

No. 680,760.

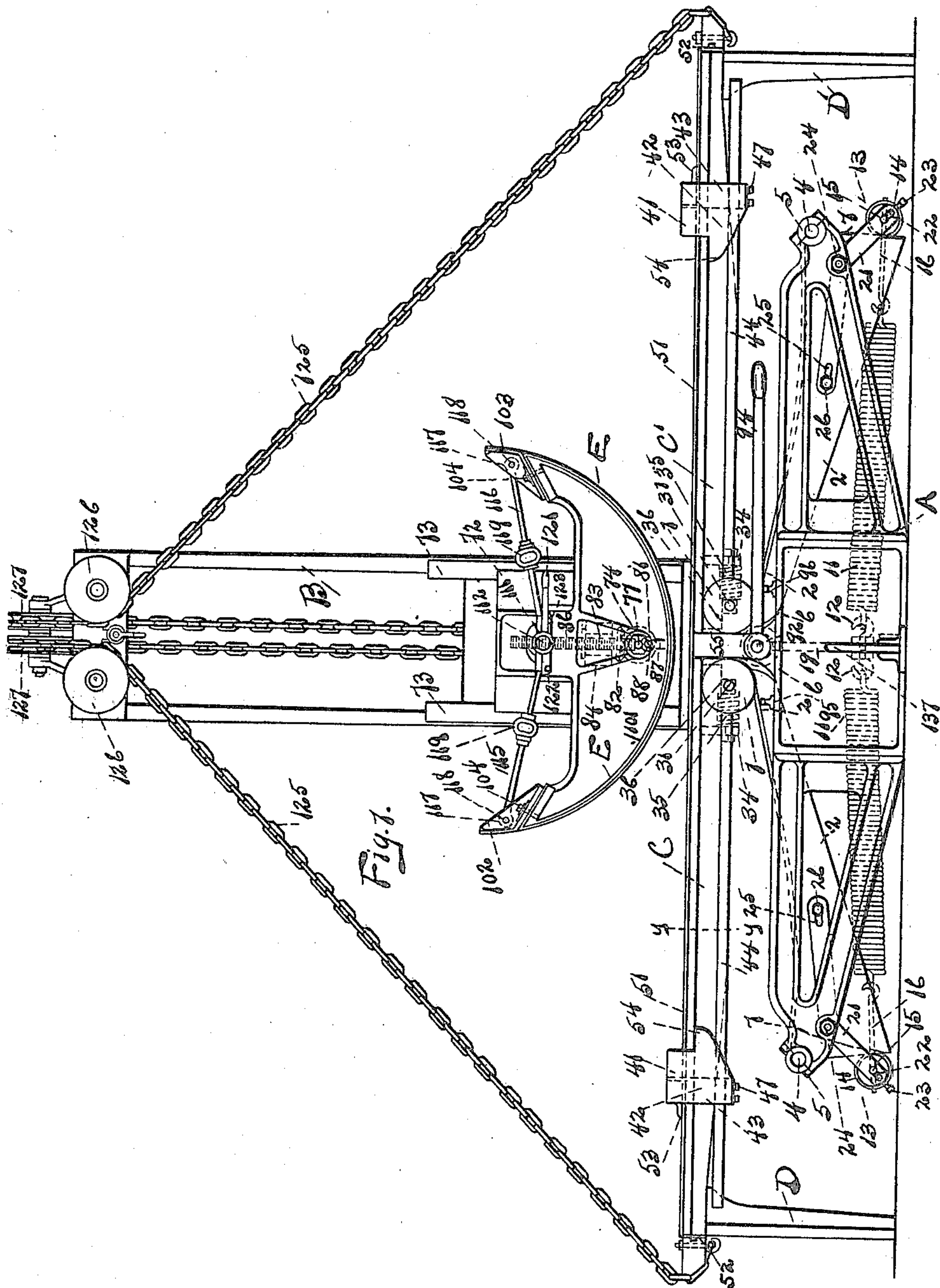
Patented Aug. 20, 1901.

G. W. BUGBEE.  
BENDING MACHINE.

(Application filed Feb. 25, 1901.)

(No Model.)

4 Sheets—Sheet 1.



Witnesses:  
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Inventor:  
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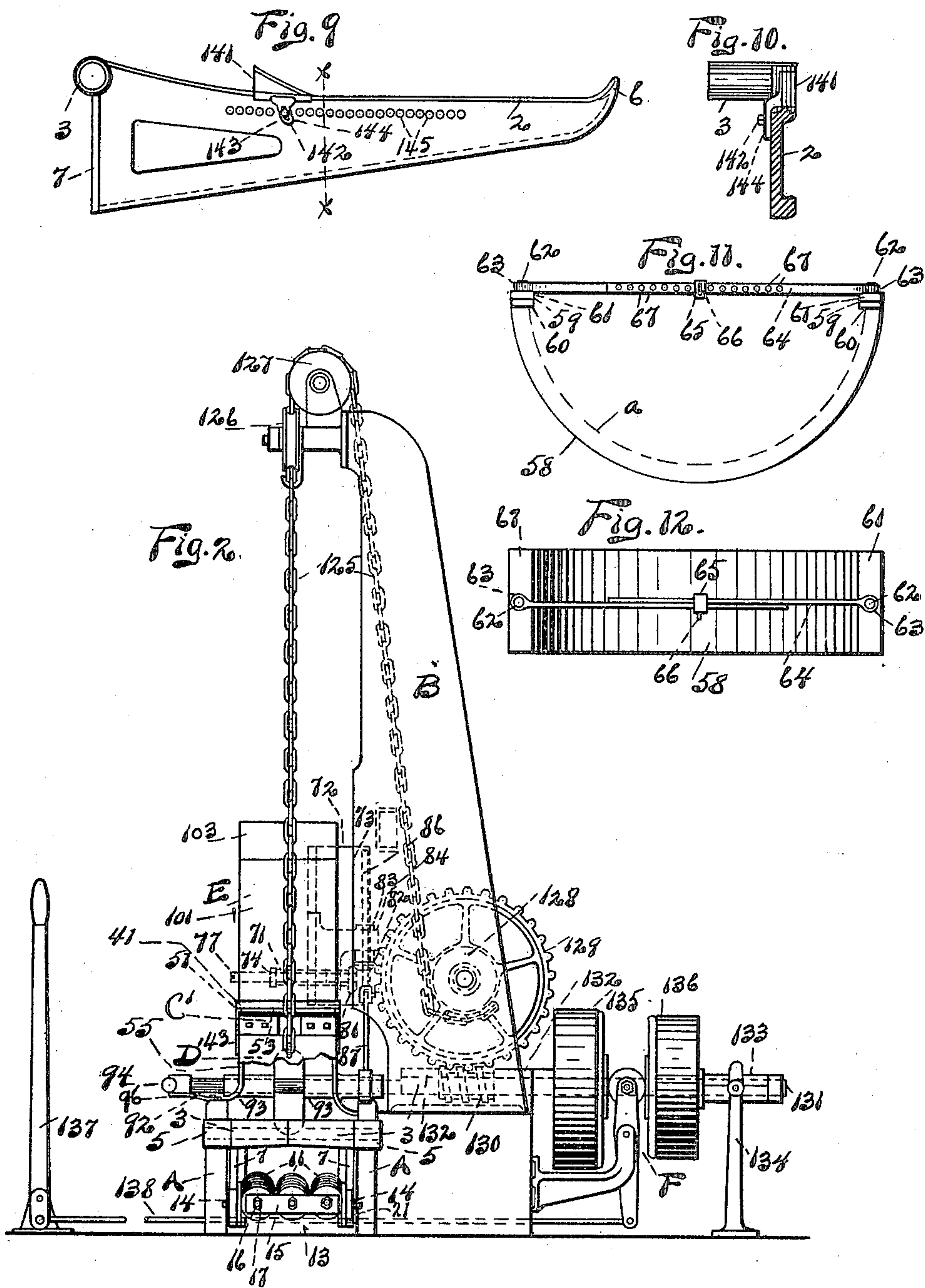
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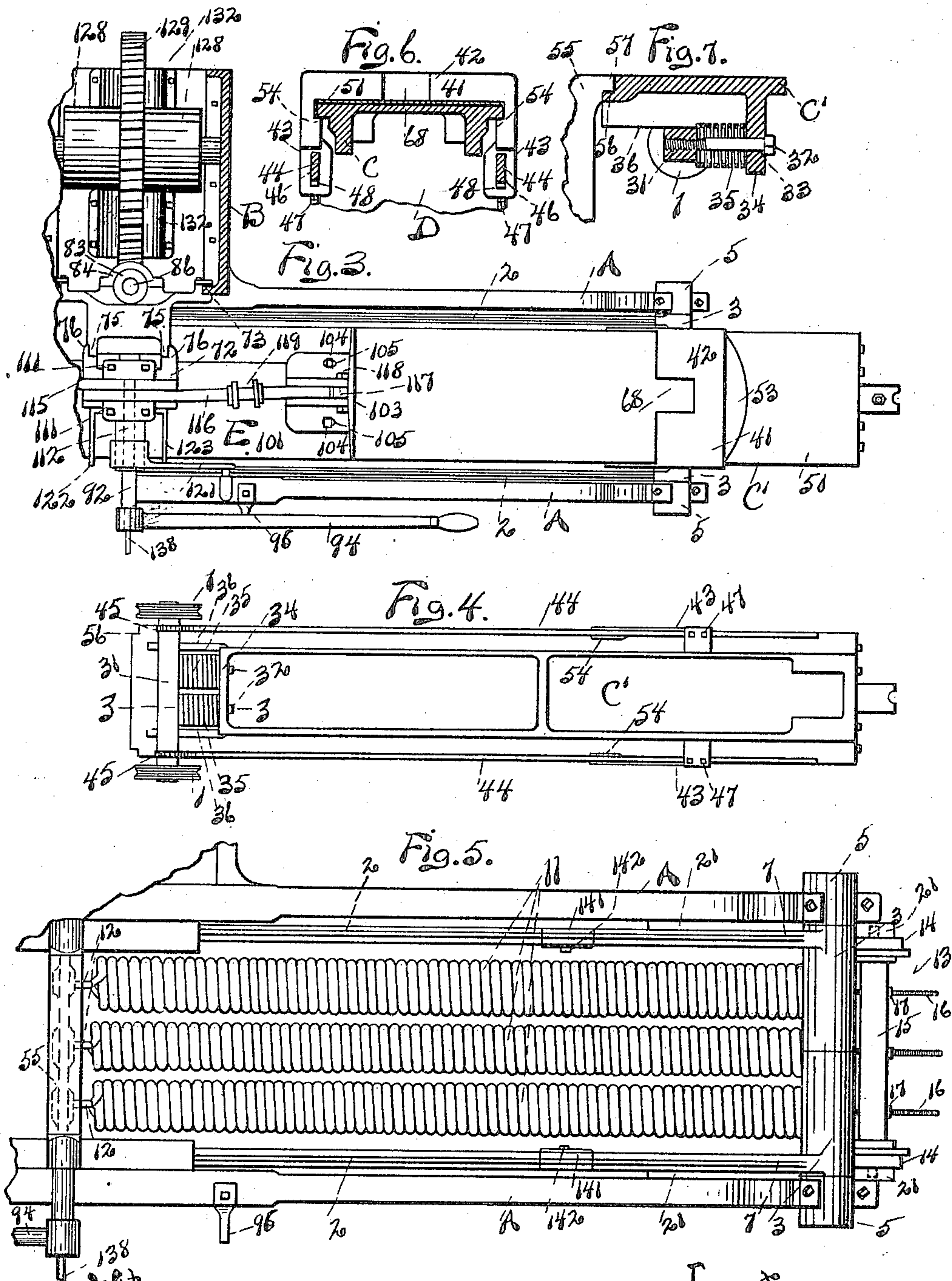
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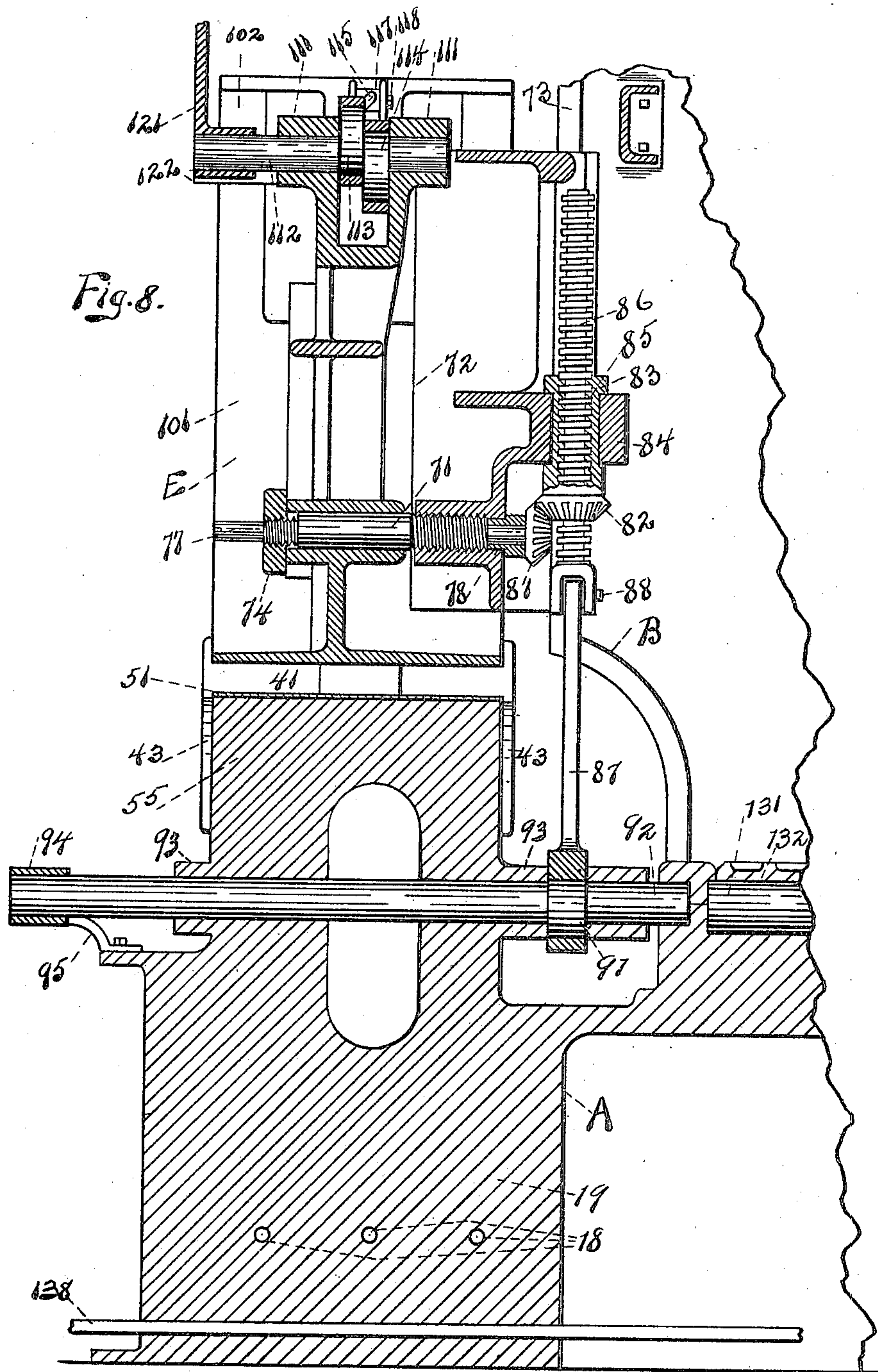
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(No Model.)

4 Sheets—Sheet 4.



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# UNITED STATES PATENT OFFICE.

GEORGE W. BUGBEE, OF DELHI, OHIO, ASSIGNOR TO J. A. FAY & EGAN  
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## BENDING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 680,760, dated August 20, 1901.

Application filed February 25, 1901. Serial No. 48,778. (No model.)

*To all whom it may concern:*

Be it known that I, GEORGE W. BUGBEE, a citizen of the United States, residing at Delhi, in the county of Hamilton and State of Ohio, have invented certain new and useful Improvements in Bending-Machines, of which the following is a specification.

My invention relates to bending-machines; and it consists in providing a bending-lever between which and the form the material to be bent is adapted to be placed, having moving support or fulcrum supported by a track yielding bodily with the lever swinging on its moving fulcrum for progressively exerting pressure along the stock from its point of initial pressure as the stock is being progressively bent to the shape of the form; further, in providing an end abutting device for the stock actuated by the end pressure of the stock, and, further, in the parts and in the construction, arrangement, and combinations of parts hereinafter more fully described and claimed.

In the drawings, Figure 1 is a front elevation of my improved device, and Fig. 2 is a side elevation of the same. Fig. 3 is a plan view, partly in section, of one end of my improved device. Fig. 4 is a bottom view of the bending-lever. Fig. 5 is a plan view of one end of my improved device with the bending-lever omitted, showing the parts under the bending-lever. Fig. 6 is a detail, partly in section, on the line *yy* of Fig. 1, showing the connection between the abutment and the bending-lever. Fig. 7 is a detail, partly in section, on the line *zz* of Fig. 4. Fig. 8 is a central transverse enlarged section of part of my improved device, showing form and slide construction. Fig. 9 is a side elevation showing the track construction. Fig. 10 is a section on the line *xx* of Fig. 9. Fig. 11 is a side elevation of a retaining-strap, and Fig. 12 is a plan view of the same.

A represents the frame, on which a column B may be supported.

C C' are bending arms or levers supported at their outer ends by legs D D'. Their inner ends are supported on wheels 1 1, which travel on ways or tracks 2 2. Each of the levers is preferably supported on two of the wheels, one at each side, there being also two

tracks for each lever, having large hubs 3, supported on a pivot, rod, or shaft 4 in bearings 5. The swinging track or ways have a toe 6 and heel 7. A spring or springs 11 are secured between the frame (as by a hook 12) and a shifting device 13, preferably consisting of rolls 14, mounted on a cross-bar 15, to which adjusting-screws 16 for the springs may be secured, (as by means of adjusting-nuts 17.) The hook 12 may take into an aperture 18 in web 19 of the frame. The cross-bar 15 may be adjustably secured to one end of a crank-lever 21, as in a slot 22, adjusting-bolts 23 providing adjustment of the cross-bar in the slots. (See Fig. 1.) The crank-lever 21 is pivoted on a bolt 24, taking into the frame. At its other end it has a slot 25, through which a bolt 26 takes into the ways 2.

The wheels 1 1 (see Figs. 1, 4, and 7) are mounted on an axle 31, slidably secured with relation to the bending-lever by means of bolts 32, which take through and slide in apertures 33 in a lug 34 on the bending-lever, with springs 35 between the lug and axle. The bolts 32 are threaded into the axle, so as to position the axle with relation to the bending-lever and to regulate the tension of the springs. The axle slides with relation to the bending-lever on ways 36 against the tension of the springs. This construction provides fulcrums for the levers movable along the tracks.

An abutment 41 is provided for acting against the end pressure of the stock, comprising, preferably, a casting 42, having depending ears 43. Links 44 connect with the axle 31 at one end by means of a bearing 45, taking about the axle, and are adapted to be secured to the casting by taking through slots or apertures 46, with set-bolts 47 for securing a wedge 48, interposed between the set-bolt and the link. (See Fig. 6.) This abutment is adjustable along the links for different lengths of stock. The abutments serve the purpose of yieldingly resisting the end pressure of the stock and form end-pressure agencies for the stock, undue pressure from the stock against the abutments causing undue tension on the springs 35 and consequent yielding of the abutments. When an abutment yields, it slides longitudinally of



its bending arm or lever and of the master-strap, and, through the links 44, acts to slide the axle 31 along the ways 36, also longitudinally of the bending-lever, thereby compressing the springs 35 and causing the bolts 32 to slide in their apertures 33, the ways 2 at the same time rising to any change in position of the wheels 1.

A master-strap 51 has a lip 52 at each end depending against the edge of the outer ends of the bending-levers, to which they are secured by suitable rivets. The abutments 41 preferably take over the master-strap and are slidable thereon and along the bending-levers. To insure greater resistance to buckling when the end pressure of the stock is exerted against them, they have outwardly-projecting heels 53, taking above the master-strap, and inwardly-projecting toes 54, taking under the bending-lever, the master-strap and bending-lever thereby forming a slide for the abutments.

The frame has an upward extension 55, taking between the inner ends of the bending-levers, the upper side of which is on a level with the bending-levers when the latter are in lowered position. When in lowered position, the bending-levers, with the support and the master-strap taking thereover, form a table adapted to support the stock to be bent or its retaining-strap. The inner end of the lever may have a projection 56, taking under a lip 57 on the extension. The stock to be bent is placed on a retaining-strap 58, the outer ends of which are preferably bent perpendicularly to the strap when in flat position, so as to extend radially thereto when bent, as shown at 59, with plates 60 and 61 suitably secured to the bent ends, the plates 60 forming the shoulder for the stock, as indicated by dotted line *a*, Fig. 11. A lug 62 extends from each end of the retaining-strap, and they are adapted to receive the eyes 63 of a spanner 64, as more clearly shown in Figs. 11 and 12, after the stock is bent, in order to retain the stock in bent form until it is suitably dry. The spanner consists, preferably, of two parts overlapping each other, with a buckle 65, taking about the same, and a pin 66, taking through apertures in the buckle, and through selected apertures 67 in the spanner, the effective length of the spanner being determined by the apertures through which the pin 66 takes. The lugs 62 are adapted to be accommodated by recesses 68 in the abutments.

E is a form, of which there may be a suitable number provided for the machine, according to the sizes, shapes, and diameters of the product it is desired to produce. I have shown this form substantially semicircular in shape, illustrating the machine as adapted especially for bending felloes or rims of wheels. The form E is supported on a support, shown as a sleeve 71, secured in a slide 72, slidable on ways 73 on the column. The form is secured

rigidly to the slide by a nut 74, taking over the threaded end of the sleeve and against the form, forcing the form rigidly in place against the slide. To prevent turning of the form on its sleeve, I provide shoulders 75 76 between the form and slide. A shaft 77 takes through and turns in the sleeve 71 and is journaled in a bearing 78 in the slide and carries a bevel-gear 81, meshing with a bevel-gear 82, having an elongated hub 83, journaled in a bearing 84 upon the slide. The interior of the gear or hub is threaded, as shown at 85, to receive a screw-shaft 86, supported on a link 87, as by pin 88. The lower end of the link is journaled about an eccentric 91 on a shaft 92, supported in bearings 93 in the frame, a lever 94 being secured to the shaft 92 with suitable stops 95 and 96 for arresting the thrust of the lever.

The form E is preferably multipart, consisting of the middle section 101 and the end sections 102 103. The end sections are slidable upon the middle section, as by means of having bolts 104 take through slots 105 in the end sections and into threaded apertures in the middle section, the bolts being screwed up sufficiently tight to insure snugness of fit while permitting the end sections to slide upon the middle section. The middle section has a bearing or bearings 111 for receiving a shaft 112, upon which are located eccentrics 113 114, about which the inner ends of links 115 116 are journaled, the opposite ends of the links connecting with the end sections 102 103 of the form, as by eyes 117, taking about pins 118. The links 115 and 116 are preferably adjustable or extensible, as by means of turnbuckles 119. The outer end of shaft 112 carries a lever 121, and the form has stops 122 and 123 for limiting the throw of the lever. When, for instance, the lever is thrown to the left, the shaft 112 is turned, with the eccentrics 113 and 114 thereon, which latter by reason of their eccentricity force the links and the outer sections 102 103 of the form inwardly, and when thrown to the right the links and outer sections are thrown outwardly.

The inner ends of the bending-levers are supported on the yielding tracks by means of the wheels, and the outer ends of the same are adapted to be raised and lowered by means of chains 125, taking over sheaves 126 127 and about a winding-drum 128, receiving its motion through a worm-wheel 129, with which a worm 130 meshes, the worm being secured to a shaft 131, journaled in bearings 132 on the frame and in an outer bearing 133 on a stand 134. The shaft 131 is turned in reverse directions by means of pulleys 135 136 on the shaft, receiving motion from a suitable source of power. A clutch F is provided for throwing either pulley into operative connection with the shaft by means of a lever 137, connecting with the clutch by a link 138. The pulleys 135 and 136 are of different diameters,



so that a more rapid lowering than raising of the outer ends of the bending-levers may be effected.

In operation the form E is raised by throwing the lever 94 to its extreme left position, thereby turning the eccentric 91, and through the link 87 raising the form-slide and form upon the column, the form having been positioned upon its slide by turning the shaft 77. The stock to be bent is placed upon the retaining-strap, and the retaining-strap and the stock are placed upon the master-strap under the form, the bending-levers having been lowered, and the abutments having also been positioned on the bending-lever so as to properly take against the ends of the retaining-strap. The form is then lowered upon the stock by throwing the lever 94 to its extreme right, when the stock will be firmly secured between the lower extremity of the form and the extension 55 of the frame and remain so firmly secured until the form is again raised. Power is then applied to the shaft 131 for operating the chain-drums, and the outer ends of the bending arms or levers are gradually raised to bend the stock. The direction of thrust on the bending-levers, as soon as their outer ends begin to rise, is against their inner pivotal points, the direction of thrust being inward and downward. The thrust is against the tension of the springs 11, the bending-levers riding on the wheels 1, supported by the tracks 2, and the tracks yielding bodily upon their pivots and in connection with the chain forcing the bending-levers toward the form as their outer ends rise. When the bending-levers are in their lowered position, the extreme inner ends thereof are nearest the form. As their outer ends rise these inner ends lower, and the bending-levers, so to speak, wrap themselves around the form, the points of nearest approach on the bending-levers toward the form gradually moving toward the outer ends of the bending-levers, the points of pressure gradually moving toward the ends of the stock, and where the stock is already pressed against the form the master-strap acts to keep the same in bent position, and in connection with the end-pressing agency prevents any change or slack in the stock already bent. While being bent pressure is also exerted against the ends of the stock to prevent slivering or breaking of the stock, and the yield to that pressure prevents buckling of the stock while being bent. The abutments 41 exerting this end pressure are permitted to give to any undue end strain on the stock by means of the end pressure of the stock overcoming the tension of the springs 35. As the bending-levers near their limit of thrust the wheels 1 ride upon the outer ends of the tracks, which then have an upward incline, the inner ends of the tracks having been depressed below their pivotal points, and give the abutments a longitudinal thrust away from the ends of the stock, so as to release the pressure of the

abutments against the ends of the retaining-strap, the bending-lever almost at the same time completing its movement. A spanner 64 is then placed over the lugs 62 at the end of the retaining-strap and holds the stock against the form while the direction of movement of the shaft 131 is reversed and the bending-levers permitted to lower to their normal position, the abutments in this movement just clearing the end plates of the retaining-strap, which are held in place by the spanner. If a form of less diameter than approximately the limit of capacity of the machine is employed, the longitudinal thrust of the abutments may be obtained by having each wheel ride upon the inclined face of a supplemental track 141, secured in desired position along the track, as by means of a bolt 142, taking through a slot 143 in an apron 144, extending from the supplemental track and into apertures 145 in the track, by which means it is adjustably secured to desired position on the track. The supplemental tracks thus form tripping mechanism for tripping the links or rods 44 at about the limit of movement of the bending arms or levers in bending the stock for moving the abutments or end-pressure devices, and thereby relieving the end pressure on the stock. This tripping mechanism is adjustable with relation to the tracks for different-sized forms or different diameters of bent stock. The stock is released from the form by throwing the lever 121 to cause the eccentric 113 114 to turn and draw the end pieces 102 103 of the form inwardly, thereby releasing the stock, which is then pulled away from the form in its retaining-strap and set aside to be dried.

As the inner end of the bending-lever moves along the track the inner end of the track is depressed against the tension of the springs 11 and the rolls or wheels 14 of the shifting device ride on the heel of the track, the position of the rolls being varied by the crank-levers 21, which determine their position and prevent slipping of the rolls off the heels and cause the rolls to approach the pivotal point of the track to prevent excessive pressure on the springs, and thereby equalize the pressure of the springs on the track in its various positions. If desired, the heels of the tracks may be lengthened to increase the leverage against the springs, and compression-springs may be employed, if preferred.

I claim—

1. In a bending-machine, the combination of a bending-lever for bending the stock, a fulcrum therefor, and a way, with the fulcrum movable along the way and the way yielding to the force of the fulcrum bodily with its parts maintained in similar relation to each other, substantially as described.

2. In a bending-machine, the combination of a swingable bending-arm, with an end-pressure agency yielding to the end pressure of the stock, mounted on, moving with, and



slidable with relation to the bending-arm, and a rod and tripping mechanism for the end-pressure agency.

3. In a bending-machine, the combination of a main frame or bed, a standard therefor, a form carried by the standard, two bending-arms located below the form, means in connection with the outer ends of said arms to swing the same, a master-strap extending from one arm to the other, with yielding non-bendable spring-pressed tracks below the arms serving to hold the inner ends of the arms, and to thrust the arms toward the form, substantially as described.

4. In a bending-machine, the combination of the two arms supported at their inner ends by rollers on yielding non-bendable tracks, substantially as described.

5. In a bending-machine, the combination of two arms supported at their inner ends by rollers on yielding non-bendable tracks, with an end-pressure device for the stock yieldable to end pressure of the stock, with a rod and tripping mechanism for the end-pressure device for relieving the end pressure on the stock at about the limit of movement of the bending-arm in bending the stock, substantially as described.

6. In a bending-machine, the combination of a frame, with a form supported therefrom, and a pair of bending-arms located under the form, a master-strap extending from one arm to the other, with means for connecting with the outer ends of the arms to swing the same, yielding non-bendable tracks below the arms for supporting the inner ends of the arms, a tension device for the tracks, and means acting in connection therewith and movable with relation to the tracks for compensating for the changing position of the tracks while yielding, substantially as described.

7. In a bending-machine, the combination of a frame, with a form supported therefrom, and a pair of bending-arms located under the form, a master-strap extending from one arm to the other, with means for connecting with the outer ends of the arms for swinging the same, with yielding non-bendable spring-pressed pivoted tracks below the arms for supporting the inner ends of the arms, heels for the tracks, and a compensating device movable along the heels and connecting with the spring for the track for compensating for the changing position of the tracks, substantially as described.

8. In a bending-machine, the combination of a yielding way, a swinging bending-arm movable along the same and forming a side-pressure agency for the stock, and an end-pressure agency for the stock mounted on and moving with the swinging arm and yieldable to the end pressure of the stock for moving the same longitudinally of the swinging arm, with a rod and tripping mechanism for the end-pressure device for relieving the end pressure on the stock at about the limit of

movement of the bending-arm in bending the stock, substantially as described.

9. In a bending-machine, the combination of a yielding way, a supplemental way therefor, with a swinging bending-arm movable along the ways, and an end-pressing agency for the stock mounted on and moving with the swinging bending-arm, with the end-pressing agency arranged to be moved longitudinally of the swinging arm by the end pressure of the stock and arranged for further longitudinal movement of the end-pressing agency and release of the end pressure on the stock by the movement of the bending-arm along the supplemental way, substantially as described.

10. In a bending-machine, the combination of a bending-lever, a support therefor, and a track, with a raised portion for the track, an abutment for the bending-lever, with the support of the lever movable along the track while the latter yields, and a connection in addition to the lever between the support and the abutment, substantially as described.

11. In a bending-machine, the combination of a bending-lever, a fulcrum therefor, a pivoted yielding track, with the fulcrum movable along the track, a heel for the track, and a spring exerting pressure against the heel, substantially as described.

12. In a bending-machine, the combination of a bending-lever, a fulcrum therefor, a pivoted yielding track, with the fulcrum movable along the track, a heel for the track, and a spring exerting pressure against the heel, with an abutment for the bending-lever adapted to be moved by the end pressure of the stock.

13. In a bending-machine, the combination of a bending-lever, a fulcrum therefor, an abutment for the bending-lever, a connection between the abutment and the fulcrum slidable with relation to the lever, with a yielding pivoted track and with the fulcrum movable along the track, substantially as described.

14. In a bending-machine, the combination of a bending-arm, a support for one end of the arm upon which the arm is permitted to swing, an abutment for the arm, with a connection between the abutment and the support, and a spring for forcing the abutment toward said supported end of the arm and permitting the abutment to yield to end pressure of the stock, substantially as described.

15. In a bending-machine, the combination of a bending-arm, a support for one end of the arm upon which the arm is permitted to swing, an abutment for the arm, with a connection between the abutment and the support, and a spring for forcing the abutment toward the said supported end of the arm and permitting the abutment to yield to end pressure of the stock, with means for adjusting the connection, substantially as described.

16. In a bending-machine, the combination of a bending-arm, a support therefor, an abut-



ment for the bending-arm, a connection between the abutment and the support slidable with relation to the arm, a pivoted yielding track, with the support movable along the track, a heel for the track, and a spring exerting pressure against the heel, substantially as described.

17. In a bending-machine, the combination of a pair of bending-arms, wheels for their inner ends, pivoted yielding tracks for wheels, with the wheels movable along the tracks, and a pressure device for the tracks for acting against the pressure of the wheels, substantially as described.

18. In a bending-machine, the combination of a pair of bending-arms, wheels for their inner ends, pivoted yielding tracks for the wheels, heels for the tracks, and a tension device for the heels movable along the same, substantially as described.

19. In a bending-machine, the combination of a pair of bending-arms, wheels for their inner ends, pivoted tracks for the wheels, heels for the tracks, a tension device for the heels, with wheels between the tension device and the heels movable along the heels, substantially as described.

20. In a bending-machine, the combination of a frame, a pair of bending-arms, pivoted yielding tracks therefor, with the arms movable along the tracks, heels for the tracks, a tension device for a heel slidable along the heel, and a connection between the tension device and the track pivoted with relation to the frame, substantially as described.

21. In a bending-machine, the combination of a pair of bending-arms, wheels for their inner ends, abutments for the arms, connections between the abutments and the wheels, pivoted yielding tracks for the wheels, heels for the tracks, a tension device for the heels, and wheels between the tension device and the heels moving along the heels, substantially as described.

22. In a bending-machine, the combination of a pair of bending-arms, wheels for their inner ends, abutments for the arms, connections between the abutments and the wheels, and springs between the wheels and the arms, pivoted yielding tracks for the wheels, heels for the tracks, a tension device for the heels, and wheels between the tension device and the heels, substantially as described.

23. In a bending-machine, the combination of a pair of bending-arms, wheels for their inner ends, abutments for the arms, connections between the abutments and the wheels, and springs operatively interposed between the wheels and the arms, with tracks for the arms, substantially as described.

24. In a bending-machine, the combination of a bending-lever, a support therefor, a yielding track, a supplemental track adjustable thereon, an end-pressure agency for the stock, a connection between the end-pressure agency and the support, all constructed and arranged to relieve the end pressure on the

stock when the support rides upon the supplemental track, substantially as described.

25. In a bending-machine, the combination of a bending-lever, a support therefor, a yielding track, a supplemental track adjustable thereon, an end pressure agency for the stock, a connection between the end-pressure agency and the support, with a pressure device operatively interposed between the bending-lever and the support, constructed and arranged to relieve the end pressure on the stock when the support rides upon the supplemental track, substantially as described.

26. In a bending-machine, the combination of a bending-arm, an end-pressure device therefor constructed and arranged to be moved by the end pressure of the stock, an inclined way, a rod between the end-pressure device and the inclined way slidable with relation to the arm, with the inclined way arranged for causing the sliding of the rod.

27. In a bending-machine, the combination of a swinging bending-arm, an end-pressure agency for the end of the stock mounted on and moving with the arm, with a connection from the end-pressure agency, and tripping mechanism for moving the connection at about the limit of movement of the bending-arm in bending the stock for relieving the end pressure of the end-pressure agency on the stock, substantially as described.

28. In a bending-machine, the combination of a bending-arm, a track, with the bending-arm movable along the track when bending the stock, an end-pressure agency for the stock mounted on and moving with the bending-arm, tripping mechanism adjustable on the track, a rod in addition to the bending-arm between the end-pressure agency and the tripping mechanism actuated by the tripping mechanism at about the end of movement of the bending-arm in bending the stock, constructed and arranged to relieve the end pressure on the stock when the rod is actuated by the tripping mechanism, substantially as described.

29. In a bending-machine, the combination of a bending-arm, a slidable support therefor, a yielding end-pressure agency for the stock, a connection between the end-pressure agency and the support, and a spring operatively interposed between the support and the bending-arm, substantially as described.

30. In a bending-machine, the combination of a bending-arm, a slidable support therefor, a yielding end-pressure agency for the stock, a connection between the end-pressure agency and the slidable support, with means for adjusting the connection, and a spring operatively interposed between the slidable support and the bending-arm, substantially as described.

31. In a bending-machine, the combination of a frame, a slide therefor, for supporting a form, a gear journaled thereon, a screw-shaft taking through the gear, a rock-shaft, and an eccentric connection between the rock-shaft



and the screw-shaft for raising and lowering the form-slide, with a shaft for the slide for adjusting the latter to position with relation to the frame, substantially as described.

5 32. A form for a bending-machine comprising a middle section and two outer sections, with slides between the latter and the middle section, a rock-shaft journaled in the middle section, a pair of eccentrics on the rock-shaft, 10 and links connecting each eccentric with one of the end sections, substantially as described.

33. A form for a bending-machine comprising a middle section and two outer sections, 15 with slides between the latter and the middle section, a rock-shaft journaled in the middle section, a pair of eccentrics on the rock-shaft, and links connecting each eccentric with one of the end sections, with means for adjusting 20 the links, substantially as described.

34. In a bending-machine, the combination of a frame, a form-slide therefor, a screw-shaft for adjusting the slide with relation to the frame, a rock-shaft, an eccentric connection between the rock-shaft and the screw-shaft, a form for the slide comprising a mid-

dle section and two end sections, a rock-shaft on the middle section, a pair of eccentrics on the rock-shaft, and links for connecting each eccentric with one of the end sections, substantially as described. 30

35. In a bending-machine, the combination of a frame, a form-slide therefor, a screw-shaft for adjusting the slide on the frame, a sleeve for the slide, an adjusting-shaft for the 35 screw-shaft taking through the sleeve, a rock-shaft, an eccentric connection between the rock-shaft and the screw-shaft, a form supported by the sleeve comprising a middle section and two end sections, a rock-shaft for the 40 middle section, with a pair of eccentrics on the rock-shaft, and links connecting each eccentric with one of the end sections, substantially as described.

In testimony whereof I have signed my 45 name hereto in the presence of two subscribing witnesses.

GEORGE W. BUGBEE.

Witnesses:

PARKE S. JOHNSON,  
EDWIN C. VOGT.