No. 662,654. Patented Nov. 27, 1900.

F. B. NEWTON.

APPARATUS FOR BENDING WOOD.

(Application filed Feb. 2, 1898.)

(No Model.)

4 Sheets—Sheet 1.

Fig. 2.

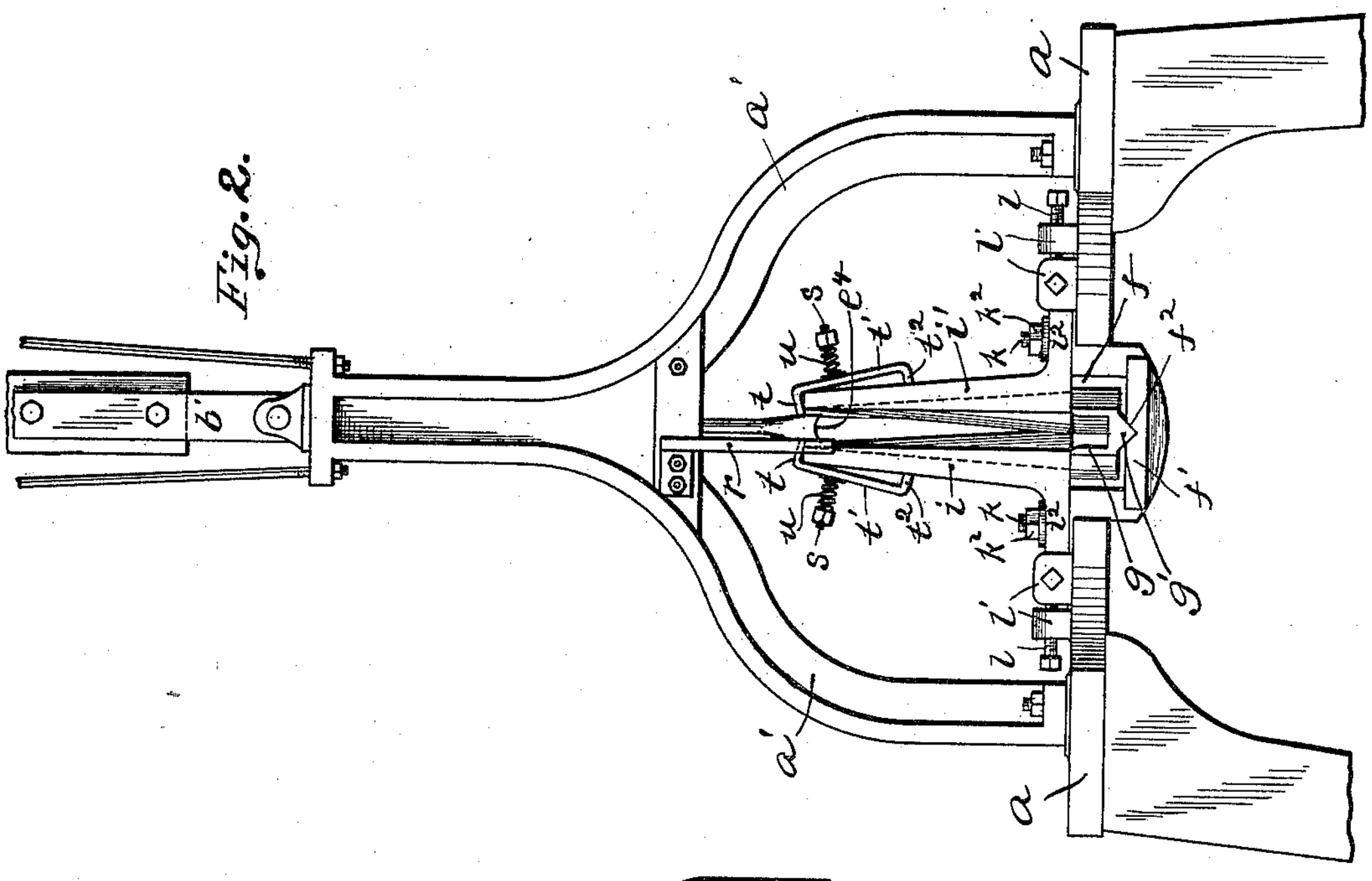
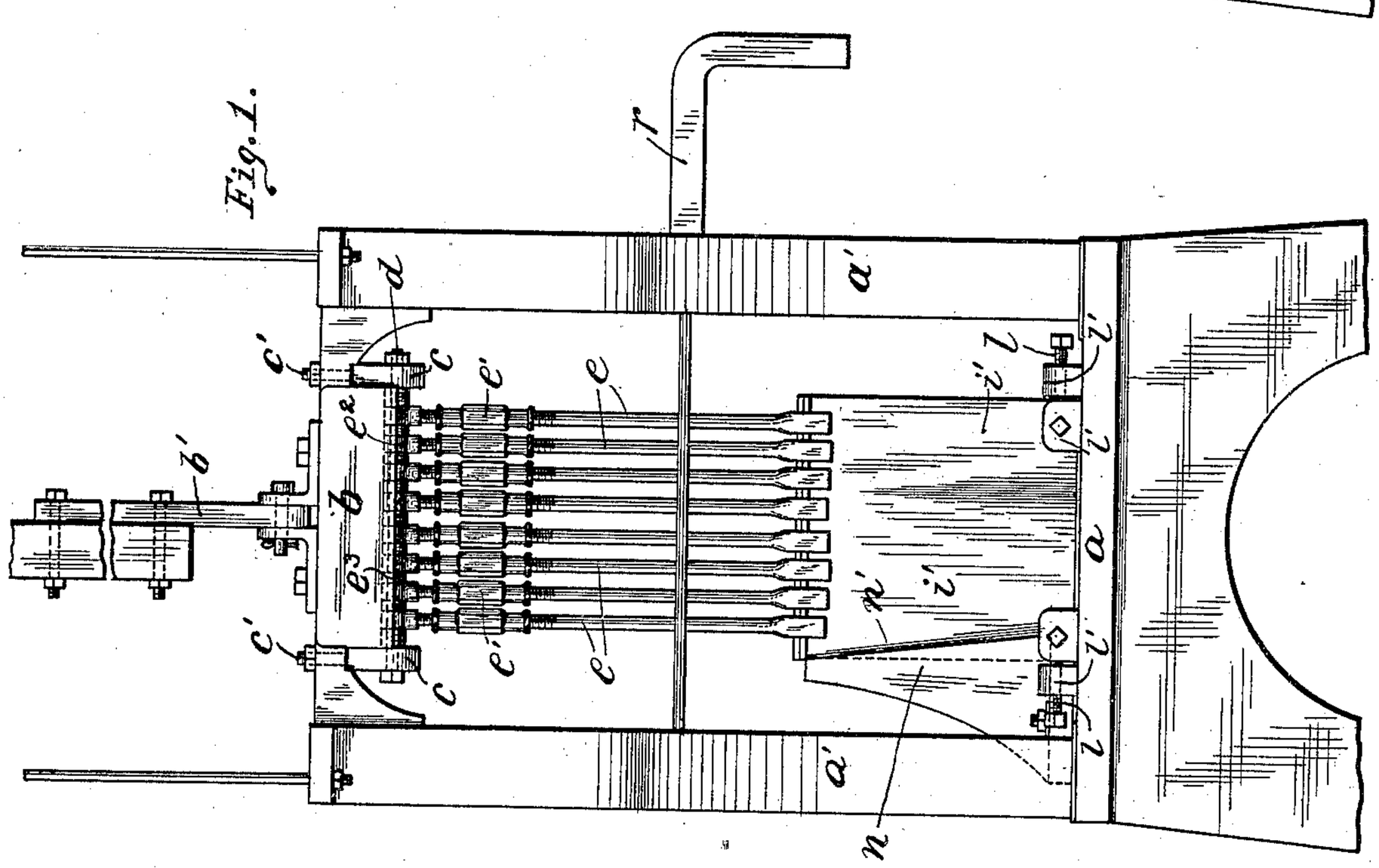


Fig. 1.



Witnesses:
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No. 662,654. Patented Nov. 27, 1900.

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(No Model.) 4 Sheets—Sheet 2.

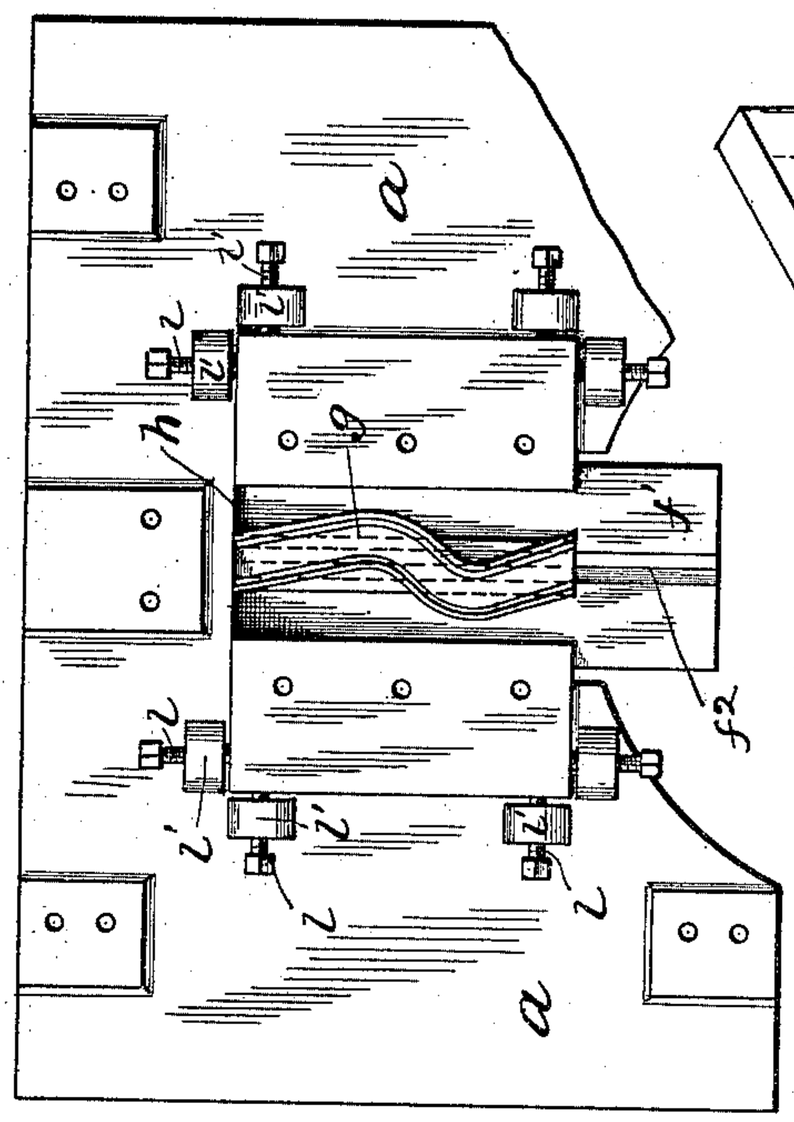

Fig. 4.

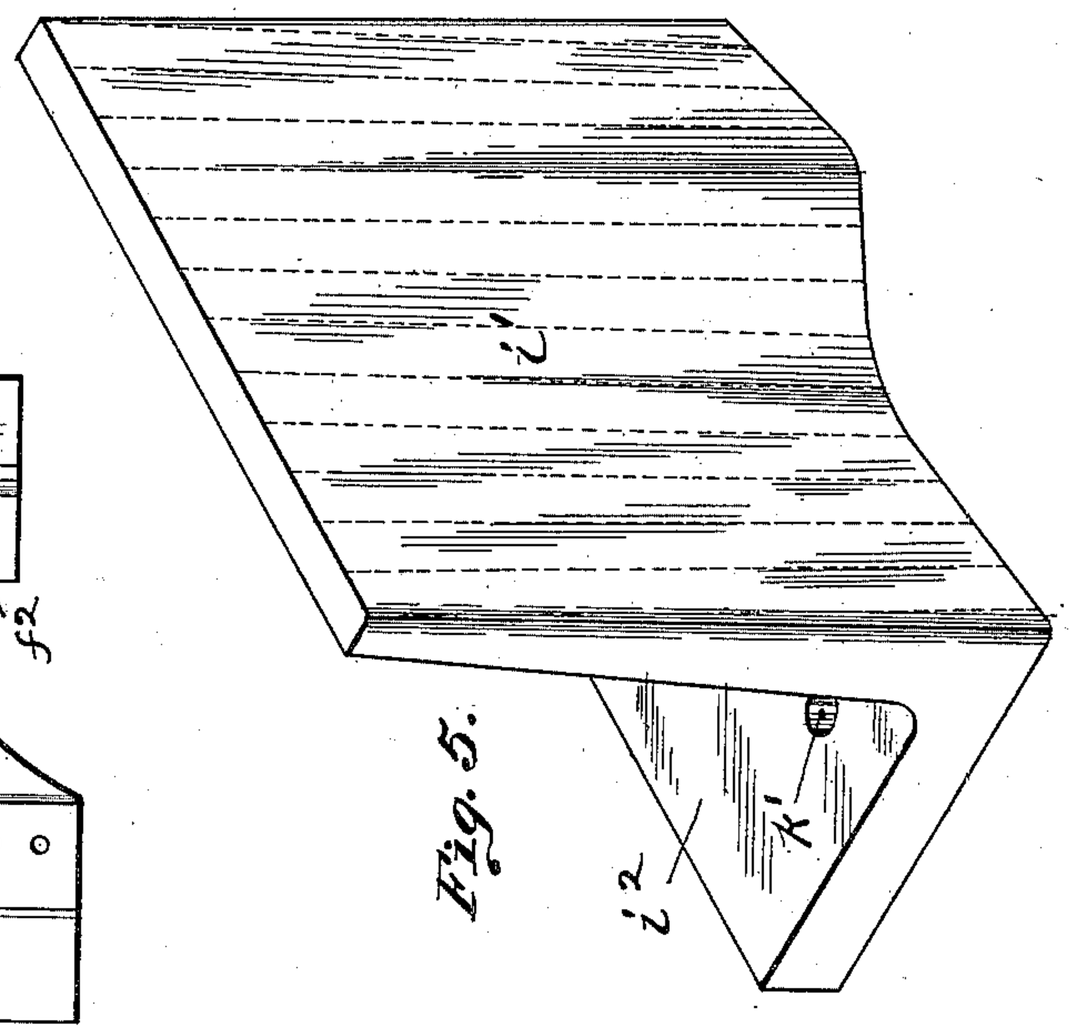

Fig. 5.

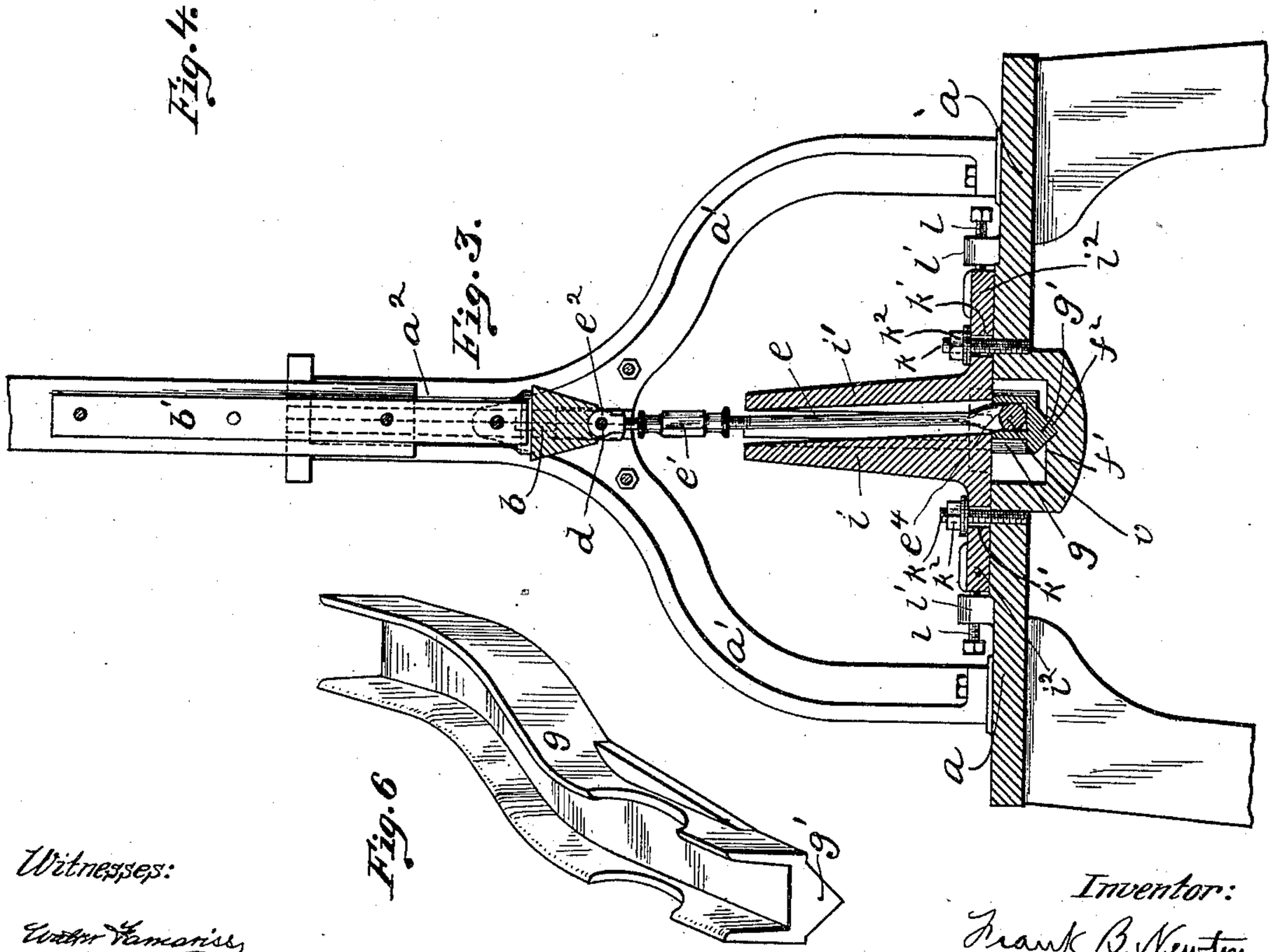

Fig. 3.

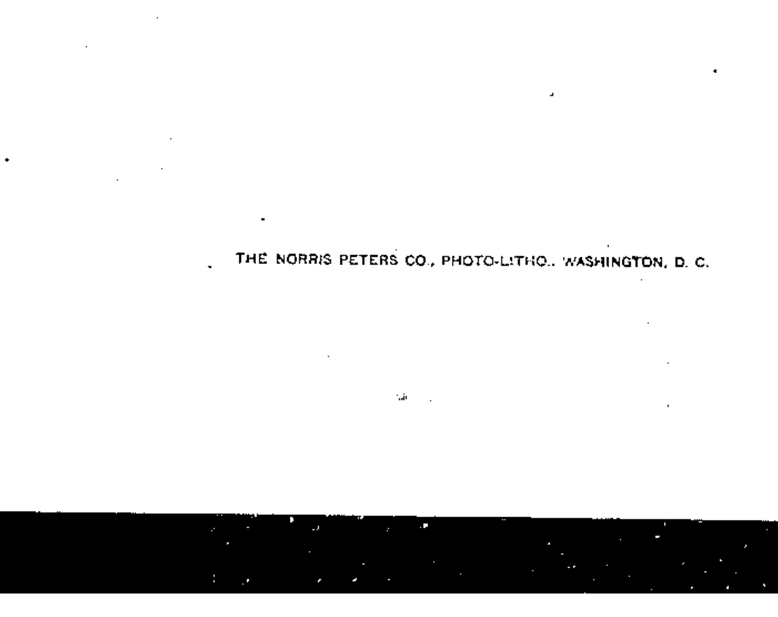

Fig. 6.

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No. 662,654. Patented Nov. 27, 1900.

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APPARATUS FOR BENDING WOOD.

(Application filed Feb. 2, 1898.)

(No Model.) 4 Sheets—Sheet 3.

Fig. 7.

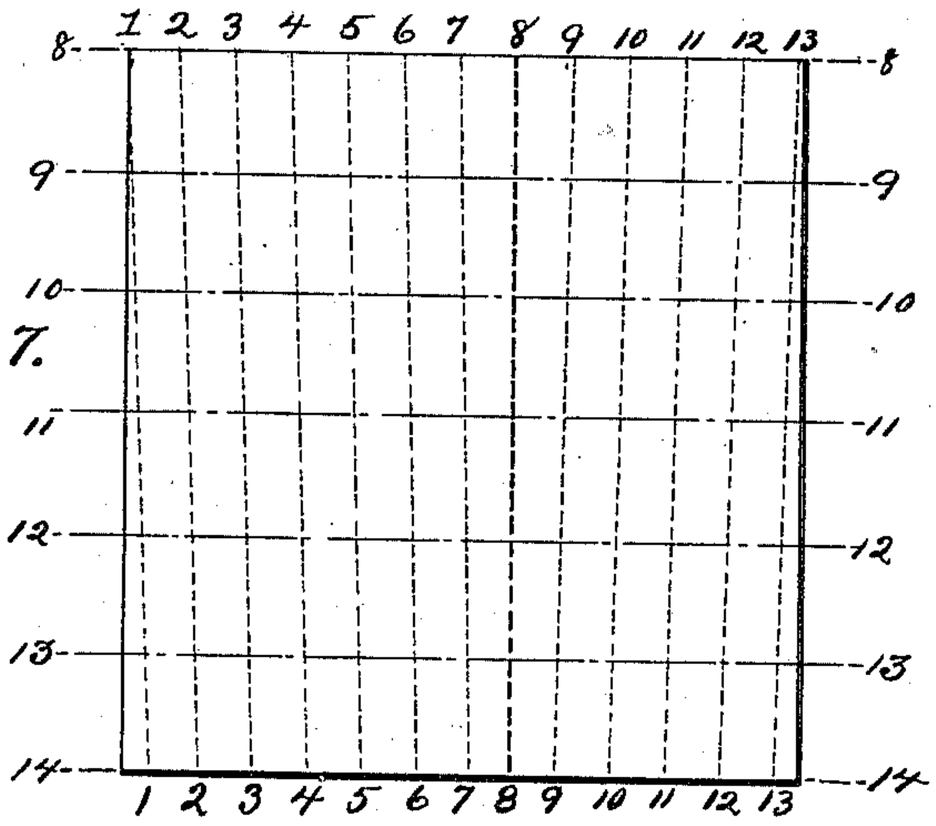


Fig. 8.

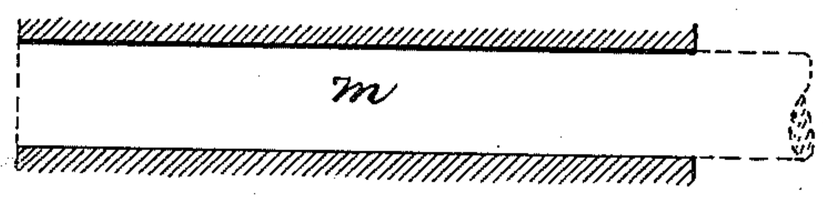


Fig. 9.

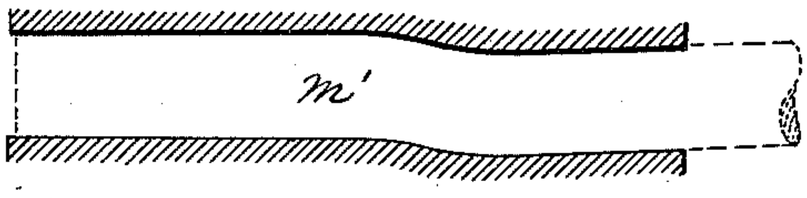


Fig. 10.

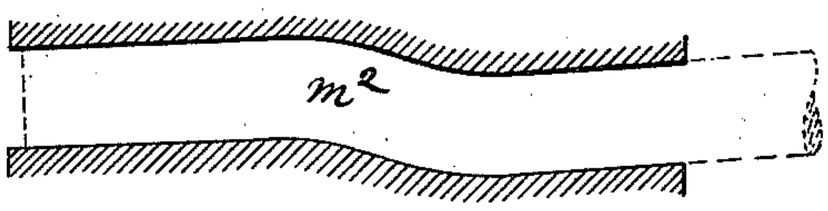


Fig. 11.

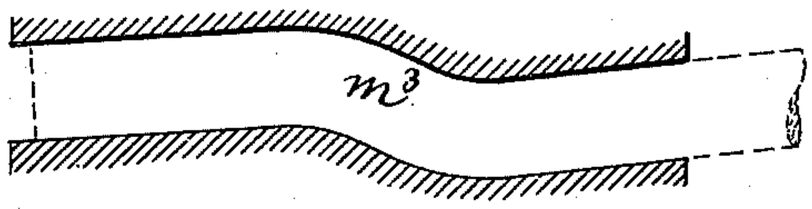


Fig. 12.

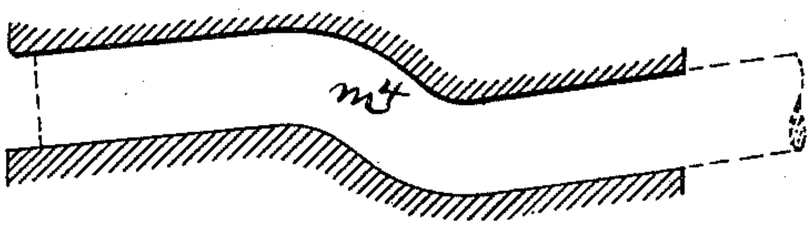
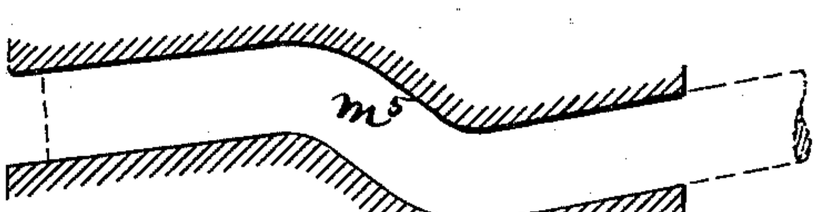


Fig. 13.



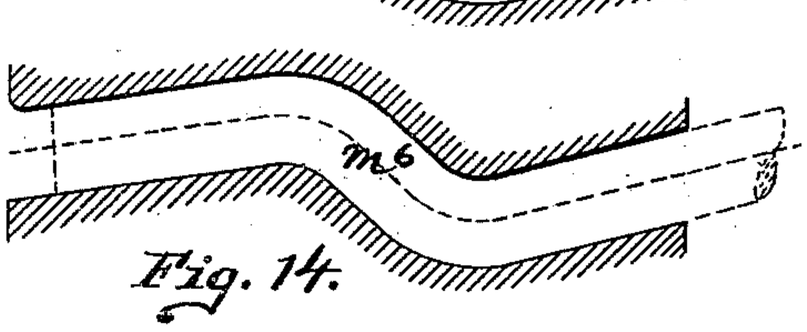


Fig. 14.

Witnesses:

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By Kay & Potter

Attorneys

No. 662,654. Patented Nov. 27, 1900.

F. B. NEWTON.

APPARATUS FOR BENDING WOOD.

(Application filed Feb. 2, 1898.)

(No Model.) 4 Sheets—Sheet 4.

Fig. 15.

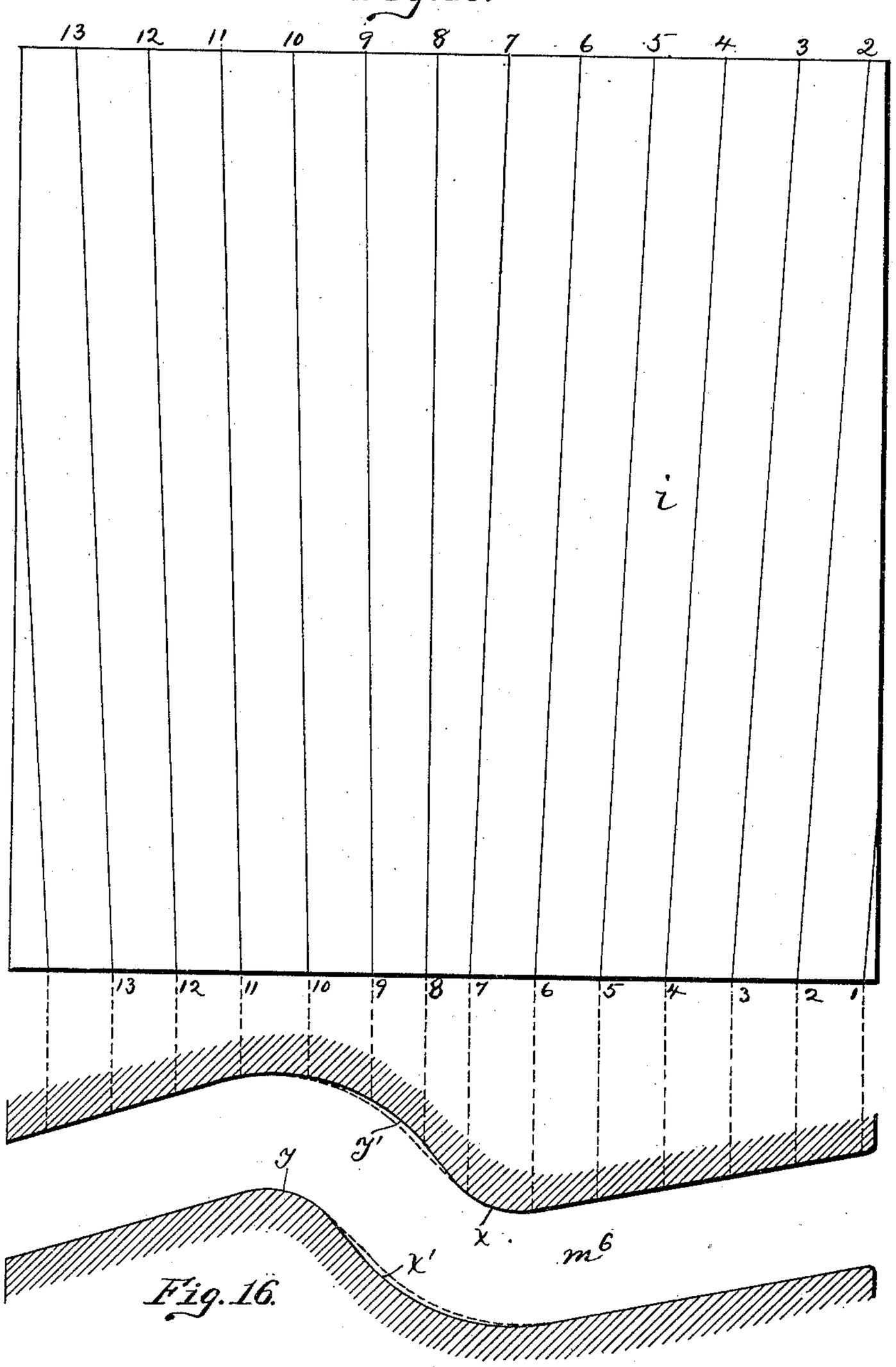

Fig. 16.

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UNITED STATES PATENT OFFICE.

FRANK B. NEWTON, OF CHARLEVOI, PENNSYLVANIA.

APPARATUS FOR BENDING WOOD.

SPECIFICATION forming part of Letters Patent No. 662,654, dated November 27, 1900.

Application filed February 2, 1898. Serial No. 668,813. (No model.)

To all whom it may concern:

Be it known that I, FRANK B. NEWTON, a resident of Charlevoi, in the county of Washington and State of Pennsylvania, have invented a new and useful Improvement in Apparatus for Bending Wood; and I do hereby declare the following to be a full, clear, and exact description thereof.

My invention relates to apparatus for bending wood, such as the handles of shovels, spades, and such other implements to which the invention may apply.

Taking the manufacture of shovel-handles by way of illustration, it has been the general custom heretofore to force the end of the shovel-handle to be bent longitudinally through a die having a passage or channel corresponding to the shape to be given to said handle. The disadvantage of this method of bending lies in the fact that as the handle is fed longitudinally to the die each portion of that part of the handle acted on has to follow the curves or bends of the die-passage. The consequence is that as the handle is fed to the die the extreme lower portion of the handle will first be bent at the first turn in the die-passage, and then as said handle advances farther the extreme portion of the handle which was just bent passes into the portion of the die-passage curved in the opposite direction, the result being that having been first bent it is then straightened. This bending and then straightening is a severe tax on the fibers of the wood, and the wood having once been bent is often split or weakened by the bending in a different direction. This leaves weak points at that portion of the handle where the greatest strain comes.

The object of my invention is to give the proper bend and shape to the wood without subjecting the fibers of the same to opposite bending strains at the same point, so that no portion of the wood is bent more than once, and at the same time to compress the fibers longitudinally and imparting an upsetting to the handle for the reasons more fully hereinafter apparent.

To enable others skilled in the art to make and use my invention, I will describe the same more fully, referring to the accompanying drawings, in which—

Figure 1 is a side elevation of my improved apparatus. Fig. 2 is a front elevation of same. Fig. 3 is a longitudinal vertical section showing the plungers lowered. Fig. 4 is a plan view of the platform or support for dies with the mold in position thereon. Fig. 5 is a perspective view of one of the dies. Fig. 6 is a perspective view of the mold. Fig. 7 is a diagrammatic view of the inner surface of one of the side dies. Figs. 8 to 14 are views showing the gradual steps in bending as performed by the contiguous faces of the side dies as the wood is forced down between said dies. Figs. 15 and 16 are enlarged diagrams of the die and die-bottom, respectively, showing the points projected.

Like letters indicate like parts in each of the figures.

While I have illustrated my invention as applied to the bending of shovel-handles and I will describe it in that connection, yet I do not wish to limit its scope to any particular application of it.

The letter a designates a suitable table or support adapted to carry the bending mechanism about to be described. Erected on said table a is the plunger-frame a', having the guideways a^2 formed therein. Within the guideways a^2 fits the cross-head b, which is adapted to reciprocate in said guideways. Any suitable mechanism may be employed for operating said cross-head, and I have not deemed it necessary to illustrate the same in detail. The connections b' connected to said cross-head may extend up to a crank-shaft.

Suspended from the cross-head b by means of the bolts c' are the hangers c, said hangers having the shaft d journaled therein. The individual plungers e are suspended from the shaft d, said plungers being formed of two parts connected by the sleeve-nuts e' with right and left hand threads, so that the length of the plungers may be varied to suit the circumstances. The upper ends of the plungers e have the rings e^2 formed therein, which encircle the shaft d loosely, being free to swing thereon. The rings e^2 of the several plungers are separated by the liners or washers e^3. By this construction the shaft d may be quickly removed and one or more of the plungers taken therefrom or the distance between the plungers may be varied by the use of more or less liners. The lower ends of the plungers

e have the curved ends e^4, adapted to correspond with the curve of the handles to be operated on.

The table *a* has the recess *f* formed therein, the bottom *f'* of said recess having the groove f^2 therein. This groove is adapted to receive the correspondingly-shaped rib *g'* on the bottom of the mold *g*. This mold *g* has a seat formed therein corresponding in shape to the shape to be imparted to the wood. As the seat is made in the present instance for forming the handle of a shovel the said seat is substantially an ogee curve. The mold *g* is inserted horizontally into the groove f^2, the rib *g'* sliding freely therein. A suitable stop or shoulder *h* arrests the inward movement of the die *g* beyond a certain point.

Mounted on the table *a* are the side dies *i i'*, said dies having the flanges i^2, by means of which they are secured to said table. Bolts *k* pass through openings *k'* in said flanges and corresponding threaded openings in the table itself, said bolts having the nuts k^2 thereon. The openings *k'* are slightly enlarged to permit of the adjustment of said side dies with reference to each other. Adjusting-screws *l*, passing through threaded openings in the lugs *l'* on the table, bear against the flanges i^2. The contour of the lower ends of the side dies *i i'*, on the inner faces thereof, coincides substantially with the sides of the mold *g*, so that when said dies are in proper position with relation to each other the lower inner edges of the side dies will correspond with the upper edges of the sides of the mold.

In order that the bending of the wood may be done gradually, so that the fibers may not be too quickly bent or stretched, but that they may have an opportunity to adjust themselves gradually to their new position, the inner faces of the side dies are formed as illustrated in Figs. 7 to 14 of the drawings. Those figures represent the variable pass formed by the contiguous faces of the side dies from the extreme upper ends to the extreme lower ends thereof. The letter *m* represents the form of the pass as made by the upper faces of the side dies, it being noted that said pass at its upper end is formed by two substantially parallel faces. A little farther down, as at *m'*, there is a slight bend in the pass, which bend becomes more pronounced as we descend the remaining variations m^2, m^3, m^4, m^5, and m^6 of the pass.

It will be evident that the lower portion of a shovel-handle which was straight when it entered the dies *i i'* will as it passes through the different stages of the bending operation be slightly shortened at each stage, owing to the increase in the bend given to it by each stage. The diagrammatic view Fig. 7 illustrates this gradual shortening of the handle during the bending operation. The vertical lines 1 1, 2 2, 3 3, 4 4, 5 5, 6 6, &c., indicate the gradual bending and shortening of the handle, while the horizontal lines 8 8, 9 9, &c., indicate the variations in the pass, as represented in Figs. 8 to 14, which produce this change in the length. These side dies are so constructed that the shortening of the handle due to the bending operation is provided for and insured by the shape of the dies. Referring to the vertical lines 1 1, 2 2, &c., the line 8 8, which is shown prolonged in dotted lines through the several passes *m m'*, &c., Figs. 8, 9, &c., is substantially a straight perpendicular line. This line represents the center of bend of the handle and the point which follows said line undergoes no substantial change of bending. From this point—the center of bend—the imaginary lines of the dies converge as they descend. Each succeeding line on either side of the line 8 8 as it descends takes a little more of an incline than the preceding line, carrying its lower end in toward the line 8 8. Of course the face of the die is made up of an infinite number of converging lines, only a few of which are selected and drawn upon the face of the die, Fig. 7, by way of illustration. In each case a straight-edge placed so as to coincide with the extremities of these lines would coincide with the face of the die throughout its length. If a handle were placed in the pass *m* at the top of the dies, the points of the wood coinciding with the points 1 2 3 4, &c., would be firmly grasped in the dies as said handle is forced down, and on account of the shape of the dies, as just described, the points would follow the lines 1 1, 2 2, &c., to the bottom. These lines are so drawn upon the faces of the die that the points of the handle to be bent in following these lines are forced to properly shorten to correspond to the bending of the wood and prevent flattening or stretching of the fiber as said handle is bent. In practice I have found it better to slightly exaggerate the inclination of these lines—that is, to make them converge slightly more than the exact inclination required. This is to insure the filling of the mold as the handle descends and also to insure the proper shortening of the handle due to bending and further prevent flattening the cross-section of the handle at the bending. In Figs. 15 and 16 I have illustrated this principle more clearly. The line 8 8, as stated, is substantially perpendicular and the other lines converge toward this line 8 8, the result being that the distance between the several converging lines is greater at the upper ends than at the lower ends thereof. The wood in passing down between the dies must be shortened accordingly; but, as stated, I prefer to exaggerate this converging of the lines in order to obtain more of the longitudinal compressing or upsetting of the fibers of the wood. Taking the view shown in Fig. 16 as representing the lower end of the passage between the dies, it is apparent that the wood will be bent on the centers of bends *x* and *y* and will be drawn away from the opposite concave recesses *x' y'*. The dotted lines in Fig. 16 represent the form of the passage if the converging of the lines was not

exaggerated, while the full lines represent the enlargement of the recesses x' y' to correspond to this exaggeration. The enlargement of these recesses allows for this increased longitudinal compression or upsetting of the fibers of the wood, and the wood is by this compressing action made to fill up the recesses instead of avoiding them, due to the bending on the bends x y.

In the bending of handles, &c., it is necessary to make different length of snouts to fit the sockets and straps of the shovels. To allow for the forming of said snouts and to insure the exact length of snout desired in the finished handle, I provide the gage n, having the inclined face n'. This gage n is secured to the table a by means of the bolts n^2, which pass through slots n^3 in the flanges n^4 on said gage and into openings in the table. The slots n^3 permit of the adjustment of the gage at different positions. The upper end of gage regulates the proper position of the handle when inserted between the dies previous to the bending operation, and the lower end of the inclined face n' insures the proper length of snout in the finished handle.

The letter r designates a guide-arm which is bolted to the frame, said arm projecting downwardly and serving to guide the handle for a suitable distance down within the dies and prevent its swerving.

Projecting out from the outer faces of the side dies i i', at the upper end thereof, are the studs s. Mounted on said studs s are the plunger-guides t, having the arms t', through which the studs pass. The arms t' have the inwardly-projecting ends t^2, which bear against the dies. Springs u are interposed between the arms t' and the nuts on the studs s. These springs act to normally hold the guides t in contact with the plungers e. These guides are for the purpose of insuring the proper position of the faces e^4 with reference to the handles.

While I have described my invention with reference to the accompanying drawings, yet I do not wish to be understood as limiting myself in any sense to the particular construction shown, as I desire to include all other constructions which will perform the same functions in a similar manner.

The operation of my invention as applied to the bending of shovel-handles is as follows: The handle v, having been properly treated by being steamed or soaked preparatory to the bending operation, is inserted in the upper end of the pass between the side dies i i', the operator holding the outer portion of the handle in contact with the guide-arm r, so that the handle will enter the dies in the proper position. In other words, the portion of the handle to be bent is introduced into that part of the pass represented by m in Fig. 8, the walls of which are parallel. Power is then applied to lower the plungers e. As said plungers descend they force down the handle and cause it to pass through the various stages of gradual bending represented by m' m^2 m^3, &c. It is apparent that in order to accommodate themselves to the changes in the contour of the inner faces of the side dies i i' the plungers must swing slightly laterally on the shaft d. Furthermore, to accommodate themselves to the shortening of the handle in bending said plungers must also have a slight end play. It is apparent that as the plungers descend the shape of the pass between the dies will compel them to assume different positions. While one of said plungers may descend in substantially a vertical position, another may be compelled to change its original position to that of a slanting one. In order, therefore, that the plungers may all bear upon the handle with equal pressure along that portion of it being bent at the point where the handle finally passes from the dies to the mold, some of the plungers will have to be longer than others. When the proper lengths for the different plungers have been determined, the adjustment may be readily effected by the nuts e'. The inner end of the handle abuts against the gage n, and as said handle descends it continues to move in contact with the inclined face n' of said gage, said incline corresponding to the amount taken up by the different stages of the passage through the dies i i' and insuring the proper length of snout desired. When the handle has been forced by the plungers entirely through the pass formed by the side dies, said handle is pressed into the mold g, its progress through the side dies fitting it to assume its position within said mold. The shape of the inner faces of the side dies is such that the effect of the dies on the wood is to upset and shorten it, so as to fill up the space between the dies. This upsetting is caused by the gripping action of the contiguous faces, which shorten the portion being bent gradually, as illustrated by the diagrammatic view. As soon as the handle has entered the mold g the operator by withdrawing the handle withdraws the mold g with it, said mold moving freely within the groove f^2 in the bottom of the recess f. The handle is allowed to remain in the mold g until the wood has conformed sufficiently to the form of the mold as to retain the shape imparted to it when removed therefrom. Another mold g is then inserted in position and another handle is fed to the machine, which is subjected to the same bending operation.

By my invention the bending is done so gradually that the fibers of the wood are not subjected to any sudden bending strains, and consequently no weak spots develop in the handle where it has been bent. No one portion of the handle is bent in more than one direction, as in the case hereinbefore alluded to in which the handle was fed longitudinally to the dies. The compressing of the wood or upsetting which I accomplish I believe to be absolutely novel, and I wish to be understood as claiming the same broadly. Of course in

all bending there is a shortening action; but the longitudinal compression during the bending is, so far as I am aware, entirely new.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. In apparatus for bending wood, a die having its upper part conforming to the unbent wood and its lower part conforming to the shape to be imparted to the wood, and its walls varying from the upper to the lower part of the die, and mechanism for forcing the entire portion of the blank to be bent transversely through said die at one time, substantially as set forth.

2. In apparatus for bending wood, a die having its upper part conforming to the unbent wood, and its lower part conforming to the shape to be imparted to the wood, and its walls varying from the upper to the lower part of the die, a plurality of plungers entering the top of the die and adapted to force the entire portion of the wood to be bent transversely through the die, substantially as set forth.

3. In apparatus for bending wood, a die having a pass with walls gradually conforming to the shape to be imparted to the wood, and a plurality of plungers adapted to swing sidewise with relation to the die and thereby to conform to the shape thereof as they pass through the same, substantially as set forth.

4. In apparatus for bending wood, a die having a pass with walls gradually conforming to the shape to be imparted to the wood, and a plurality of plungers adapted to swing sidewise with relation to the die and thereby to conform to the shape thereof as they pass through the same, the bases of said plungers being at different levels when entering the die, substantially as set forth.

5. In apparatus for bending wood, a die having a pass with walls gradually conforming to the shape to be imparted to the wood, and a plurality of plungers adapted to swing sidewise with relation to the die and thereby to conform to the shape thereof as they pass through the same, the bases of said plungers being at different levels when entering the die, and on the same level at the end of their stroke, substantially as set forth.

6. In apparatus for bending wood, a die having a pass with walls gradually conforming to the shape to be imparted to the wood, and a plurality of plungers adapted to reciprocate in the pass of said die, said plungers being formed in sections, and right and left hand sleeve-nuts connecting said sections, substantially as set forth.

7. In apparatus for bending wood, a die having a pass with walls gradually conforming to the shape to be imparted to the wood, a gage at one end of said die against which the end of the unbent blank abuts, and mechanism for forcing the entire portion of the wood to be bent transversely through said die at one time, substantially as set forth.

8. In apparatus for bending wood, a die having a pass with walls gradually conforming to the shape to be imparted to the wood, a gage with an inclined face against which the end of the wood abuts, and mechanism for forcing said wood through said pass, substantially as set forth.

9. In apparatus for bending wood, side dies, the inner contiguous faces of which form a pass gradually conforming to the shape to be imparted to the wood, a mold conforming in shape to the extreme inner end of said pass, and mechanism for forcing the wood through said pass into said mold, substantially as set forth.

10. In apparatus for bending wood, the combination of a suitable table, side dies supported thereon, the inner contiguous faces of said dies forming a pass gradually conforming to the shape to be imparted to the wood, a sliding mold conforming in shape to the extreme inner end of said pass, said table having a seat therein within which said mold fits, and mechanism for forcing the wood through said pass into said mold, substantially as set forth.

11. In apparatus for bending wood, the combination of a suitable table, side dies supported thereon, the inner contiguous faces of said dies forming a pass gradually conforming to the shape to be imparted to the wood, a sliding mold conforming in shape to the extreme inner end of said pass, and having a rib on its bottom face, said table having a seat therein adapted to receive said rib, and mechanism for forcing the wood through said pass into said mold, substantially as set forth.

12. In apparatus for bending wood, the combination of a suitable table, side dies supported thereon, the inner contiguous faces of said dies forming a pass gradually conforming to the shape to be imparted to the wood, a sliding mold conforming in shape to the extreme inner end of said pass, and having a V-shaped rib on its bottom face, said table having a V-shaped seat adapted to receive said rib, and mechanism for forcing the wood through said pass into said mold, substantially as set forth.

13. In apparatus for bending wood, the combination of a die having a pass with walls gradually conforming to the shape to be imparted to the wood, a suitable frame extending above the same, a reciprocating cross-head in said frame, and a plurality of swinging plungers suspended from said cross-head and entering the upper ends and adapted to pass through said die, substantially as set forth.

14. In apparatus for bending wood, the combination of a die having a pass therein with walls gradually conforming to the shape to be imparted to the wood, a suitable frame extending above the same, a reciprocating cross-head in said frame, a shaft carried by said cross-head and a plurality of swinging plun-

gers suspended from said shaft and entering the upper ends and adapted to pass through said die, substantially as set forth.

15. In apparatus for bending wood, the combination of a die having a pass therein with walls gradually conforming to the shape to be imparted to the wood, a suitable frame extending above the die, a reciprocating cross-head mounted in said frame, a shaft carried by said cross-head, and a plurality of plungers having rings at the upper ends thereof engaging said shaft, substantially as set forth.

16. In apparatus for bending wood, the combination with a suitable frame, of a reciprocating cross-head, a shaft carried by said cross-head, a plurality of plungers having rings at the upper ends thereof engaging said shaft, liners between said rings, and a die having a pass therein with walls gradually conforming to the shape to be imparted to the wood, substantially as set forth.

17. In apparatus for bending wood, the combination with a suitable frame, of a die whose walls form a vertical pass, mechanism for forcing the wood to be bent down into said pass, and a guide-arm beyond said die and adapted to guide said wood therein, the pass of the die being open at the end toward said arm, substantially as set forth.

18. In apparatus for bending wood, the combination with a suitable frame, of a die whose walls form a vertical pass, mechanism for forcing the wood to be bent down into said pass, and a downwardly-projecting guide-arm beyond said die adapted to guide said wood therein, the pass of the die being open at the end toward said arm, substantially as set forth.

19. In apparatus for bending wood, the combination with a suitable frame, of a die, a plurality of swinging plungers adapted to enter said die, and yielding guides adapted to press against said plungers from opposite sides, substantially as set forth.

20. In apparatus for bending wood, the combination with a suitable frame, of a die, a plurality of swinging plungers adapted to enter said die, guides on opposite sides of said plungers, downwardly-extending arms on said guides, projections on said die upon which said arms are mounted, and springs interposed between said arms and heads on said projections, substantially as set forth.

21. In apparatus for bending wood, the combination with a suitable frame, of a die, a plurality of swinging plungers adapted to enter said die, guides on opposite sides of said plungers, downwardly-extending arms on said guides, said arms having inwardly-projecting ends bearing against said die, projections on said die upon which said arms are mounted, and springs interposed between said arms and heads on said projections, substantially as set forth.

22. In apparatus for bending wood, a die having opposing faces bearing on the sides only of the blank and contacting with it at different points, the distance between the opposing die-faces being substantially the same at all points, said faces being so formed as to compress longitudinally the fibers of the wood fed transversely therethrough.

23. In apparatus for bending wood, a die having opposing faces bearing on the sides only of the blank and contacting with it at different points, the points of engagement of said faces with a given point of the blank in its travel through the die forming a series of converging lines on said faces.

24. In apparatus for bending wood, a die having opposing faces bearing on the sides only of the blank and contacting with it at different points, the points of engagement of said faces with a given point of the blank in its travel through the die forming a series of converging lines on said faces, and mechanism for forcing the blank transversely through said die.

25. In apparatus for bending wood, a die having opposing faces bearing on the sides of the blank and contacting with it at different points, the distance between the opposing die-faces being substantially the same at all points, but the points of engagement of said faces with a given point of the blank in its travel through the die forming a series of converging lines on said faces.

26. In apparatus for bending wood, a die having opposing faces bearing on the sides only of the blank and contacting with it at different points, said faces varying laterally from the plane of travel of the blank, and the points of engagement of said faces with a given point of the blank in its travel through the die forming a series of converging lines on said faces.

27. In apparatus for bending wood, a die having a pass formed by contiguous faces bearing on the sides of the blank and contacting with it at different points, said faces varying laterally from the plane of travel of the blank, the variation increasing in degree in the direction of travel of the blank, and the points of engagement of said faces with a given point of the blank in its travel through the die forming a series of converging lines on said faces.

In testimony whereof I, the said FRANK B. NEWTON, have hereunto set my hand.

FRANK B. NEWTON.

Witnesses:
I. P. HEPLER,
JOHN C. MCKEAN.