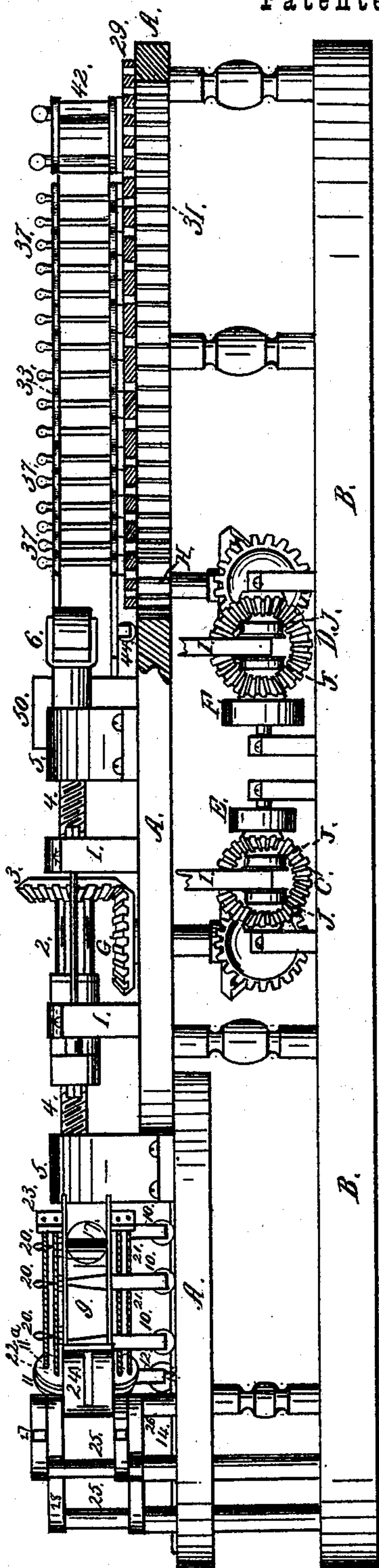


J. W. GRIFFITHS.
MACHINE FOR BENDING WOOD.

No. 171,376.

Patented Dec. 21, 1875.

Fig. 1.



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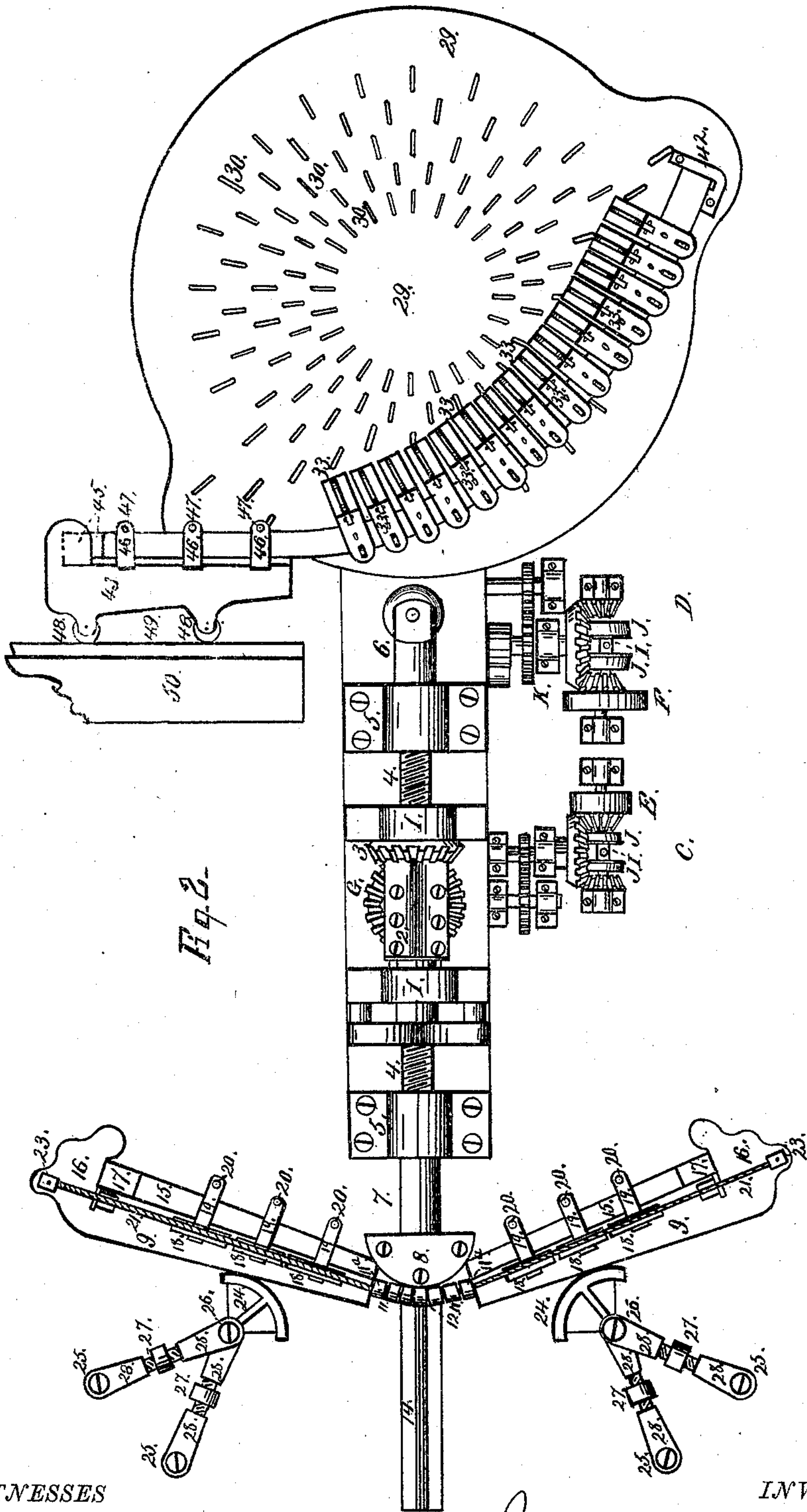
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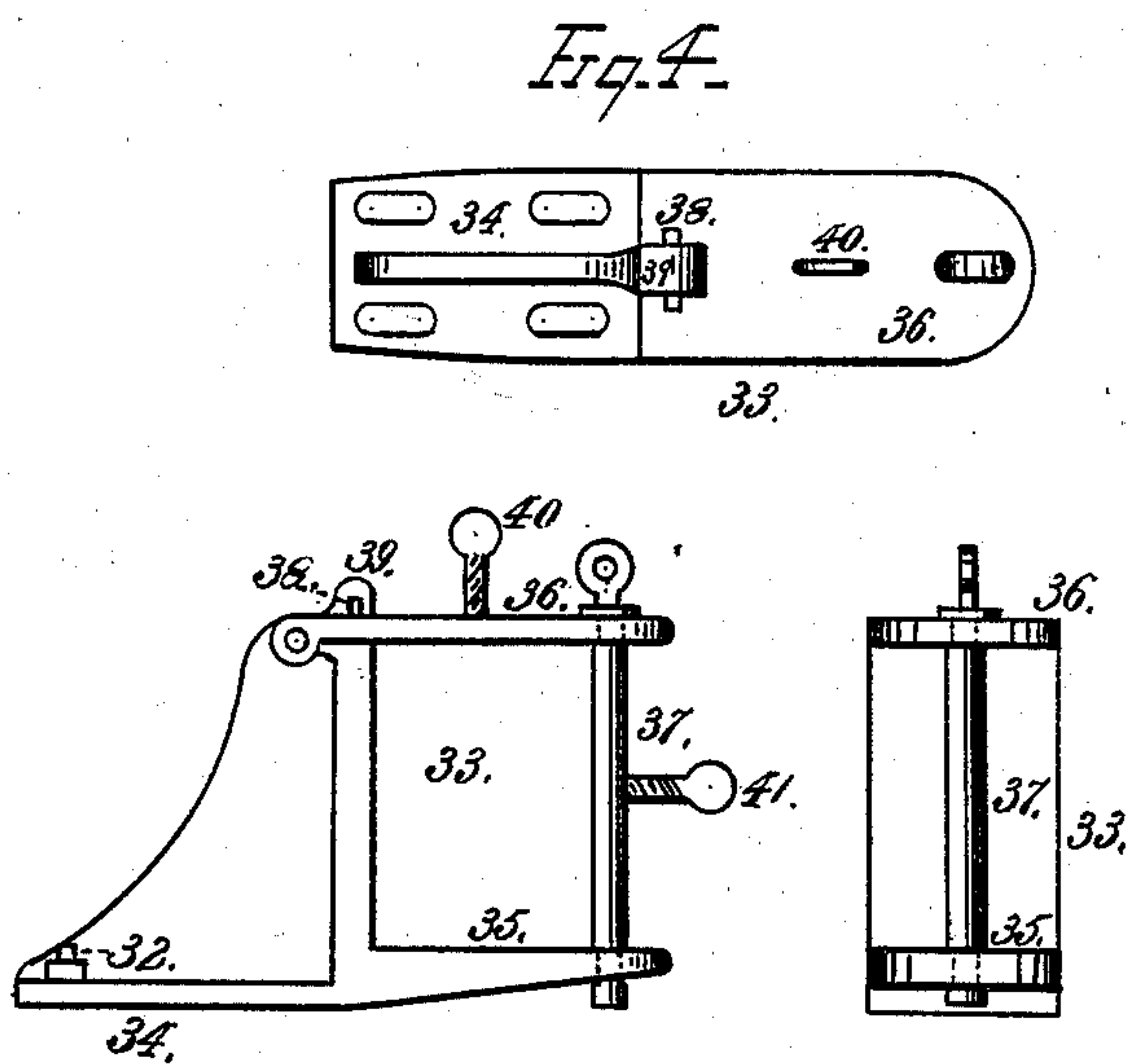
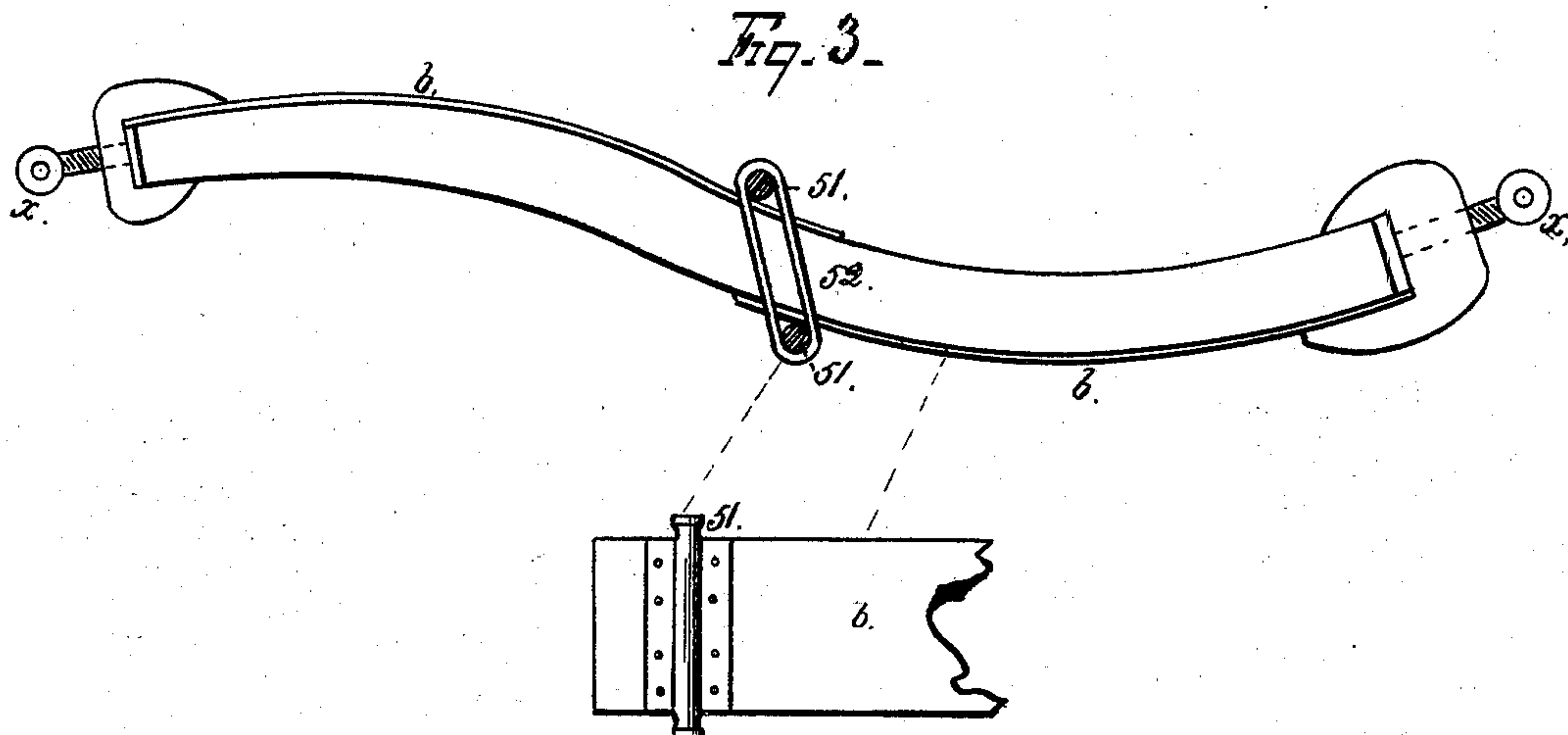
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UNITED STATES PATENT OFFICE.

JOHN W. GRIFFITHS, OF BROOKLYN, NEW YORK, ASSIGNOR TO HERBERT MERVIN GRIFFITHS, EDGAR BATES GRIFFITHS, GEORGE FRANKLIN GRIFFITHS, MARY SUSAN GRIFFITHS, AND BUTLER GRIFFITHS.

IMPROVEMENT IN MACHINES FOR BENDING WOOD.

Specification forming part of Letters Patent No. **171,376**, dated December 21, 1875; application filed October 19, 1875.

To all whom it may concern:

Be it known that I, JOHN W. GRIFFITHS, of Brooklyn, in the county of Kings and State of New York, have invented certain new and useful Improvements in Machines for Bending Wood; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it pertains to make and use it; reference being had to the accompanying drawings, which form part of this specification.

My invention relates to wood-bending machines; and consists of certain devices and appliances united and operating to form a machine for bending wood from the straight growth into all the forms required for the frame, timbers, floors, knees, breast-hooks, plank-stocks, and water-ways of vessels, and such crooked timbers as are required for civil architecture, carriage, car and furniture use, &c., as and for the purposes hereinafter and at large will appear.

In the drawings, Figure 1 is a side elevation, partly in section, of the machine complete; Fig. 2, a plan view of same, showing the top platform as removed; Fig. 3, a detached view, showing a ship-timber after it has been bent into a compound curve and removed from the machine, and secured by straps and clamps to cool and set; Fig. 4, detached views of the holders or clamps for securing or holding the timber in place on the bending-table.

A B is a suitable platform or support, constructed into two stories, as shown, the one, A, containing the bending machinery, and the lower one, B, the driving mechanism or power. This power consists of any suitable or appropriate arrangement of screws, wheels, or gear, C D, &c., driven by band from the engine, over pulleys E F. This mechanism communicates rotary motion to gears G H on the top platform A, and is regulated or controlled by hand-levers I I, operating friction-cones J J on the pulley-shafts. Suitable stops or pawls and ratchets K are employed to prevent reverse or backward movement of the parts when the machine is stopped.

Supported in suitable journal-bearings 1 1 on the platform A is a revolving nut, 2, with bevel-gear wheel 3, which connects with the gear G. Extending longitudinally of the machine is a screw shaft or plunger, 4, supported in sheaths or bearings 5 5, and extending through and operated by the nut 2. Upon one end of this shaft or plunger 4 is a removable roller, 6, and at the other end a removable head or throat form, 7. This form 7 is made hollow, with a curved face, of the same curve or form as the throats of the knee, breast-hook, or floor-timbers are to be after they are bent, and constructed with top and bottom projecting flanges 8 8, between which the timbers fit, the top flange being made removable, for the purposes hereinafter set forth.

The mechanism for bending the different timbers consists of two separate arrangements of devices, appliances, and movements, communicated by the machinery C D, and effected by the double acting-plunger 4, operating in opposite directions—viz., the knee, breast-hook, or floor-timber division or forming devices, and the general timber-bending division.

The knee-division consists as follows: At one end of the machine stand two iron compressors, 9 9, mounted upon casters 10 10, and united together at their smaller or inner ends by a number of ribs, 11 11. The central one, 12, of these ribs extends down to the floor, and is provided with a roller, 13, which enters and works in a way or guide, 14, on the platform A. These compressors are constructed of a long, stout, and strong trough-shaped frame, 9 9, with straight front edge, with lower projecting flanges 15 15 and enlarged heads 16 16, within which are situated hydraulic pumps 17 17, for purposes hereinafter set forth. At the top and bottom faces of each of the compressors are secured, by straps 18, sliding or adjustable bars 19, through the outside ends of which pass removable bolts 20.

Extending from end to end of the compressors, along the top and bottom thereof, are two strong wire cables, 21 21, which pass through two sets of holes, 22 22, in the top and bottom of the ribs 11 11, and bands 11^a 11^a, secured across the inner end of each compress-

or, and secured at the larger end of each of the compressors in posts 23 23, which unite and secure the parts together. The whole of this arrangement of compressors, ribs, &c., is supported upon the casters 10 10 and roller 13, and moves in different directions thereon. These compressors, &c., may be made of any desired or appropriate size, width, height, distance apart, &c., to suit the work to be performed, or number of timbers desired to be bent at one operation.

The central portion or ribs should be maintained in a straight line in front of the plunger-form 7, so that the form will come about the center of these ribs, at the central portion of the timbers lying therein, and with the back edge of the timber directly under the middle of the cables, whereby, when in operation or being bent, the strain is brought to bear on the wire-ropes and throat-form, instead of on the timber around the breech of knee.

When in their first or normal position, the faces of these compressors form a straight line, at right angles with the middle line of machine.

At an angle behind each of the compressors 9 9 are quadrants or sectors 24 24, supported or mounted in a triangle-frame, composed of two end long shafts, 25 25, which pass through the top platform down to the lower one, and short shaft 26, upon which the sectors or quadrants are mounted. These short shafts rest upon the table A, and are united to the long shafts by turn-buckles 27, with collars 28. These quadrants or sectors are adjusted and held at such an angle and height as to have a bearing against the ribs of the knee-compressors, while the wood confined within the compressors is being bent.

The sectors are adjusted backward and forward toward the compressors by the turn-buckles 27, to suit the angle or size of timbers to be bent.

The operation of this portion of the machine is as follows: The compressors being in their normal position—that is, with their faces in a straight line, at right angles with the middle line of the machine, resting at the back against the quadrants 24, and in front of, and close to, the throat-form 7, which is back in place, close within the nut 2—the bolts 20 are removed, and the bar 19 slipped back, and the top flange 8 of the form 7 also removed, which leaves the face of the compressors and form free and unobstructed for the introduction of the timber. The timbers to be bent into knees, &c., are now brought from the steam-box, having previously received an end clamp to hold them together, which clamp has connections *x*, similar to those shown on the ends of the timber in Fig. 3, for the purposes hereinafter more fully set forth. They are taken from the steam-box, and, by use of tramways, are placed in the machine, resting on the flange 15 of the compressors, and flange 8 of the form 7, a short strap of steel being placed behind the

timber against the ribs, with connections at the corners for holding its weight. The timbers, being in place, are secured and clamped by the bolts 20 being inserted in the bars 19 in front of the timber, and the top flange 8 of the form 7 secured in place on the form and resting on top of the timbers. While thus clamped and held, pressure is applied to the ends of the timber by operating the hydraulic pumps 17 at each end of the compressors, which drives the timbers together or compresses them longitudinally, shortening them somewhat in length. The timbers are now in position, ready to be bent. Steam is now injected into the hollow head or form 7, until it is very hot. The driving power or machinery C is now put in motion by operating hand-lever I, which causes nut 2 to revolve and force out the plunger 4, carrying form 7 against the timber, and carrying it and the whole compressor devices back against the quadrant-bearings 24 24. As the movement is continued, the compressors turn on their self-adjustable casters, accommodating the direction to which they point inward to their respective angles, while the center rib follows the central groove on the floor.

As the curve is made the ribs stretch out or extend over the whole distance of the required curve, thus giving shape to the outside of the bend. The flanges on the top and bottom of the form 7 prevent the wood from bulging on the sides at the neck or curve. The throat-form or mold 7 being very hot, as it is pressed against the timber, all moisture pressed to the inside throat-surface of the wood while being bent is dried up or evaporated.

The plunger is pressed forward until the angle required is reached, when the bend is complete. The inner ends of the compressors are then shackled by links and chain to the floor A, and the plunger drawn back to give room for applying the cross-ties on the knees. The cross-ties are attached to the connection *x* of the clamps on the ends of the timbers, and screwed up tight by means of turn-buckles, to secure and hold the knees firmly in place. The clamps or bolts 20 are now loosened and removed, and the end pressure of the pumps 17 taken off, when the knees are free from the compressors, and may be hoisted out by the tramway, and removed to a place of convenience to dry and set. The compressors are now unshackled from the floor, and carried back toward the form in a position ready for another bend.

We now turn to the other end of the machine, operating in connection with the knee-former or plunger.

Upon the platform A, at the opposite end from the knee-bender, in suitable bearings, and on a central pivot, 28, is a gage-table, 29, of any desired size or shape, with a number of concentric rings of slots 30 therein. Beneath this table is secured a toothed rack, 31, which engages with the gear H, operated by machinery D, by which means the table is re-

revolved. Secured in these holes 30 in the revolving gage-table 29, by bolts 32 passing through the same, is a number of clamps, 33, constructed, as shown in detail in Fig. 4, with an angle or knee back, 34, formed with projecting bottom flange 35, and with a hinged cap, 36. 37 is a removable bolt, passing through the front ends of the cap and flange. 38 is a key, inserted through a hole in the projecting end 39 of the top portion of the clamp, which end passes through the hinged cap 36, and secures the cap down in place. 40 is a set-screw, passing through the hinged cap 36. 41 is another similar set-screw, passing through the bolt 37. 42 is another form or end clamp, secured to the table 29, at the extreme head or line of clamps 33. 43 is a compressor, constructed similar to the knee-compressors, supported on casters 44, with a hydraulic pump, 45, at its end, and removable straps 46 and bolts 47. At the rear or back edge of this compressor-frame are journaled friction-rollers 48, which, when the machine is in operation, come against a track, 49, in a bulk-head, 50.

The operation of this part of the machine is about as follows: The clamps 33 are secured around the table 29, in slots 30, in any line, curve, or form which it is desired to bend the timbers to. The vertical backs of the holders is the round form against which the hollow parts of the bent timbers are pressed. The timber, having been previously properly steamed, has a strap placed along one edge, and is secured at one end, in the compressor 43, against the hydraulic pump 45, and secured therein by the bolts 47. The other end rests in and is held by the end clamp 42, which is rigidly secured to the table. The table carrying the holders is now caused to revolve slowly by operating the hand-lever I, which causes the machinery D to operate the gear H and table 29. Previous to revolving the table, all the bolts 37 of the clamps or holders 33, and the hinged caps 36, were removed and thrown back, leaving the mouth of the clamps free and unobstructed. As the table revolves the open clamps are carried around, one after the other, in position against and inclosing the timber. As each one comes into position the hinged caps are brought down over the timber, forcing the timber down in place, and secured by the keys 38. The bolts 37 are next placed down in position at the back of the timber, which secures the timber tight in place in the clamp. The set-screws 40 41 may now be tightened up, which further secures the timber in place. While the table is being turned the compressor 43, holding the end of the timber, rests against the bulk-head 50, and is drawn along the face thereof, and guided by the grooved rollers 48, which revolve on a track, 49. Thus, as the table is revolved a portion of one end of the timber is held in a straight position against the bulk-head, while the other portion is curved or bent around the table any desired distance, as shown in Fig. 2, wherein is shown one of a ship's ribs.

Before the timber was placed in position in the machine, a thin strap was applied thereto, inside of the main strap, against the outside of the timbers. This thin strap is used to take the timbers immediately out of the machine, and put in holders on the floor to cool and set, while the machine and larger strap are free to make another bend with or without the inside strap.

When compound bends are required, two lengths of strap are used, or a double mold, as shown in Fig. 3, one strap, *b*, on each round part of the bend. When this form of bend is adopted—that is, a round and a hollow on the same side of the piece to be bent—the straps are used on opposite sides of the timber, the one coming down from the head on the outside, and the other extending up from the lower end on the inside of the timber. These two overlapping ends of the straps, on opposite sides of each other, are then clamped, or are connected together by projecting ends of studs 51, placed at right angles across the strap and secured by link 52, as shown in Fig. 3. When a sufficient bend is given to the timber the machine is stopped, the pawl and ratchet K preventing the table revolving backward. The timber is now secured by cross-ties, clamps, &c., and removed from the machine to a proper place to dry and set.

When compound bends are made, similar to that shown in Fig. 3, the roller 6 is placed in position on the plunger-shaft 4, and the machinery C put in operation, which drives the plunger, with roller 6, forward against the timber and bends it at that place.

Thus it will be seen that at the same time a knee is being formed on one side of the machine, a curved timber or rib may be formed at the other. After this bend is given to the timber by the plunger 6 it is secured at this point by a clamp, 33, secured to the table 29. The plunger is then drawn back by means of the machinery C. The table is then further revolved to complete the bend.

The object of the hydraulic pump 45 in the end of the compressor 43 is to drive or force the timbers in a longitudinal direction against its bearings, and compress, shorten, or condense the grain lengthwise, the same as in the knee-bender.

Having thus fully described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In combination with the hinged cap 33 and removable bolts 37, the holders or clamps 33, the set-screws 41 and 42, and key 38, as and for the purposes described.
2. The compressor 43, mounted upon casters 44, and constructed with friction-rollers 48 at the back, as and for the purposes described.
3. In combination with the compressor 43, with friction-rollers 48, the bulk-head 50, with track 49, for bearing for the compressor, as described.
4. The hydraulic pump 45 in the end of

compressors 43, as and for the purposes described.

5. In combination with the compressors 43, the removable straps 46 and bolts 47, for securing the timber in place in the compressor, as described.

6. The combination, in a wood-bending machine, of revolving table 29, removable adjustable clamps 33, and compressor 43, as and for the purposes described.

7. In combination with the clamps or holders 33 and compressor 43, the straps *b*, placed outside of the timber, being bent within the clamps, and constructed to hold the timber while moving around the form, and to prevent breaking the outside surface thereof, as described.

8. In a timber-bending machine, the hollow curved-faced throat-form 7, adjusted in the end of plunger 4, and constructed with a removable top and stationary bottom flanges, 8 8, as and for the purposes described.

9. The combination, in a timber-bending machine, of driving machinery C H, nut 2, plunger 4, throat-form 7, and roller 6, as and for the purposes described.

10. The knee-compressors 9 9, mounted upon casters 10, and constructed of a long straight-faced trough, with lower projecting flange 15, as and for the purposes described.

11. In combination with the compressors 9 9, the sliding bars 19 and removable bolts 20, as and for the purposes described.

12. In combination with the compressors 9 9, the hydraulic pumps 17 17, situated in the head of each compressor, and adapted to operate against the timber contained therein, as described.

13. In combination with the compressors 9 9, the ribs 11 11, uniting the compressors at their inner ends, as and for the purposes described.

14. The central rib 12, with roller 13, working in a guide, 14, on the platform A, as and for the purposes described.

15. The cables 21 21, attached at top and bottom at each end to heads of compressors 9 9, passing through bands 11^a 11^a at the inner

ends thereof, and through top and bottom of ribs 11 11, uniting the whole together, as described.

16. The knee-timber holding, bending, or forming devices or apparatus, consisting of compressors 9 9, mounted upon casters 10, ribs 11, central roller-rib 12, guide or way 14, hydraulic pumps 17 17, cables 21 21, and securing-bolts 20, all constructed and arranged as and for the purposes described.

17. The combination of knee-timber-holding devices, consisting of compressors 9 9, ribs 11 11, straps 18 19, and bolts 20, and throat-form 7, as and for the purposes described.

18. The back brace or support for the compressors, composed of triangle-frame of four vertical rear shafts, 25 25, and short front shafts 26, resting upon the platform A and quadrants 24, mounted thereon, as and for the purposes described.

19. In combination with the frame or brace 25 26, the turn-buckles 27 and collars 28, uniting the parts, and for adjusting the angle of the quadrant, as described.

20. The double straps *b*, placed on opposite sides of the timber, studs 51, and links 52, for securing the straps in place when making compound bends, as described.

21. The combination, in a machine for bending timber, of knee bending and forming devices, consisting of compressors 9 9 and throat-form 4, 7, and curved timber-bending mechanism, consisting of revolving table 29 30, clamps 33, and compressor 43, or their equivalents, each separate and distinct, but acting in connection, one with the other, as and for the purposes described.

22. The improved machine for bending timber, composed of the parts and constructed and arranged to operate substantially as and for the purposes herein set forth and shown.

In testimony that I claim the foregoing I have hereunto set my hand this 7th day of October, 1875.

JOHN W. GRIFFITHS.

Witnesses:

CALVIN PAGE,

CHARLES P. BROWN.