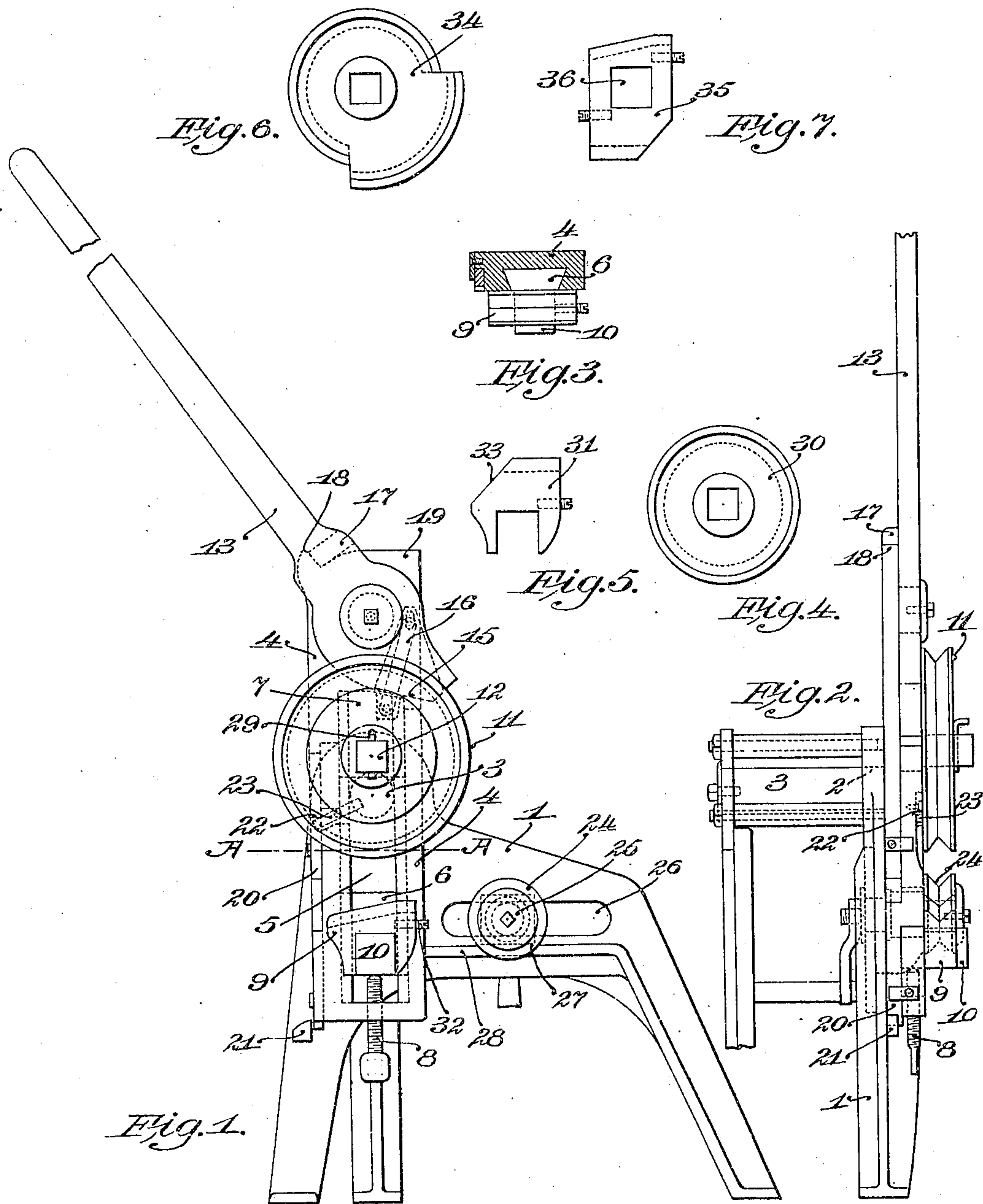


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PATENTED FEB. 19, 1907.

L. H. GARDNER.
BENDING MACHINE.
APPLICATION FILED JAN. 6, 1904.



Witnesses
Edward S. Day
Alfred H. Hildreth

Inventor
Sam bert H. Gardner
by his Attorneys
Phillips Van Kuren Fish

UNITED STATES PATENT OFFICE.

LAMBERT H. GARDNER, OF CAMBRIDGE, MASSACHUSETTS.

BENDING-MACHINE.

No. 844,789.

Specification of Letters Patent.

Patented Feb. 19, 1907.

Application filed January 6, 1904. Serial No. 187,876.

To all whom it may concern:

Be it known that I, LAMBERT H. GARDNER, a subject of the King of the United Kingdom of Great Britain and Ireland, residing at Cambridge, in the county of Middlesex and State of Massachusetts, have invented certain new and useful Improvements in Bending-Machines; 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 appertains to make and use the same.

This invention relates to an improvement in bending-machines.

The object of the invention is to reorganize and improve machines of this kind in various ways, which will be apparent from the following specification.

To this end the invention consists in the bending-machine hereinafter described, and particularly defined in the claims.

In the drawings, Figure 1 is a front elevation of the bending-machine. Fig. 2 is a side elevation looking from left to right in Fig. 1. Fig. 3 is a section, on line A A, Fig. 1, of the rotatable head and parts carried thereby. Fig. 4 shows a former; and Fig. 5 shows the cooperating gripping-jaw for use in making a bend of short radius, while Figs. 6 and 7 show modified forms of former and gripping-jaw.

The machine comprises, briefly, a standard, upon which is pivotally mounted a rotatable head carrying a former and a cooperating gripping-jaw for gripping the pipe or rod to be bent. The jaw is adjustably fixed to the head, and the former has a sliding motion thereon. A lever is attached to the head for rotating the same to bend the pipe or rod, and this lever is secured to the head by pivotal connection and is connected with the movable former, so that the motion of the lever acts also to move the former into engagement with the work and cause it with the cooperation of the gripping-jaw to grip the work prior to the rotation of the head. A roller mounted on the standard is engaged by the work and cooperates with the former in bending the work. A latch carried by the head prevents rotation thereof until the former has moved into position to engage the work.

The standard 1 has journals 2 supporting the stem 3, upon which is secured the rotatable head 4. The head has a dovetailed slot 5, in which are mounted two slides 6 and 7,

upon which are mounted the former and gripping-jaw, respectively. The slide 6 rests upon a screw 8, which fixes in position the slide and the jaw 9, carried upon a square projection 10 from the said slide. The former 11 is circular in form and is mounted upon a square projection 12 from the slide 7. The working faces of the former and gripping-jaw are preferably grooved in order to hold the work securely and to prevent as far as possible lateral distortion in the bending of pipe. The lever 13, pivotally connected to the head 4, serves both to rotate the head and to operate the movable former 11. The latter function is performed by means of a cam-surface 15, engaging the top of the slide 7 to move the same downward when the lever is turned to the right, and a link 16, connecting the lever and the slide to draw the slide back when the lever is turned to the left. A dog 17 on the lever engages in the extreme positions thereof surfaces 18 and 19 on the head, which acts as stops to limit the motion of the lever with respect thereto.

Mounted upon the side of the head 4 is a bar 20, which is free to slide up and down for a short distance on the head. The lower end of the bar engages a stop 21 on the standard and acts as a latch to prevent rotation of the head on the standard when the bar is in its lower position. The upper end of the bar has a shoulder 22, engaged by a lever 23, pivoted at its middle to the head. The inner end of the lever 23 is in position to be engaged by the bottom of the slide 7 when in its lowermost position. A grooved roller 24 serves as an abutment for the work and is mounted to turn on the stud 25, which is adjustably secured in a slot 26 on the standard. The stud has a square portion 27, which rests upon the ledge 28 on the standard in order to support the stud against the downward pressure of the work.

The operation of the machine is as follows: A piece of pipe or other material to be bent is laid upon the jaw 9 and the roller 24, the head and the lever 13 being in the position shown in the drawings. The screw 8 is then turned to adjust the jaw 9 into such position that when the lever 13 has been drawn as far to the right as possible with respect to the head and the former 11 has been moved downward as far as possible and the bar 20 has been raised the work shall be gripped between the former and gripping-jaw. After this adjustment the lever 13 is then drawn to the

right. During the first part of its motion the head is prevented from rotation on the standard by the latch 20, so that the effect of the movement of the lever is to force the former 11 down against the pipe, so as to grip it. As soon, however, as the jaw reaches the lower limit of its movement the latch, through the operation of the lever 23, is disengaged from the stop 21, and the continued motion of the lever 13 causes the head to rotate about the stem 3, thereby, with the coöperation of the roller 24, bending the pipe about the curved periphery of the circular former 11. This action may be continued until the pipe has been bent through a quarter of a circle. Upon a reverse action of the lever the slide 7 and former 11 are drawn away from the work by the link 16, and the head is rotated to its original position. If it is desired to give a half-bend to the pipe, this action may be repeated, and if a reverse bend or offset is desired the pipe will be first inverted.

The radius of the curved portion of the pipe will depend upon the radius of the former 11. It is contemplated, therefore, to provide two or more interchangeable formers of different diameters. The former 11 is secured to the projection 12 by a pin 29, which may be easily removed and the former 11 exchanged for a smaller former like that shown in Fig. 4. In order that readjustment of the slide 6 by the screw 8 may not be required when the circular formers are interchanged, several interchangeable gripping-jaws are provided, of different heights, so as to coöperate with the corresponding circular formers of different diameters. Thus when the former 30, Fig. 4, is used the gripping-jaw 9 may be replaced by the gripping-jaw 31, which is considerably higher, so that a pipe or rod of the same size may be properly gripped between the former and jaw without readjustment of the slide 6.

The roller 24 and the stud upon which it is carried are moved along the slot 26, so as to adjust the roller longitudinally of the work, and the position of the roller depends upon the diameter of the pipe or rod which is to be bent. For a large rod the roller may be moved nearer the outer end of the slot than for a small pipe or rod. Owing to the inclination of the grooved surface of the jaw 9, this adjustment of the roll 24 is also useful to secure coincidence between the working face of the roll and the working face of the jaw 9 when the latter is adjusted up or down by the screw 8 to accommodate work of different diameters. During the bending of the pipe or rod after the lever 13 has been moved far enough to grip the work, the dog 17 engages the stop 19 and prevents further downward movement of the former, so that however strongly the lever may be pulled to bend the work there will be no danger of crushing the work between the former and jaw if it be a

thin pipe. The parts are so proportioned that the center of the circular former substantially coincides, when the former is in its gripping position, with the center of rotation of the stem 3, upon which the head turns.

In making quarter-bends it is frequently desirable to so locate the bend that the line of one portion of the pipe shall be at a given distance from the end of the other portion, and in order that this may be done in the present machine a gage has been provided which consists of a pin 32, screwed into the gripping-jaw. In practice the given distance is marked off from one end of the pipe, which is then placed in the machine with that end of the pipe to the right, as seen in Fig. 1, and with the mark directly above the end of the gage 32. The length of the gage is such that if the machine be now operated a quarter-bend will be produced at such a point that the distance from the end of one portion of the pipe to the line of the portion at right angles thereto shall be the given distance.

Each of the interchangeable gripping-jaws may have a similar fixed gage secured to it, and the gages once fixed will need no further adjustment. The left-hand corner 33 of the jaw 31 is beveled for convenience in making a quick reverse bend or offset.

In Figs. 6 and 7 are shown modified forms of former and jaw, former 34 comprising two circular portions of different radii of curvature, while jaw 35 is provided with two oppositely-placed working faces at different distances from the square aperture 36 to receive the square projection 10, upon which the jaw is to be mounted. A gage is provided for each working face. By the use of these double formers and jaws the number of different bends possible with a given number of parts is doubled, and as in many classes of work bends of two different radii of curvature are sufficient only one set of formers and jaws is necessary and all danger of losing detached formers and jaws is avoided. When it is desired to change from one radius of bend to the other, it is necessary simply to remove the former and jaw, turn them through one hundred and eighty degrees, and then replace them on their supports, no change in the adjusting-screw 8 being required, because the face of the jaw 35, which coöperates with the portion of less curvature on the former 34, is at a corresponding greater distance from the aperture 36.

Although the formers 11 and 30 are shown as circular disks, the present invention is not limited thereto, as only the working faces of these formers may be circular. Moreover, although the formers 11 and 30, as well as the working faces of former 34, are shown as arcs of circles, it is to be understood that it is not essential that the bends be all arcs of circles, as it is within the purview of the present invention to make these formers with a curved

face of any desired shape according to the character of the work.

The arrangement of the lever 13, the head 4, and the slide 7 secure the advantage that a single motion of the lever is sufficient not only to grip the pipe or rod, but also to bend the same to the required angle, a feature which results in great saving of time in the use of the machine.

Although a preferred construction of the invention has been particularly shown and described, the invention is not limited to the illustrated embodiment thereof, but may be embodied in many other forms which are broadly described in the claims.

Having thus described my invention, I claim as new and desire to secure by Letters Patent of the United States—

1. A bending-machine, having, in combination, a rotatable former, means including an actuating device for rotating the former, independent means for gripping the work, an abutment for the work, and a single actuating device for actuating both of said means, substantially as described.

2. A bending-machine, having, in combination, a rotatable former, means including an actuating device for rotating the former, independent means for gripping the work, an abutment for the work, and a single lever constructed and arranged when moved in one direction to actuate, first, the means for gripping the work, and then the means for rotating the former, substantially as described.

3. A bending-machine, having, in combination, a rotatable former, means including an actuating device for rotating the former, independent means for gripping the work, an abutment for the work, and a single lever constructed and arranged when moved in one direction to actuate, first, the gripping means to grip the work, and then the means for rotating the former to bend the work, and, when moved in the opposite direction, to actuate, first, the gripping means, to release the work, and then the means for rotating the former to return the former to its original position, substantially as described.

4. A bending-machine, having, in combination, a rotatable former, means including an actuating device for rotating the former, independent means for gripping the work including a gripping-jaw cooperating with the former, an abutment for the work, and a single actuating device for relatively moving the former and jaw to grip the work, and for rotating the former, substantially as described.

5. A bending-machine, having, in combination, a rotatable head, a former movably mounted thereon, a gripping-jaw carried by the head and cooperating with the former to grip the work, and means for moving the former to engage the work and for rotating the head, substantially as described.

6. A bending-machine, having, in combination, a rotatable head, a former movably mounted thereon, a gripping-jaw adjustably supported on the head and cooperating with the former to grip the work, and means for moving the former to engage the work and for rotating the head, substantially as described.

7. A bending-machine, having, in combination, a standard, a head rotatably mounted thereon, means for rotating the head, a former mounted on the head, a jaw cooperating therewith, means for relatively moving the former and jaw to grip the work, a latch for preventing rotation of the head on the standard, and means for operating the latch to release the head when the former and jaw have gripped the work, substantially as described.

8. A bending-machine, having, in combination, a standard, a head rotatably mounted thereon, means for rotating the head, a former mounted on the head, a cooperating jaw adjustably mounted on the head, means for relatively moving the former and jaw to grip the work, a latch for preventing rotation of the head on the standard, and means for operating the latch to release the head when the former and jaw have gripped the work, substantially as described.

9. A bending-machine, having, in combination, a standard, a head rotatably mounted thereon, means for rotating the head, a former and a cooperating jaw carried by the head for gripping the work, and a roller on the standard for engaging the work, and having provision for adjustment longitudinally of the work, substantially as described.

10. A bending-machine, having, in combination, a rotatable head, a former mounted on the head, a gripping-jaw cooperating therewith, a lever pivoted to the head, means operated by the lever for relatively moving the former and jaw to grip the work, and stops to limit the motion of the lever with relation to the head, substantially as described.

11. A bending-machine, having, in combination, a rotatable head, a former mounted on the head, a gripping-jaw cooperating therewith, a lever for rotating the head pivotally mounted thereon, and a cam-surface on the lever for relatively moving the former and the gripping-jaw to grip the work when the lever is operated to rotate the head, substantially as described.

12. A bending-machine, having, in combination, a rotatable head, a former movably mounted on the head, a gripping-jaw cooperating therewith, a lever for rotating the head pivotally mounted thereon, a cam-surface on the lever for moving the former into engagement with the work, and connections between the lever and the former for withdrawing the former from the work, substantially as described.

13. A bending-machine, having, in combination, a rotatable former, means for gripping the work, and a gage for positioning the work in the machine to locate the line of one arm of the bend at a predetermined distance from the end of the other arm of the bend, substantially as described.

14. A bending-machine, having, in combination, a rotatable head, a former mounted thereon, a gripping-jaw cooperating with the former to grip the work, and a gage on the jaw for positioning the work in the machine to locate the line of one arm of the bend at the predetermined distance from the end of the other arm of the bend, substantially as described.

15. A bending-machine, having, in combination, a former having a plurality of concentric circularly-curved segmental gripping-faces of different radii, and means for supporting the former so that one or another of said faces may be in operative position, substantially as described.

16. A bending-machine, having, in combination, a former-support, a former mounted thereon and having a plurality of curved faces each concentric with said support, a jaw-support, a gripping-jaw mounted thereon and having a plurality of faces at different distances from said jaw-support, so as to cooperate respectively with the several faces of the former, substantially as described.

17. A bending-machine, having, in combination,

a rotatable head, a former movably mounted thereon, and having a circular working face, a gripping-jaw cooperating therewith to grip the work, and means for moving the former to engage the work arranged to move and hold the former in a position in which the center of curvature of the former coincides with the center of rotation of the head, substantially as described.

18. A bending-machine having, in combination, a rotatable former, means including an actuating device for rotating the former, an independent gripping device, connections between the gripping device and the actuating device, and an abutment for the work, substantially as described.

19. A bending-machine, having, in combination, a rotatable former, a gripping-jaw cooperating therewith, means for relatively moving the former and jaw to grip the work, means for rotating the former to bend the work, a latch for preventing rotation of the former, and means for operating the latch to release the former when the former and jaw have gripped the work, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

LAMBERT H. GARDNER.

Witnesses:

ALFRED H. HILDRETH,
BEULAH H. BARRETT.