



# UNITED STATES PATENT OFFICE.

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## PIPE-BENDING MECHANISM.

SPECIFICATION forming part of Letters Patent No. 655,259, dated August 7, 1900.

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*To all whom it may concern:*

Be it known that I, JAMES ACTON MILLER, a citizen of the United States, residing at New Haven, in the county of New Haven and State of Connecticut, have invented certain new and useful Improvements in Pipe-Bending Mechanism, of which the following is a specification.

My invention relates to pipe-bending machinery, and has for its object to provide improved mechanism for the rapid coiling of pipe, and particularly short pipe elbows and returns or bends near the threads and of less than an entire convolution or coil.

The invention consists in the novel gripping device for seizing the threaded end of the pipe, the frictionless removable resisting-bearing, and in the arrangement and combination and construction of parts, as hereinafter more fully described and claimed.

In the accompanying drawings, forming a part of this specification, Figure 1 is a rear elevation of my improved bending-machine, and Fig. 2 is a front elevation of the same. Fig. 3 is a plan view with the bending-former shown in central section on the horizontal line *xx* of Fig. 2, the gripping device and the resisting-bearing released, and the pipe shown as placed ready for being secured to the bending-former. Fig. 4 is a plan view showing the pipe gripped in place and the parts in position for the operation of bending. Fig. 5 is a vertical sectional view of the resisting-bearing, taken on the line *yy* of Fig. 4; and Fig. 6 is an end view of the same. Fig. 7 is a plan view of the machine with the bending-former and gripping device shown in horizontal section on the line *xx* of Fig. 2 and with the gripping device in clamped position. Fig. 8 is a vertical section through the gripping-stirrup on the line *xx* of Fig. 7.

Referring to the drawings, A designates the frame or table of the machine, having the upright power-shaft B suitably journaled in the table. Such shaft will usually be geared to derive the requisite power for bending large pipe, but the driving mechanism forms no part of the invention and need not here be shown, it being understood that the shaft may be rotated by any suitable means or power.

Upon the upper end of the power-shaft is secured a bending wheel or former D, having its periphery grooved to conform to the size

and shape of the pipe which it is adapted to bend. Said former does not comprise an entire wheel, as a portion of the circle is cut away on one side, as shown in Figs. 1, 3, 4, and 7, and a steel part E is secured thereto, having the threaded jaw *e'* tangential to the groove of the bending-wheel, as shown. The jaw is threaded to fit or receive the semicircumference of the ordinary threaded portion of the pipe, being practically one-half part of a split nut, and a corresponding jaw *f'*, forming the other half of the split nut, is secured in a stirrup F, which is hinged to the bending-former, the respective limbs of the stirrup passing upon the upper and lower sides of the wheel. Said jaws or half-nuts are slightly counterbored, as shown at 77 in Fig. 7, to receive the smooth portion of the pipe above the thread sufficiently to prevent the concentration of the bending strain at the base of the thread, and consequent breaking of the pipe at that place. The fixed jaw may have a plain groove, as the strain is least on that part.

The stirrup is hinged to the bending-former by a pivot, having a central journal 44 fitting the bearing in the bending-former, and is provided at its ends with journals 55, eccentric to the central bearing, which are received in the bearings in the ends of the upper and lower limbs of the stirrup. A lever 66 is secured to the upper end of the pivot above the stirrup, and by means of this construction the jaw *f'* may be powerfully clamped upon the pipe by a quarter-turn of said lever, when the stirrup and its jaw are swung around from the released position (shown in Fig. 3) to the clamping position, (shown in Fig. 4,) the lever in such clamping action being turned to bring the eccentric journal 44 on a dead-center, with the strain on the journals 55.

To prevent the pipe from swinging with the bending-former in operation, a resistance bearing or block H is provided, movably fitted between the ribs or guide-flanges *h'* on the frame as close as possible to the jaw *e'*. Said guides extend at a right angle to the pipe, and the resistance-bearing is adapted to slide in the groove or way thus formed toward or away from the pipe. The position of the resistance-block in operation is in juxtaposition to the pipe, as shown in Fig. 4; but for

the purpose of releasing the pipe or placing it in the machine it is requisite that the bearing be moved back to the position in Fig. 3. This movement may be accomplished, preferably, by a parallel motion comprising a pair of toggle-joints, with links  $h^2$   $h^3$ , coupled, respectively, to ears  $i$  on the bearing and ears  $j$  on a bracket  $k$  on the frame, the opposite ends of each pair of links being connected together to form toggle-joints, and the pair of joints being coupled by a link 88 to insure parallel movement of the joints. A handle or lever  $m$  is attached to one of the toggle-links for operating the same. In operation the movement of said lever between the positions shown in Figs. 3 and 4 will throw the resistance-block out of or into position for pipe-bending, and the toggles when in line, as shown in Fig. 4, will resist the thrust upon the bearing without yielding in the well-known action of toggle-joints. The resistance-bearing may comprise a block  $H$ , grooved on the side adjacent the pipe to receive the same, but is preferably provided with a semi-circular shell 37, which is perforated, as shown in Fig. 5, to receive antifriction-balls  $n$ , projecting slightly interiorly to the inner face of the shell and bearing against the internal surface of the block  $H$ . The pipe as it is drawn through the groove thus bears against the balls, reducing the friction and facilitating the process of pipe-bending in the operation of the bending-former.

In operation with the resistance-bearing drawn back and the gripping device released, as shown in Fig. 3, the pipe may be placed with its threaded end 9 in the jaw or half-nut  $e'$ , and the gripping device, with the jaw or half-nut  $f'$ , then swung around upon it, as shown in Fig. 4, which securely fastens the end in the jaw  $e'$ , and the gripping device then being tightened by the eccentric action and lever 66 the pipe will be held rigidly clamped to the bending-former. The resistance-bearing then being thrust up to the working position, as shown in Fig. 4, and the bending-former set into motion the pipe will be drawn around the bending-former, and thereby shaped as required, but retaining rotundity. When bent to form, the pipe may readily be disengaged from the machine by releasing the gripping device and resistance-bearing, as hereinbefore described.

In the action of this machine the use of a cooling or lubricating medium for chilling the threaded portion of heated pipes is contemplated. To this end flexible tubes  $r$  are connected with the jaws or half-nuts  $e'$  and  $f'$ , having suitable outlets  $t$  at the threaded surfaces thereof, as shown in Fig. 7, the tubes being connected with a source of water or cooling liquid, which is thereby conducted upon the threaded surface of the red-hot pipe and is adapted to chill that portion of the pipe gripped in the holding-jaws. Water may be similarly conducted into suitable cavities 72 in the block  $H$  and discharged

upon the pipe through suitable orifices 73 as the latter is drawn through the resistance-bearing for the purpose of superficially chilling the exterior surface of the pipe and insuring greater compression of the particles of metal at the internal side of the bend, thus preventing to a considerable degree the reduction of the original thickness of the pipe where bent by stretching or extension of the outer side of the pipe as it passes around the bending-former.

To lighten the resistance-block, flanges  $u'$  are cast upon the lower side thereof to be received between the guide-flanges  $h'$  on the table, it being unnecessary that all said space between the flanges be filled with metal. A shoulder 10 is provided on the shaft to support the bending-former, and a nut 12 at the upper end of the shaft secures the bending-former in place, but permits ready removal thereof for changing for different sizes of pipe. The resistance-bearing may also readily be changed if the bracket  $k$  is bolted or otherwise removably fastened to the table or frame.

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

1. In pipe-bending mechanism the combination of a bending-former, a fixed jaw or half-nut secured thereto axially tangential to the curve of the bending-former, and a movable jaw or half-nut hinged or pivoted to the bending-former and comprising with the fixed jaw a split nut for receiving and clamping a threaded pipe, substantially as and for the purpose specified.

2. In pipe-bending mechanism the combination of a bending-former, a fixed jaw or half-nut secured thereto axially tangential to the curve of the bending-former and a movable jaw or half-nut hinged or pivoted to the bending-former by an eccentric and comprising with the fixed jaw a split nut for receiving and clamping a threaded pipe substantially as and for the purpose specified.

3. In pipe-bending mechanism the combination of a bending-former a fixed jaw or half-nut secured thereto axially tangential to the curve of the bending-former a stirrup spanning the bending-former and hinged or pivoted thereto, a jaw or half-nut carried by the stirrup and comprising with the fixed jaw a split nut for receiving a threaded pipe, and clamping means for forcing the same together, substantially as and for the purpose specified.

4. In pipe-bending mechanism the combination of a bending-former, a fixed jaw or half-nut secured thereto axially tangential to the curve of the bending-former a stirrup carrying a jaw or half-nut and received upon or spanning the bending-former pivotally connected thereto and eccentric clamping means for compressing the movable jaw upon the fixed jaw, said jaws being counteracted to fit the unthreaded body of the pipe at the base of the thread in the operation of bending substantially as and for the purpose specified.

5. In pipe-bending mechanism the combination of a bending-former, clamping mechanism for securing a pipe to the former, a resistance-bearing fitting the pipe on the side of the strain and antifriction rolls or balls arranged in said bearing in a series around the periphery of the pipe-groove to sustain the thrust of the pipe against the bearings substantially as and for the purpose specified.

6. In pipe-bending mechanism the combination of a bending-former, clamping mechanism for securing a pipe to the bending-former, a movable resistance-bearing fitting the pipe on the side of the strain, friction rolls or balls arranged in said bearing in a series around the periphery of the pipe-groove to sustain the thrust of the pipe thereon and mechanism for throwing the bearing into working position against the pipe or releasing it therefrom, substantially as and for the purpose specified.

7. In pipe-bending mechanism the combination of a bending-former, clamping mechanism for securing the pipe to the bending-former, a movable resistance-bearing fitting the pipe on the side of the strain, friction rolls or balls arranged in said bearing to sustain the thrust of the pipe thereon, and a toggle-joint acting between the bearing and an abutment on the frame and adapted for throwing the bearing in working position against the pipe or releasing it therefrom substantially as and for the purpose specified.

8. In pipe-bending mechanism the combination with a resistance-bearing of a pipe having an outlet within the pipe-receiving cavity of the bearing and adapted for connection

with a cooling-liquid supply for chilling the surface of the pipe preparatory to bending substantially as and for the purpose specified.

9. In pipe-bending mechanism the combination of a bending-former, threaded clamping mechanism for securing a pipe to the former, and a resistance-bearing provided with a groove or way fitting and adapted to receive the longitudinal semisection of the pipe and sustain the thrust thereof substantially as and for the purpose specified.

10. In pipe-bending mechanism the combination of a bending-former, a fixed jaw or half-nut secured thereto axially tangential to the curve of the bending-former, and a movable jaw or half-nut hinged or pivoted to the bending-former and comprising with the fixed jaw a split nut for receiving and clamping a threaded pipe, said jaws being provided with orifices within their threaded grooves or ways adapted to be connected with a cooling-liquid supply and to discharge the same upon the heated threaded portions of the pipe, substantially as and for the purpose specified.

11. In pipe-bending mechanism the combination of a bending-former provided with a pipe-receiving groove or seat, a threaded half-nut for engaging and clamping the threaded end of a pipe in said groove or seat, and clamping means for operating and holding the half-nut in position on the former, substantially as and for the purpose specified.

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Witnesses:

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