

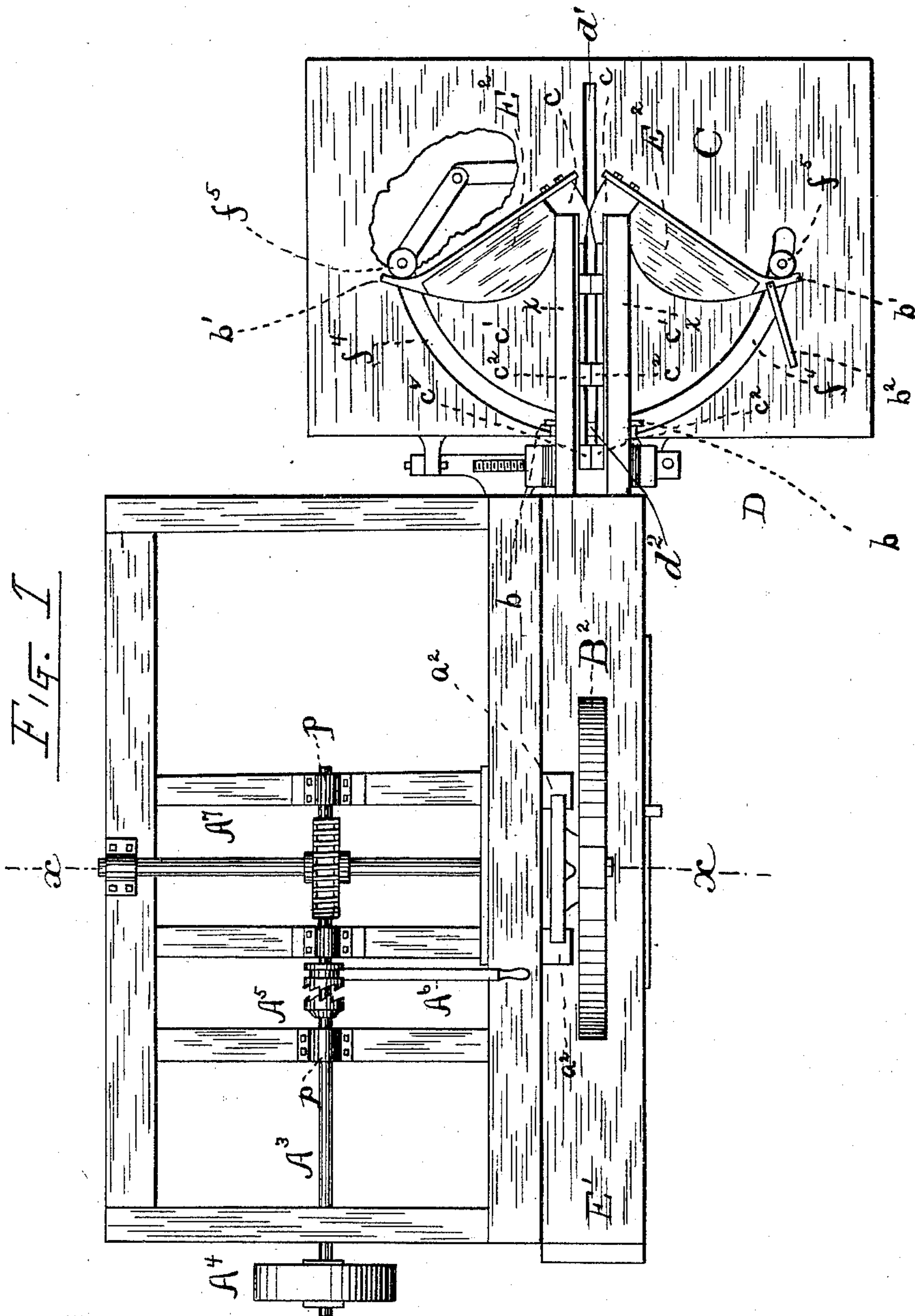
(No Model.)

E. L. BOOHER.
BENDING MACHINERY.

5 Sheets—Sheet 1.

No. 474,358.

Patented May 10, 1892.



WITNESSES:

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(No Model.)

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BENDING MACHINERY.

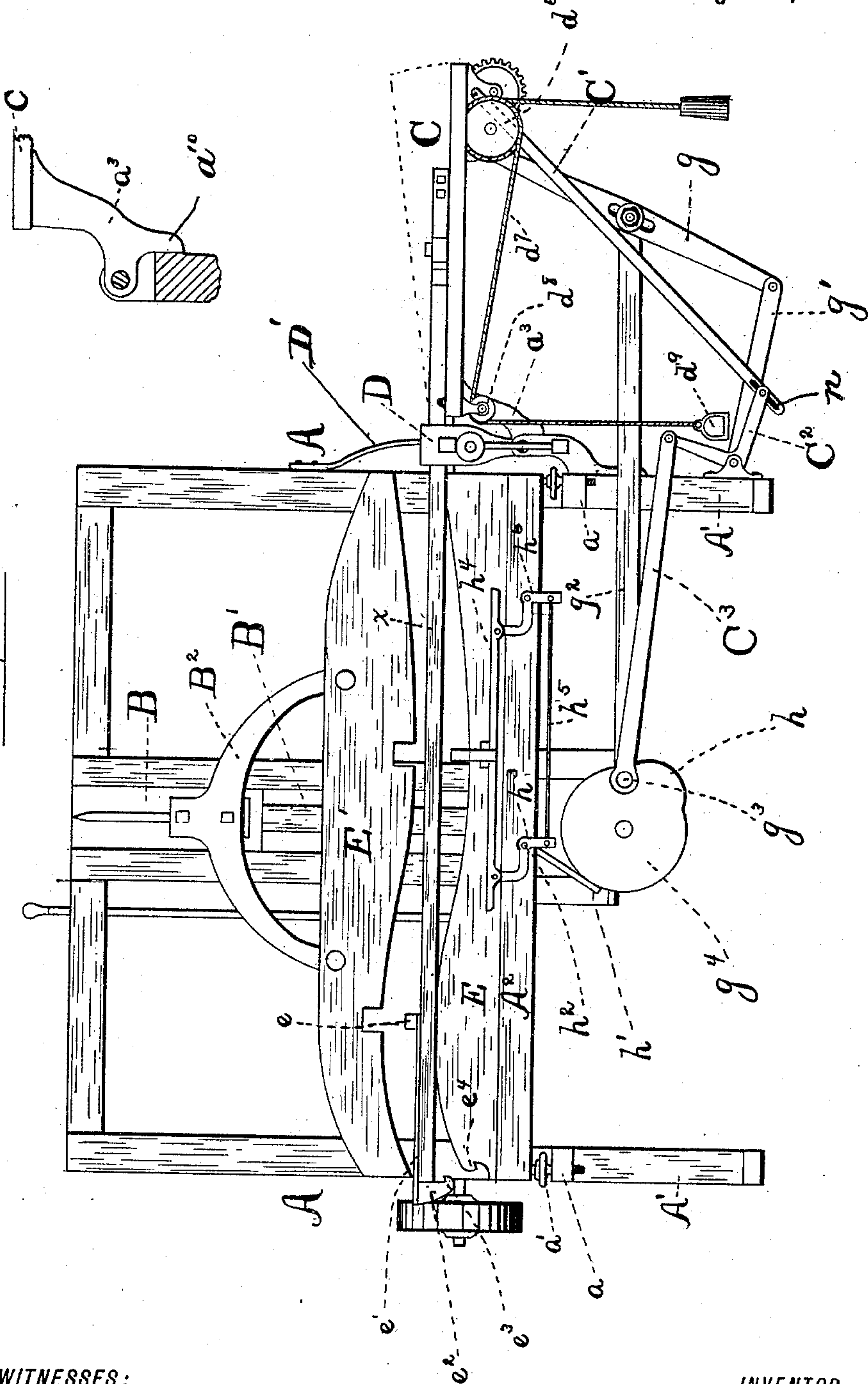
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Fig. 6.

FIG. 5



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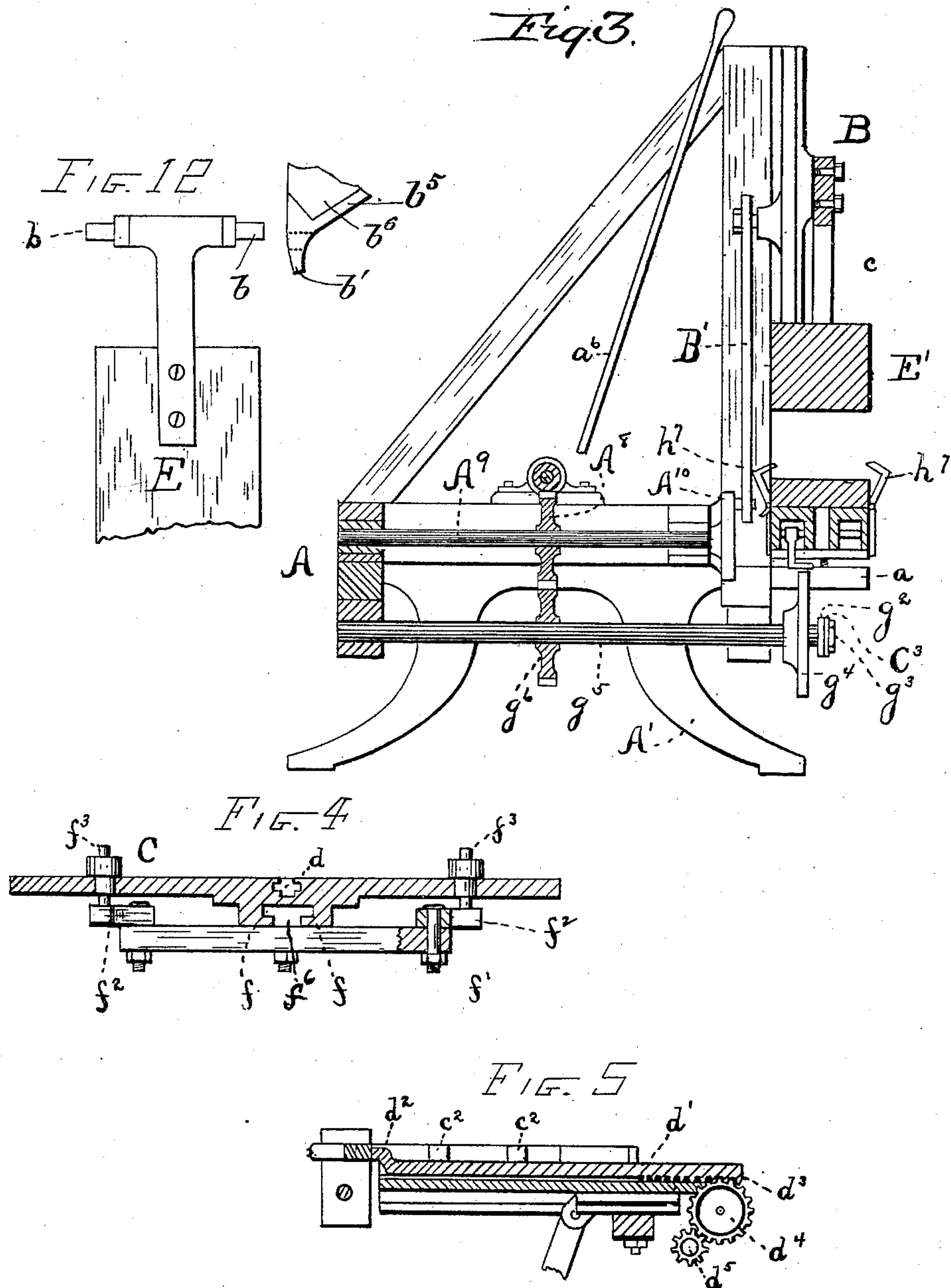
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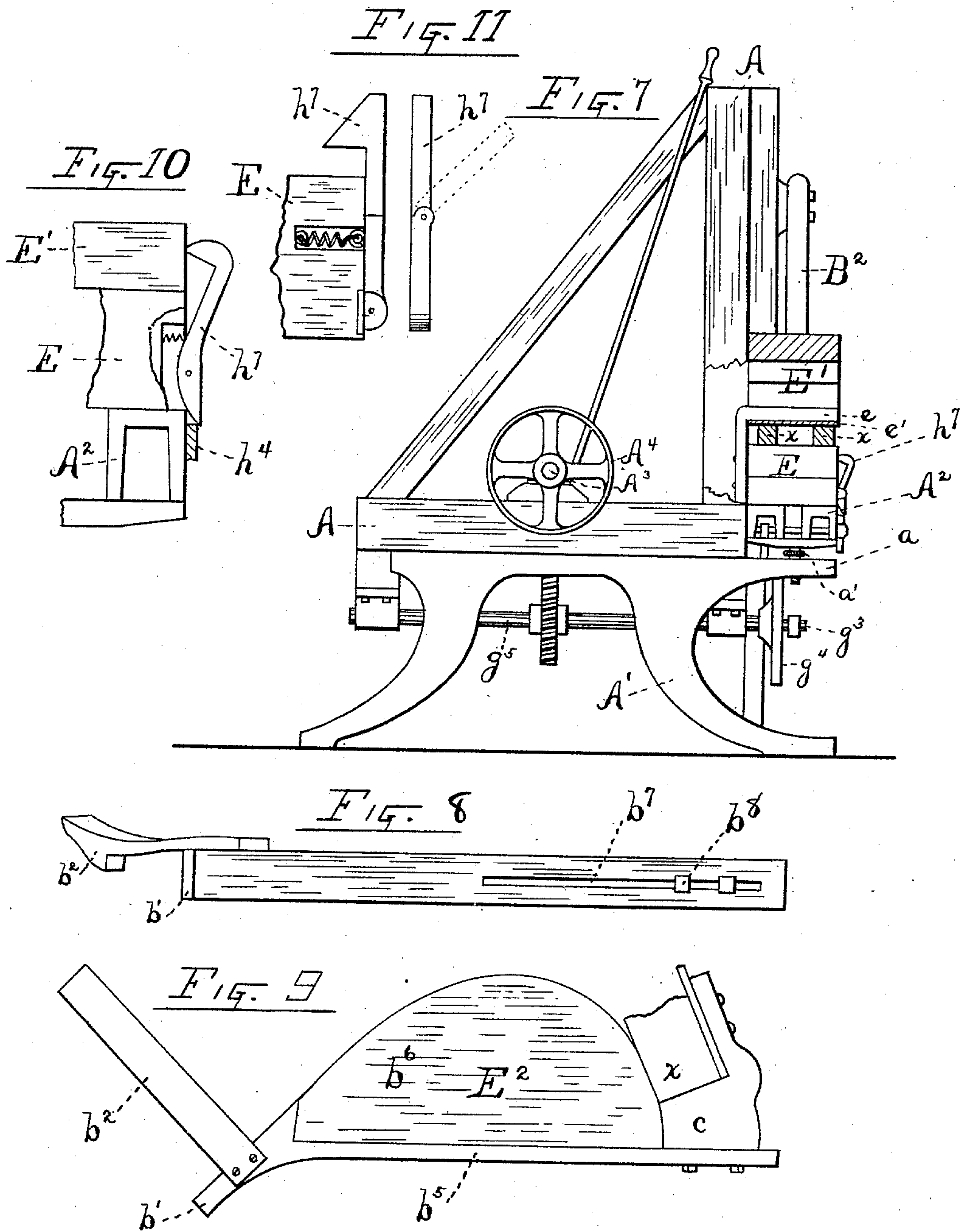
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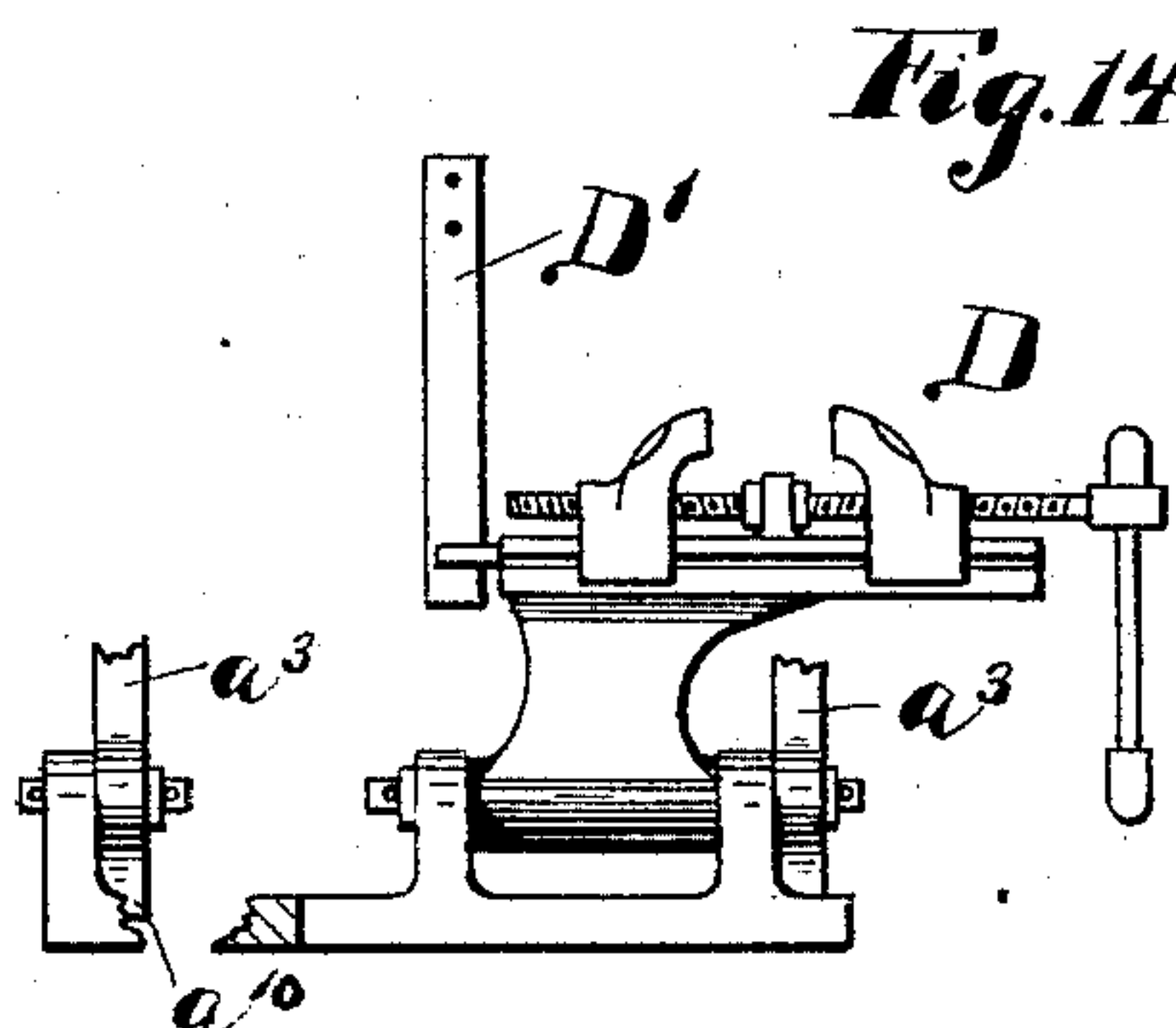
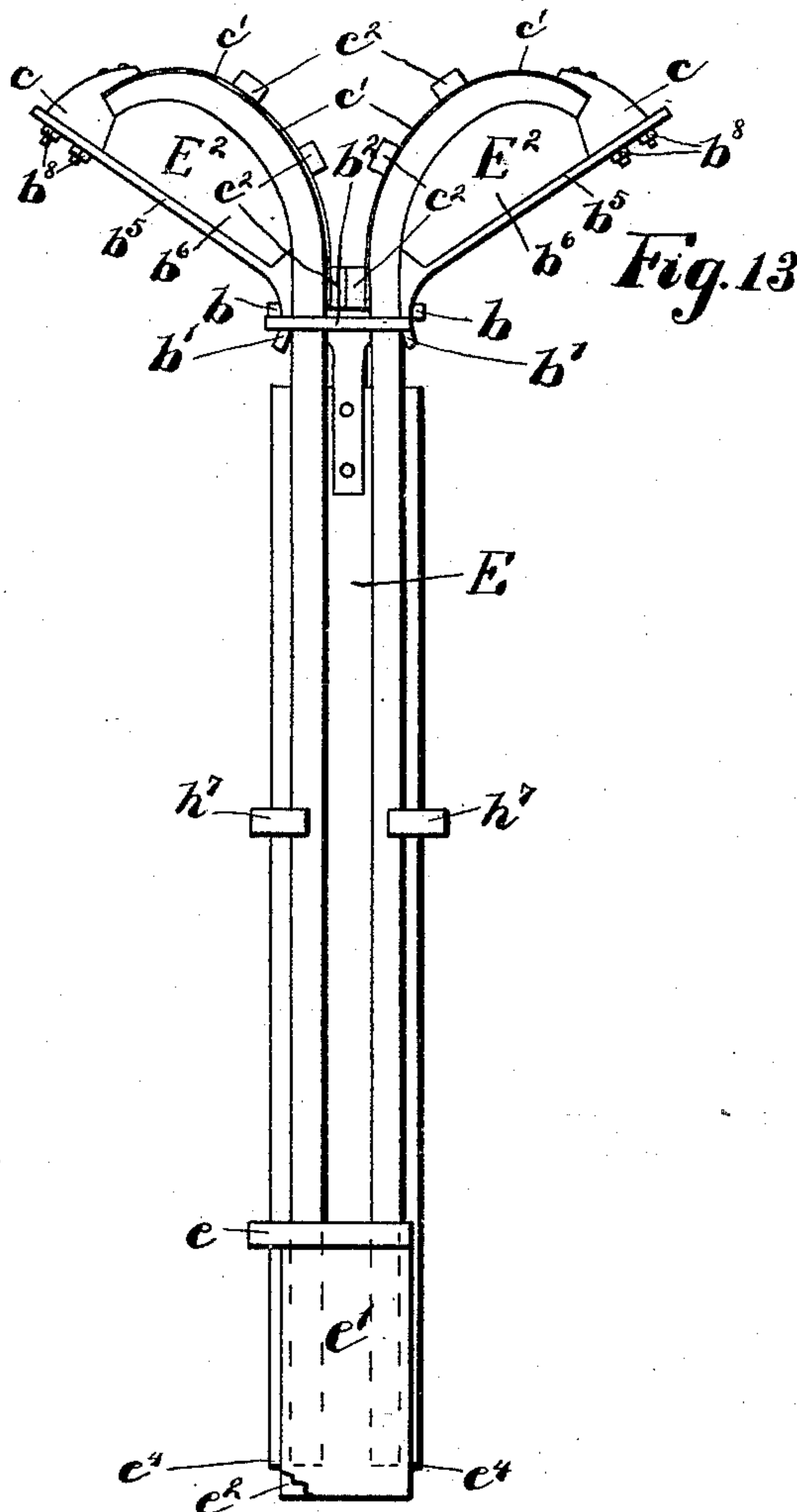
(No Model.)

E. L. BOOHER.
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5 Sheets—Sheet 5.

No. 474,358.

Patented May 10, 1892.



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UNITED STATES PATENT OFFICE,

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BENDING MACHINERY.

SPECIFICATION forming part of Letters Patent No. 474,358, dated May 10, 1892.

Application filed June 29, 1891. Serial No. 397,891. (No model.)

To all whom it may concern:

Be it known that I, EVERETT L. BOOHER, a citizen of the United States, residing at Tippecanoe City, in the county of Miami and State of Ohio, have invented certain new and useful Improvements in Bending Machinery, of which the following is a specification.

My invention relates to improvements in bending machinery, and it especially relates to a machine for bending poles or shafts for vehicles.

The object of my invention is to provide a machine by which the operation of bending a pair of shafts or two poles may be completed at a single operation, the construction being such that the parts shall be bent in the proper directions to secure the right and left shafts forming a pair.

A further object of my invention is to provide means for removing the shafts or poles, together with the forms to which they are bent, to permit the shafts or poles to become set before being removed from the forms.

My invention consists in the various constructions and combinations of parts herein-after described, and set forth in the claims.

In the accompanying drawings, Figure 1 is a plan view of a device embodying my invention. Fig. 2 is a side elevation of the same. Fig. 3 is a transverse sectional view on the line $x x$ in Fig. 1. Figs. 4 and 5 are sectional views in detail of portions of the supporting-table. Fig. 6 is a detail of the hinged connections of the table. Fig. 7 is an end elevation of the machine from the driving end. Figs. 8 and 9 are details of the heel-forms. Figs. 10 and 11 are views of modified forms of catches for retaining the bending-forms referred to hereinafter. Fig. 12 is a detail of a portion of the main removable form, showing the locking device or projection to which the heel-forms are connected. Fig. 13 illustrates the removable forms with the blanks clamped therein and removed from the machine. Fig. 14 is a detail of the pivoted clamping device and the hinged connections of the supporting-table.

Like parts are represented by similar letters of reference in the several views.

In the said drawings, A A represent a main frame supported at each end upon suitable supporting-legs A' A', preferably cast in

metal, the frame proper being formed of wood and is substantially triangular in cross-section, as shown in Figs. 3 and 7. The supporting-legs A' are extended beyond the frame A A in front, as shown at a , to support the form-bed A², which is arranged above the said extensions and preferably supported therefrom by adjustable supporting-screws a' , by means of which the form-bed A² may be adjusted to level the same or to compensate for different forms placed thereon.

Extending longitudinally through the main frame and supported in suitable bearings p therein is a main two-part driving-shaft A³, provided at its outer end with a driving-pulley A⁴, the respective parts of said shaft being adapted to be connected or disconnected through the medium of a detachable clutch A⁵, adapted to be operated in a well-known manner by a hand-lever A⁶. The inner portion of the shaft A³ carries a worm A⁷, which meshes with a worm-gear A⁸ on a transverse shaft A⁹, also supported in suitable bearings in the main frame A A.

Located at the front of the machine and above the form-bed A² is a reciprocating head B, adapted to slide in suitable guides or ways a^2 , secured in the main frame A A. A pitman connection B' extends from the head B to a crank-head A¹⁰ on the transverse shaft A⁹, so that a reciprocating motion is imparted to said head by the revolution of said shaft.

Located at one end of the main frame is a hinged table C, connected to the main frame by suitable hinged connections a^3 and supported at its outer extremity by brace-rod C', pivoted at its upper end to said table and at its lower end to a bell-crank lever C², pivoted to the leg A' of the main frame.

Between the main frame A A and the table C is a screw-clamp or vise D, by means of which the blanks to be bent are secured between the respective sets of forms which produce the front and rear bends, as hereinafter more fully described.

Located on the bed A² is a removable form E, corresponding to the shape to be imparted to the front end of the shaft or pole. A corresponding form E' is arranged above the same and connected to the reciprocating head B by a bifurcated or U-shaped supporting-yoke B². On the table C are removable forms

$E^2 E^2$, one for each shaft or pole to be bent and shaped to correspond to the shape or form to be produced on the heel of the pole or shaft. These forms are each provided with
 5 a stop-lug c , adapted to contact with the end of the blank to be bent, and have attached thereto flexible metallic strips $c' c'$, with abutting projections $c^2 c^2$. These metallic strips c' extend along the blanks from the heel
 10 thereof to a point opposite to or within the vise D.

Located in a suitable T-shaped slot or way d in the table C is a reciprocating bar d' , having an upwardly-projecting point or spur d^2 ,
 15 adapted to contact with one set of projections c^2 on the flexible metallic pieces c' . This bar is provided at its rear end with a rack d^3 , adapted to engage with a spur-gear d^4 , which meshes with a driving-pinion d^5 . This driv-
 20 ing-pinion d^5 is on the same shaft with a pulley or drum d^6 , to which is attached a rope d^7 , which partly encircles the pulley d^6 and passes over a supporting-pulley d^8 , secured to the under side of the table, and provided at the
 25 end with a foot-stirrup d^9 . Connected at e to the lower removable form E is a flexible metallic plate e' , provided at its end with a hook-shaped projection e^2 , against which the respective blanks are adapted to be forced
 30 when placed between the forms E and E' and $E^2 E^2$. The metallic plate e' projects slightly beyond the form E', so that a certain amount of resiliency is permitted in said plate beyond said form. The stop projection e^2 is
 35 provided at the end with a hook e^3 , adapted to engage with a corresponding hook-shaped shoulder e^4 on the lower removable form E as the blank is bent to conform to the shape of said forms, as hereinafter more fully de-
 40 scribed, the engagement between the two hook-shaped projections being accomplished by the resiliency of the plate e' , as before specified.

Located beneath the table C and connected
 45 to a supporting T-shaped block f^6 , adapted to reciprocate between suitable guides or ways f on the under side of said table, is a cross head or bar f' , to which is pivoted at each end movable arms f^2 , carrying at their outer
 50 extremities projecting studs f^3 , which pass upwardly through the table through curved slotted openings f^4 , and are further provided above said table with suitable rollers f^5 , adapted to contact with the back of the
 55 forms E^2 .

Pivoted to the cross-bar f' is an operated lever g , the opposite end of which is pivoted to an oscillating link g' , the middle of said lever being attached by a pivoted connection
 60 to a pitman g^2 , which is connected at its opposite end to a wrist-pin g^3 on a revolving disk-wheel g^4 , arranged at the end of a transverse shaft g^5 , extending across the main frame and supported in suitable bearings
 65 thereon immediately below and parallel with the transverse shaft A⁹. A gear g^6 , having teeth corresponding to the worm-gear A⁸, is

secured rigidly with the shaft g^5 and meshes with said worm-gear, so that the two shafts are caused to revolve together and at the same speed.

The operation of the device as thus far described is as follows: The blanks $x x$ which are to form the respective shafts of a pair are placed between the forms E and E' with the heel ends resting against the stop c on the forms $E^2 E^2$, the front ends being located beneath the metallic plate e' . The operator places his foot on the stirrup d^9 and through the medium of the rope d^7 and rack and pinion before described produces a longitudinal movement of the forms $E^2 E^2$, which carry said blanks firmly against the respective stops in the respective forms. The blanks are clamped in this position by the vise or clamp D, the jaws of which are operated by a suitable clamping-screw in the same manner as an ordinary clamping-vise. The shifting-clutch A⁵ is thrown into gear by the handle A⁶, which causes the worm A⁷ to revolve with the shaft A³, which is continually in motion from any suitable source of supply. A revolution of the worm A⁷ causes the respective shafts A⁹ and g^5 to revolve. The head B is caused to reciprocate, carrying the form E' toward the form E, thus bending the blanks therein to correspond to the shape of said forms. At the same time the revolution of the shaft g^5 produces, through the intermediate mechanism described, a longitudinal movement of the cross-head f' , which causes the wrist-pin f^3 to be moved in the curved slotted opening f^4 and in contact with the forms $E^2 E^2$. This movement produces an inward movement of the outer ends of said form, which, being connected at their inner ends to the metallic plate c' , causes said forms to describe a curve, bending the heel ends of the respective blanks to the shape of said forms. It will be seen that as the rollers f^5 follow the curved slotted ways f^4 said rollers are gradually brought together, while the outer pivoted center of the arms supporting said rollers travel in a straight line. The angle of said arms to the reciprocating bar is thus gradually decreased, so that as the final pressure is produced against said forms an increased leverage is secured, the respective arms acting in the nature of a toggle-joint. The mechanism is so timed that the travel of both of the reciprocating forms is completed synchronously, thus producing a complete operation of the bending of both ends of the respective shafts. The heel ends of the shafts, being bent in opposite directions, form the left and right shafts of the pair. The form which bends the front end of the shaft is usually provided with a double or ogee curve, and it is desirable as this double curve is formed that the angle of the table C be changed so as to form practically a continuation of the rear or middle portion of said curve. To accomplish this, I connect the bell-crank lever C², to which the brace-rod C' is connected, to the wrist g^3

on the revolving disk g^4 by a pitman connection g^3 . As the said disk is revolved, therefore, the brace-rod C' is elevated, thus raising the table gradually to the position indicated by dotted lines in Fig. 2, thus bringing the heel portion of the respective shafts into the proper position to form the proper continuation of the ogee curve.

When the form E' is forced into its lowest position, the hook-shaped stop e^2 engages with the hook e^4 on said form, and thus holds the ends of the respective shafts firmly locked to said form. At the same time a cam projection h on the disk g^4 engages with a projecting lever h' , attached to a transverse shaft h^2 in the bed-plate A^2 . Bell-crank levers h^3 on said shaft are connected by a reciprocating bar h^4 and a connecting-rod h^5 to similar bell-crank levers h^6 , also on said bed-plate. Pivoted latches h^7 , connected to the respective sides of the form E , are engaged at their lower ends by the reciprocating bar h^4 , thus throwing said latches over the top of the shaft at the point where the greatest bend is formed, thus locking the respective shafts to the said form. A T-shaped connection having projecting prongs b is preferably secured to the end of the form E , said prongs being adapted to pass through perforated ears b' on the respective forms E^2 as said forms are closed together. At the same time a spring-catch b^2 on one of said forms hooks over the other form, locking all of the parts together. A continued movement of the parts causes the operating mechanism to return to its normal position, leaving the respective shafts bent to the desired position and locked to the respective forms to which they are bent. The vise D is then unlocked and said forms and the shafts removed from the form bed and table, respectively, another set of forms substituted therefor, and the operation repeated.

It will be understood that the blanks will be properly steamed or otherwise prepared for bending before being inserted into the machine. Upon being removed from the machine they are retained locked to the respective forms until they have become firmly set to the bent position, when they are released and the forms re-employed in the further operation of the machine.

It will be seen that a machine as thus described is simple and capable of bending a pair of shafts at one and the same operation. The vise D is preferably pivoted to the main frame or supporting-brackets in line with the pivotal supports or hinges of the table C , so that as the table is elevated, as described, the vise may assume a position corresponding thereto. The vise is held in its normal position by a spring D' , connected to the main frame and attached to the rear or supporting jaw of said vise. I also preferably provide the brackets a^3 , which furnish the supporting-hinges of the table C , with stop projections a^{10} , adapted when the table is in the normal position to rest in contact with that

portion of the main frame which supports the brackets a^3 , and thus hold said table normally in a horizontal position. The pitman connection C' , which moves the table, is also preferably provided with a slotted opening n , into which the pivotal connection from the bell-crank arm C^2 extends. This arrangement permits a limited movement of the bell-crank arm before it begins to operate upon the pitman or table, so that in returning to its normal position the table may be brought to rest, while the operating parts continue to move. I also preferably construct the removable heel-forms E^2 in two parts b^5 b^6 , the form proper b^6 being adapted to be removed from the other portion, which is made adjustable by reason of the slotted opening b^7 and the fastening-bolts b^8 , which pass therethrough, so that the conformation of the parts may be changed, as desired, by removing the part b^6 and replacing it with a different conformation and adjusting the part b^5 to correspond thereto.

Projecting studs f^3 are preferably provided with friction-rollers arranged within the curved slotted openings f^4 in the table C , which form the guides for said studs, these rollers being arranged immediately below the contact-rollers f^5 , which engage the backs of the forms E^2 , and thus cause the parts to operate with little friction.

Having thus described my invention, I claim—

1. In a shaft or pole bending machine, the combination of a main frame having a vertically-reciprocating form, a table with horizontally-operating forms and a pivoted clamping device normally held in an upright position between said frame and table by a yielding connection, substantially as specified.

2. The combination of a main frame having a vertically-operating form and a hinged table supporting horizontally-moving forms, a clamping device between the said frame and table and means, substantially as described, for producing an opposite movement of the respective horizontal forms simultaneously with a vertical movement of said table and one of the vertical forms, substantially as specified.

3. In a shaft-bending machine, the combination, with the vertically-arranged forms and the oppositely-moving horizontal forms, of a catch mechanism adapted to automatically lock said horizontal forms to one of the said vertical forms by the movement of said horizontal forms produced in bending the shafts, substantially as specified.

4. The combination of a vertically-arranged removable form having a T-shaped projection, oppositely-moving horizontal forms having perforated projections adapted to be threaded onto said T-shaped projection by the movement of said horizontal forms, and a latch adapted to automatically lock said horizontal forms to said T-shaped projection at the limit of their movement, substantially as specified.

5. The combination of the removable form E and the reciprocating form E', the vise D, and table C, and the oppositely-moving heel-forms on said table, substantially as specified.

6. The combination, in a shaft-bending machine, of a supporting-table having curved slotted guides, and the removable forms having flexible metallic pieces, as described, engaging rollers adapted to be operated in said curved slotted guides to engage said forms, and means for operating said rollers, substantially as specified.

7. The combination, with a vertically-reciprocating form and an oppositely-arranged removable form, of a spring-strip secured at one end to said removable form, a hook-shaped projection on said strip, and a catch projection on said form, said catch projection being adapted to be engaged by said hook-shaped projection by the movement of said reciprocating form, substantially as specified.

8. The combination, in a bending-machine, with a set of vertically-arranged forms, of a horizontal pivoted table having a set or horizontally-moving forms and means for changing the angle of said table synchronously with the movement of the vertical forms, substantially as specified.

9. The combination of the removable form E and the reciprocating form E', movable catches h^7 , pivoted to the form E', a reciprocating bar h^4 , supported at each end upon suitable bell-crank levers at the side of said frame, so as to engage said catches, and means for producing a vertical movement of said bar, substantially as specified.

10. In a heel-form for a shaft-bending machine, the combination of a supporting-piece b^6 , having a slotted opening b^7 , a form-piece b^5 , and bolts connecting said form-piece to the supporting-piece through the slotted opening, substantially as specified.

11. In a shaft-bending machine, the combination, with the vertical forms and the horizontal forms operating at right angles to each other, as described, of a hinged table supporting said horizontal forms, stop projections supporting said table in a normally-horizontal position, and means, substantially as described, for raising said table as the forms are moved, as specified.

12. In a bending-machine, the combination, with the vertical forms and the horizontal forms and a hinged supporting-table for said horizontal forms, having stop projections to hold it in a normally-horizontal position, of a pitman connection pivoted to said table, and operating mechanism for moving said pitman to elevate said table, as described, and a slotted connection in said pitman to permit its operating mechanism to move independent thereof when the table has reached its normal position, substantially as set forth.

13. The combination, with the main frame supporting a vertically-moving form and a set of horizontally-moving forms supported on a hinged table, as described, of a pivoted vise arranged between said forms and normally held in an upright position by a yielding connection, substantially as specified.

14. The combination, with the vertical and horizontal forms, of a table supporting said horizontal forms, a sliding bar adapted to engage said horizontal forms, and a rack and pinion for operating said bar, a rope with a stirrup connected to said pinion and adapted to revolve said pinion, and a weight for returning the pinion to its normal position, substantially as specified.

In testimony whereof I have hereunto set my hand this 10th day of June, A. D. 1891.

EVERETT L. BOOHER.

Witnesses:

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HENRY H. BRYANT.