Sept. 13, 1927. 1,642,186

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STRAP FOR USE IN BENDING WOOD TO FORM PARTS OF CURVED SHAPE

Filed July 28, 1925

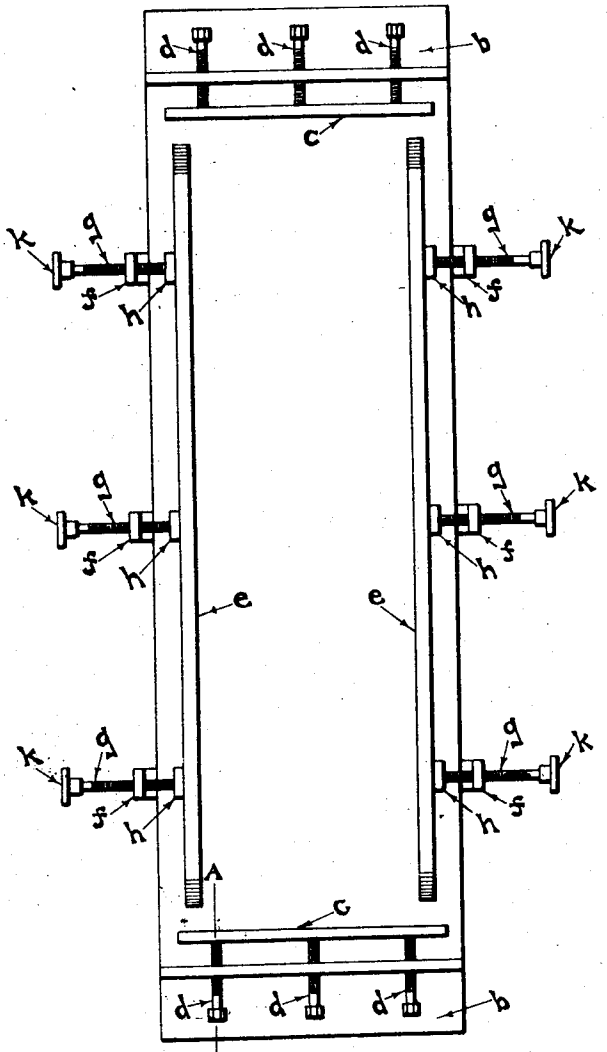


FIG.-1

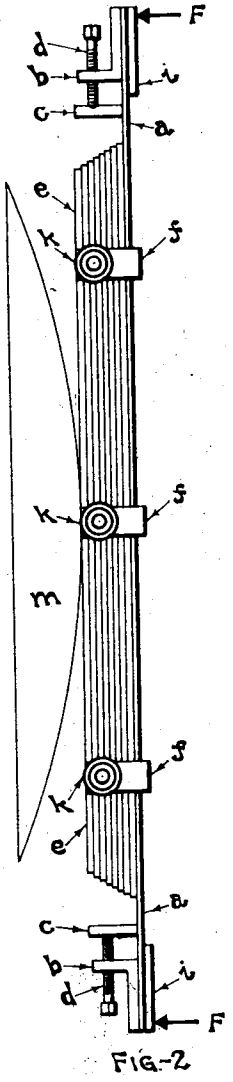


FIG.-2

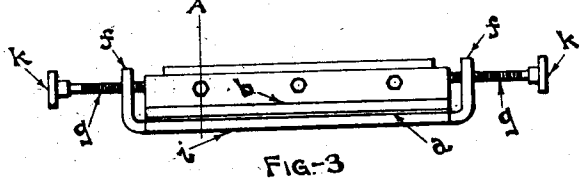
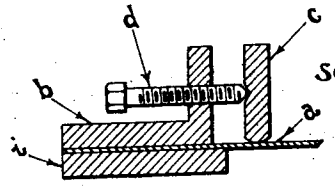


FIG.-3



Section A-A

FIG.-4

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Patented Sept. 13, 1927. 1,642,186

UNITED STATES PATENT OFFICE.

THOMAS R. C. WILSON, OF MADISON, WISCONSIN, ASSIGNOR, BY MESNE ASIGNMENTS, TO THE PEOPLE OF THE UNITED STATES.

STRAP FOR USE IN BENDING WOOD TO FORM PARTS OF CURVED SHAPE.

Application filed July 28, 1925. Serial No. 46,649.

(GRANTED UNDER THE ACT OF MARCH 3, 1883; 22 STAT. L. 625.)

This application is made under the act of March 3, 1883, chapter 143 (22 Stat. 625) and the invention herein described and claimed may be used by the Government of the United States, its officers and employees, and by any person in the United States, without the payment to me of any royalty thereon. I hereby dedicate the same to the free use of the Government and the people of the United States.

This invention consists of a certain improvement in bending straps and auxiliary apparatus, the object of which is to restrain wood against buckling and breaking in being bent to curved form and to prevent warping and twisting during seasoning subsequent to bending.

It is evident that in bending a piece of any material to curved form, the concave face of the bend and the intermediate layers must become shorter than the convex face. This can sometimes be accomplished through shortening of the concave face and the layers adjacent thereto combined with lengthening the convex face and layers adjacent thereto. During the bending some intermediate very thin layer, or surface, remains unchanged in length and the shortening or lengthening of any layer is proportional to its distance from this surface. This surface which remains unchanged in length is known as the neutral surface. Now, wood can be shortened or compressed very considerably but can be stretched or lengthened only slightly without separating. Consequently, when the bend is such that the difference in length between the concave and convex surfaces will be large it becomes necessary to restrain the stretch to a small amount or prevent it altogether thus bringing the neutral surface nearly or exactly to the convex face and increasing the compression or shortening of the layers between the neutral surface and the concave face. In fact, it may be advisable to actually shorten the convex face in which case the neutral surface is entirely outside the piece.

The usual means of restraining stretch of the convex face is a thin band or strap of metal having fastened to it end blocks between which the piece to be bent is held and against which its ends abut. In the usual construction these end blocks are inefficient for reasons which will be discussed later. width is slightly less than this distance and tion is to provide means by which the action of these end blocks and of the strap itself can be made positive and effective.

Pieces prepared for bending are sometimes warped and twisted and have lateral crooks. Also in bending there exists a tendency of the piece to expand laterally and to buckle and deflect laterally as the material at and near the concave face is compressed longitudinally or shortened. A second purpose of my invention is to remove warp, twist, and lateral crooks before bending and to restrain and prevent lateral expansion, buckling, and deflection during bending. Subsequent to the bending of wood, it must be dried while held in the bent shape. During such drying, warping and twisting frequently take place. The features of my invention which remove warp, twist, and lateral crooks before bending and restrain and prevent lateral expansion buckling and deflection during bending are well adapted to the prevention of warping and twisting during drying.

In the drawings illustrating this invention: Fig. 1 is a plan view, Fig. 2 a side view, Fig. 3 an end view of a bending strap embodying the principles of this invention. Fig. 4 is a section along A—A of Fig. 1. The same letter is used to designate the same part in these several views.

"*a*" is a metal strap or band of thickness, width, length, and quality of material adapted to the dimensions of the wooden pieces to be bent.

"*b*" are fixed end blocks securely fastened to strap "*a*".

"*c*" are movable end blocks having well within the middle third of their height and on the side next the fixed head blocks "*b*", spherical, conical, or horizontally grooved seats for the points of plungers "*d*". Their dimension perpendicular to the plane of strap "*a*" is approximately equal to the corresponding dimension of the wood to be bent.

"*d*" are end clamping plungers attached to the fixed end blocks "*b*" in such a manner that they can be readily advanced or re-

tracted in a direction parallel to the length of strap "*a*" and firmly held to fixed end blocks "*b*" in any desired position. In the accompanying drawing, the end clamping plungers have the form of screws passing through threaded holes in fixed end blocks "*b*" with means provided by which these screws can be turned. The end clamping plungers have points which fit the seats in movable end blocks "*c*" in such a manner that these movable end blocks can rock or rotate through a small angle on the points of plungers "*d*". One means of providing this rotational freedom of movable end blocks "*c*" is shown in section A—A Fig. 4 where plungers "*d*" have conical points of slightly smaller central angle than the conical seats in end blocks "*c*".

"*e*" are flexible bars so constructed as to be easily bent by, and readily become straight again upon removal of, forces acting in a direction perpendicular to the plane of strap "*a*", and at the same time be rigid under the action of forces parallel to the width of strap "*a*". Their dimension perpendicular to the plane of strap "*a*" is approximately equal to the corresponding dimension of the wood to be bent. One means of constructing flexible bars "*e*" is to build them up from several thin metal pieces or laminæ as shown in the drawing.

"*f*" are bars which pass under strap "*a*" and have their ends turned up at each side of this strap.

"*g*" are side clamping plungers attached to the upturned ends of bars "*f*" in such a manner that they can be readily advanced or retracted in a direction parallel to the width of strap "*a*" and firmly held to the upturned ends of bars "*b*" in any desired position. In the accompanying drawing plungers "*g*" have the form of screws passing through threaded holes in the upturned ends of bars "*f*" and are operable by means of hand wheels "*k*".

"*h*" are small blocks of metal to receive the thrusts of screws "*g*" and transmit them to flexible bars "*e*".

It may be convenient in some cases to omit plungers "*g*" and blocks "*h*" from one side of the strap. When this is done the inner faces of the upturned ends of bars "*f*" must be in the same plane perpendicular to the face of strap "*a*".

"*i*" are fillers of the same thickness as bars "*f*" and are securely attached to fixed end blocks "*b*". They will be necessary only when the strap is used in connection with some types of bending presses and may even then be left off the straps and attached to the press.

The use and operation of this strap in the bending of wood is as follows:

The wood to be bent consists of a single piece whose width is slightly less than the maximum distance between flexible bars "*e*" or of a number of pieces whose aggregate width in slightly less than this distance and whose length is slightly less than the distance between movable end blocks "*c*". This piece, or pieces, having been previously prepared by boiling, steaming, soaking, or other treatment are placed on the strap between flexible bars "*e*" and movable head blocks "*c*". End clamping plungers "*d*" and side clamping plungers "*g*" are then securely tightened. Following this the strap and specimen, or specimens, are brought into proper relation with the bending form "*m*" and bending is accomplished by the application of forces represented by the arrows "F". As the seasoning subsequent to bending progresses end clamping plungers "*d*" may be released and side clamping plungers "*g*" tightened to take up the slack resulting from shrinkage and thus hold the wood so that no warping and twisting takes place.

I am aware that straps with movable and adjustable end blocks have been used in the bending of wood. However, the movable end block embodied in my invention has specific advantages not possessed by any end block now known to the art. The usual bending strap has only fixed end blocks. Such end blocks are poorly adapted to accomplishing the desired result for two principal reasons:

1. It is impracticable to make straps with the end blocks absolutely parallel or with the distance between end blocks exactly the same in all straps. Furthermore, straps are subject to stretching, hence it is impossible to keep the distance between end blocks constant in any one strap or keep it exactly the same for several straps. Consequently, in order to have the stock to be bent fit exactly between the end blocks it would be necessary to have it cut to a different length for each strap and to different lengths at different times for the same strap. Such procedure is obviously impracticable when several straps are being used and a large number of pieces are to be bent. On the other hand, if the stock is all cut to the same length it will be too short for some straps and too long for others. When the stock is too short tension failure on the convex side of the stick takes place before the end blocks come into bearing against the ends of the stock as bending progresses. When the stock is too long, it must be forced between the end blocks. Such forcing results in crushing or mashing at the ends and this crushed wood is incapable of transmitting to the central portion of the stick the end pressure or longitudinal pressure necessary to prevent tension failure.

2. In bending wood a very large pressure must be applied to the ends of the stock in order to prevent tension failure. In using

straps with fixed end blocks, even if the fit of stock between these end blocks is made perfect, as soon as bending begins the pressure of the end blocks is localized at the top or bottom corners of the ends of the stock. This results in crushing at these points and the pressure transmitted is insufficient to prevent tension failures.

Such adjustable end blocks as I have observed in use have the advantage of enabling the distance between them to be adjusted to the length of the stock. However, they have been so made that the face of the adjustable end block stands at a fixed angle with the strap and hence the crushing at the corners of the ends as described above and the consequent failures by tension are not prevented.

The specific advantage of the adjustable head blocks "*c*" as embodied in my invention is that their freedom to rotate on the points of the end clamping plungers "*d*" combined with the fact that the bearing of these end plungers comes well within the middle third of the height of the adjustable end blocks results in the pressure being distributed all over the ends of the stock thus obviating the local crushing at the corners and preventing tension failures.

In the construction and operation of my invention flexible bars "*e*" may be omitted and blocks "*h*" permitted to bear directly against the stock to be bent. If the device is operated in this manner, however, care must be taken that the clamping action of side pressure screws "*g*" do not cause lateral bending and localized crushing of the stock which it is the object of flexible bars "*e*" to prevent. The flexible bars perform another important function in that, particularly when bending is done in a hydraulic press, they limit the closing of the press and thus guard against crushing of the stock.

I claim:

1. A bending strap having end clamping plungers combined with movable pivoted end blocks by means of which the distance between end blocks can be adjusted to the length of the bending stock and by means of which practically uniform pressure over the entire area of the ends of the stock can be applied before bending and maintained throughout the bending operation.

2. A bending strap equipped with side clamping plungers and flexible side clamping bars by means of which warp, twist, and lateral crooks can be removed from the stock before bending.

3. A bending strap of trough-like form having practically continuous flexible side walls of such construction, that, being practically straight when free of constraint, they can be bent in the direction the wood is to be bent but remain rigid against forces tending to bend them in the direction at right angles to this, together with provision for clamping the stock to be bent between these side walls in such a manner that local crushing or damage from the clamping devices is avoided and lateral expansion, buckling, and deflection during bending is restrained or prevented.

4. A bending strap of trough-like form having flexible side walls as well as flexible bottom into which stock to be bent can be clamped in such a manner as to reinforce it against lateral expansion, buckling, and deflection during bending and which together with the wood so clamped can be bent about a form or mould of the desired shape.

5. A bending strap of trough-like form having flexible side walls of the same height as the wood to be bent, by means of which crushing of the wood between the strap and the form, or between inner and outer forms when used, can be prevented.

6. A bending strap equipped with side clamping plungers and flexible side clamping bars by means of which warping and twisting of bent stock during the seasoning subsequent to bending can be prevented.

7. In a bending strap the combination of (*a*) means for adjusting the distance between end blocks to the length of the stock, (*b*) pivoted end blocks by means of which practically uniform pressure over the entire area of the ends of the stock can be applied before bending and maintained during the bending operation, (*c*) side clamping plungers and flexible side clamping bars by means of which the wood may be clamped in such a manner as to (1) remove warp, twist and lateral crooks from the stock before bending, (2) prevent lateral expansion, buckling, and deflection during bending, and (3) prevent warping and twisting during the seasoning subsequent to bending, and (*d*) means for protecting wood against crushing between the strap and the bending form or between inner and outer forms if these are used.

THOMAS R. C. WILSON.

Certificate of Correction.

Patent No. 1,642,186. Granted September 13, 1927, to

THOMAS R. C. WILSON.

It is hereby certified that error appears in the printed specification of the above-numbered patent requiring correction as follows: Page 1, line 55, strike out the words "width is slightly less than this distance and" and insert instead *One of the principal purposes of my inven-;* and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 13th day of December, A. D. 1927.

[SEAL.]

M. J. MOORE,
Acting Commissioner of Patents.