.

2. The combination, with bars *a*, of two sets of pivots and links, one on which the bars turn, and the other for reinforcing the former.

3. The combination, with the bars *a*, of spanner-bars *d* or pieces *f*, substantially as and for the purpose specified.

4. The spanner-bars *d*, with notched and beveled edges, and with their backs curved at the edges, substantially as shown in fig. 8.

5. The combination, with a chain made up of bars *a* connected at their ends, of clamp-bearing pieces *j*, by means of trunnions, arranged substantially as and for the purpose set forth.

Witnesses: OBADIAH MARLAND.
J. C. CROSSMAN,
J. B. CROSBY.