

5 SHEETS--SHEET 1.



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J. RUCKSTINAT.  
TUBE BENDING MACHINE.  
APPLICATION FILED JULY 29, 1912.

1,055,358.

Patented Mar. 11, 1913.

6 SHEETS—SHEET 2.

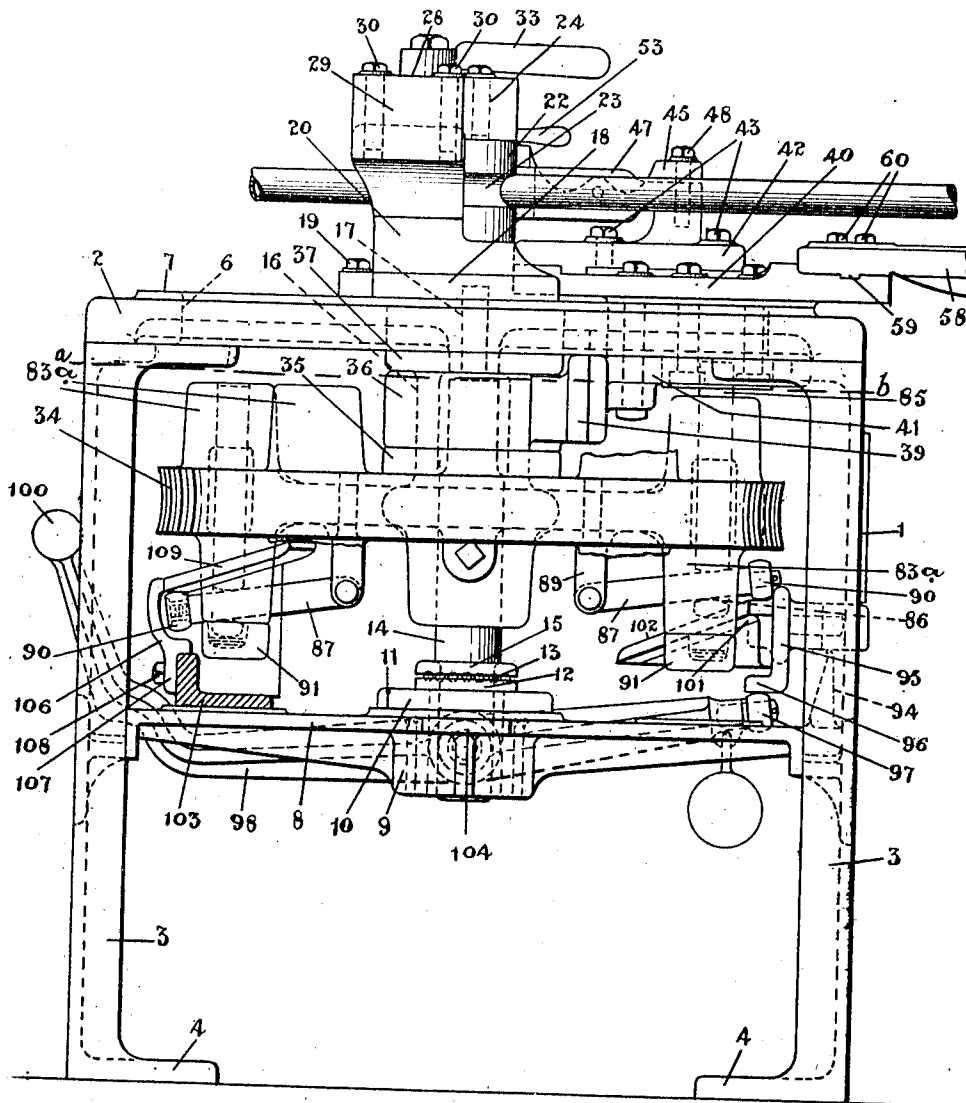


Fig. 2.

**Witnesses.**

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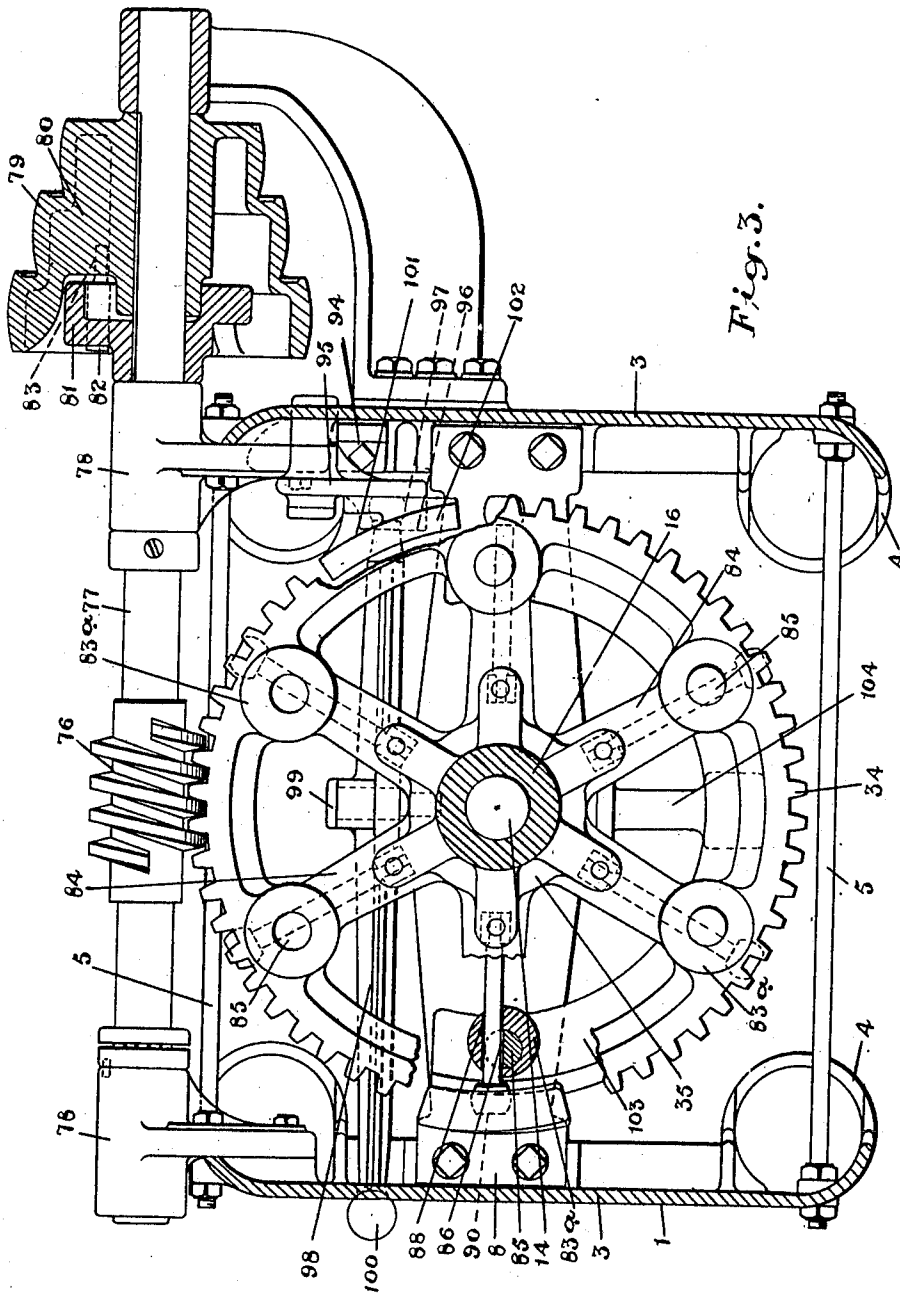
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5 SHEETS—SHEET 3.



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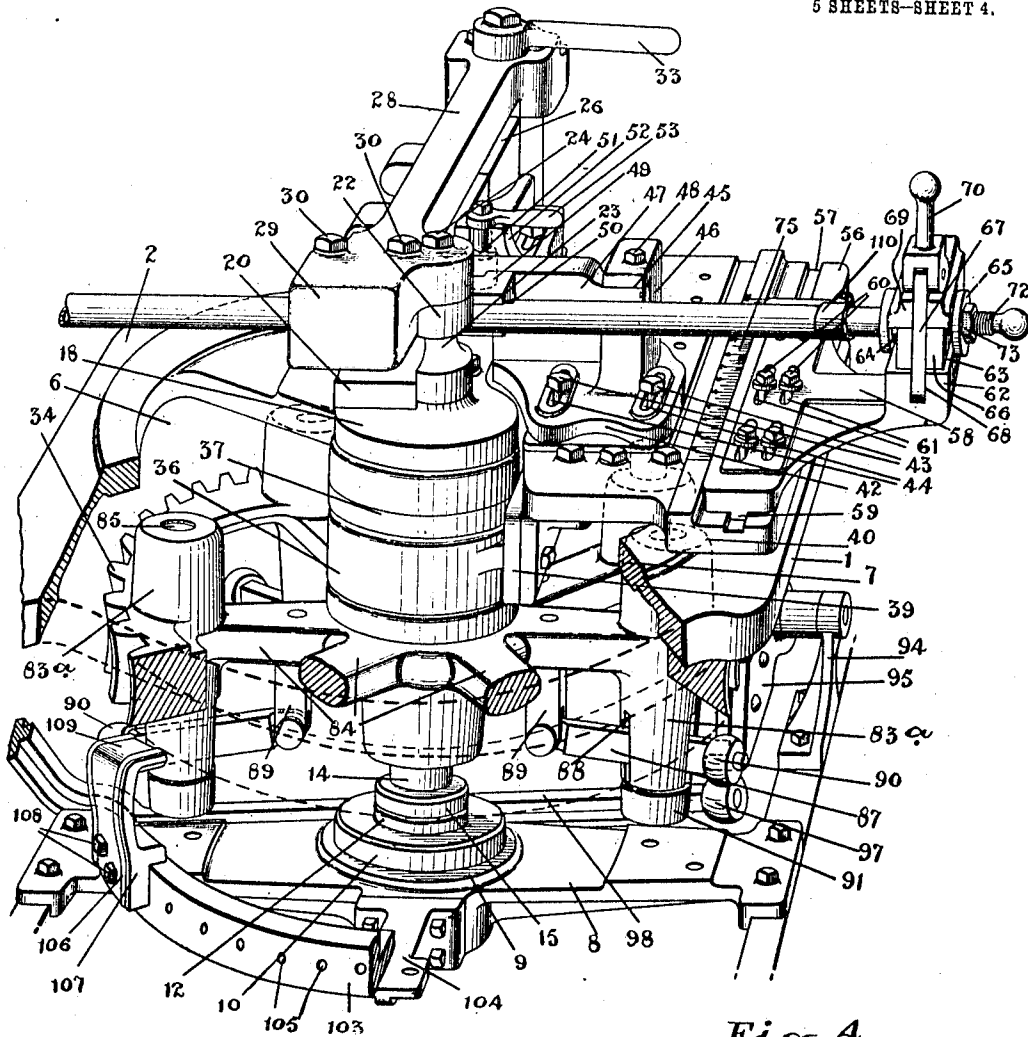


Fig. 4.

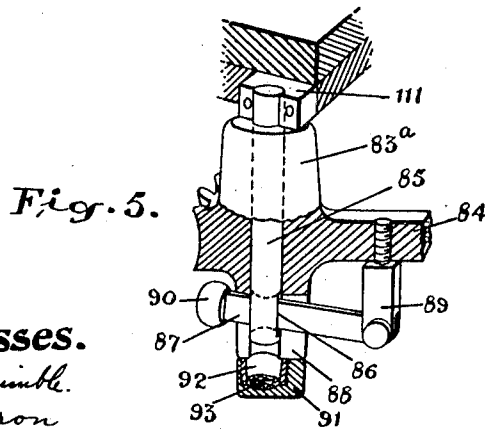


Fig. 5.

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5 SHEETS—SHEET 5.

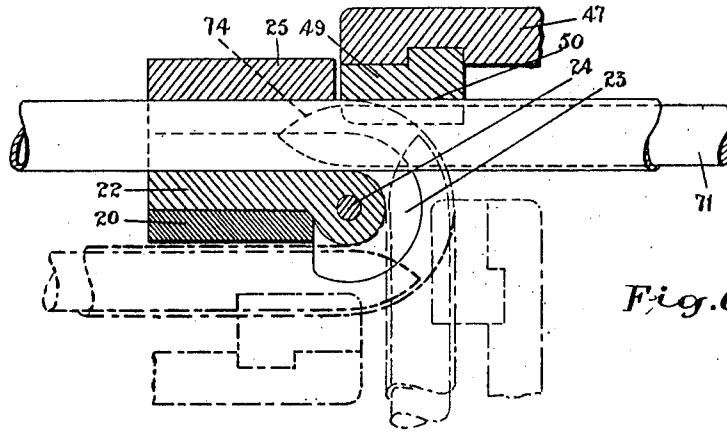


Fig. 6.



Fig. 7.

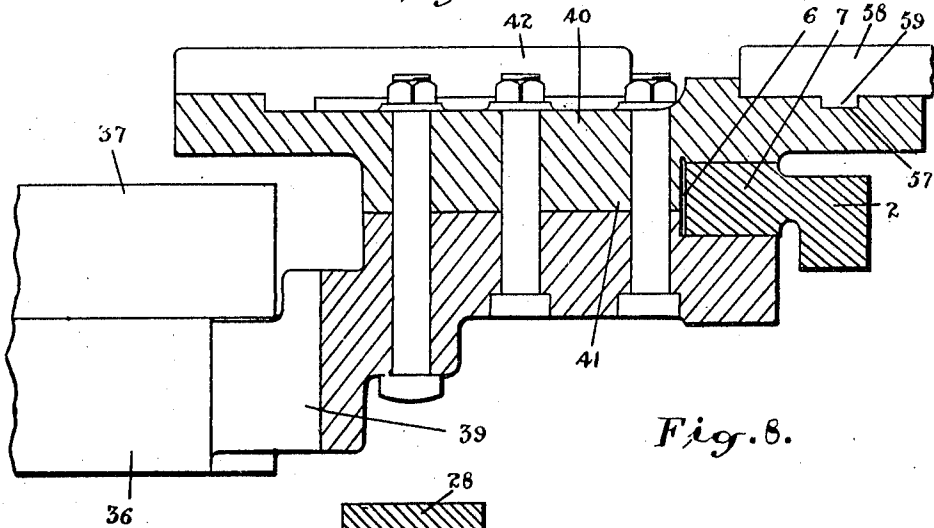


Fig. 8.

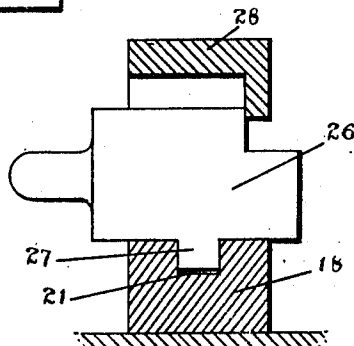


Fig. 9.

**Witnesses.**

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# UNITED STATES PATENT OFFICE.

JOHANNES RUCKSTINAT, OF TORONTO, ONTARIO, CANADA.

## TUBE-BENDING MACHINE.

1,055,358.

Specification of Letters Patent.

Patented Mar. 11, 1913.

Application filed July 29, 1912. Serial No. 712,036.

*To all whom it may concern:*

Be it known that I, JOHANNES RUCKSTINAT, a citizen of the United States of America, and resident of the city of Toronto, county of York, Province of Ontario, in the Dominion of Canada, have invented certain new and useful Improvements in Tube-Bending Machines, described in the following specification and illustrated in the accompanying drawings.

The invention consists essentially in the novel construction and arrangement of parts, whereby the tube is bent around a forming block and the metal thereof drawn to shape, the outer periphery of the bend being supported from the interior in the drawing operation.

The objects of the invention are, to reduce the cost of manufacture of bends of thin tubing used particularly in the manufacture of plumbing traps and to devise a machine for cold bending thin metal tubes of various sizes which will form the desired bend in one complete operation producing a bent tube with a smooth and uniform surface.

A further object of the present invention is to devise a machine of simple, strong and durable construction which may be very quickly and easily handled and may be set to form bends of various radii and various arcs.

In the drawings, Figure 1 is a plan view of a machine constructed in accordance with this invention and shown partly broken away. Fig. 2 is a front elevational view of the machine partly broken away. Fig. 3 is a horizontal sectional view on the line *a-b* Fig. 2, part of the mechanism being broken away to disclose other parts. Fig. 4 is a perspective view of a portion of the machine, parts thereof being broken away to disclose the construction of other parts. Fig. 5 is a sectional perspective detail showing the mechanism for transmitting motion to the swing table which carries the bending tools. Fig. 6 is a diagrammatic plan view of the former block and mandrel illustrating the bending of the tube. Fig. 7 is a detail view of a slight modification of the forming or

drawing end of the mandrel. Fig. 8 is a vertical sectional view through a portion of the table top and swing table. Fig. 9 is a vertical cross sectional view through the line *x-y* in Fig. 1.

Like numerals of reference indicate corresponding parts in each figure.

Referring to the drawings, 1 is the frame of the machine here shown formed of a table 2 supported upon a pair of side frames 3 spaced apart and resting on the feet 4.

5 are spacing rods arranged intermediate of the height of the side frames and extending therebetween. The top 2 is formed with a segmental central opening 6 therein of over half a circle, said opening being bordered by a circular slide-way 7 raised slightly above the upper surface of said top and extending below the lower surface.

8 is a transverse bracket member extending across the machine and supported at the ends on the side frames 3, intermediate of their height and rigidly secured thereto, said member 8 having a large central boss 9 formed therein, said boss having a centrally arranged cylindrical orifice therethrough.

10 is a bushing fitting within the circular orifice in the boss 9 and resting upon the annular shoulder 11.

12 is a hardened steel plate resting on the top of the bushing 10 and having a ball race formed on its upper horizontal face and carrying the ball bearings 13.

14 is a shaft vertically arranged and journaled at its lower end within the bush 10 and supported by a hardened steel ring 15 resting upon the thrust bearings 13. The upper end of the shaft is journaled in a bushing 16 secured centrally to the under side of the table 2.

17 is a dowel pin centrally located in the table 2 and centering the bushing 16 and projecting above the top of the table.

18 is the vise plate resting upon the table 2 and rigidly secured by the bolts 19, said plate being arranged parallel with the sides of the machine and extending from the back thereof forwardly and definitely located by the dowel pin 17 which extends into a hole in said vise plate.

- 20 is an upward projection at the forward end of the vise plate formed with a horizontal groove in its forward side.
- 21 is a longitudinal groove formed in the top of the vise plate 18.
- 22 is the former block adapted to fit snugly against the projection 20 of the vise 18 and having a semi-circular groove 23 in the vertical face thereof extending straight along one side and curving around in the arc of a circle the center of which is directly in line with the dowel pin 17.
- 24 is a cap screw extending through the center of the block 22 securing it in place.
- 25 is a clamping block resting upon the vise plate 18 and having a horizontal semi-cylindrical groove therein corresponding with the groove in the former block adapted to fit around and grip the tube securely.
- 26 are spacer blocks adapted to rest loosely on the plate 18 having depending tongue members 27 extending into the groove 21.
- 28 is a cap plate extending over the tops of the spacers 26 and having an overhanging portion 29 at the front end extending over the upstanding portion 20 of the plate 18, said cap plate being rigidly secured by the cap screws 30. The spacer blocks are so formed that they may be readily removed without disturbing the cap plate.
- 31 is a vertically arranged cam journaled at the bottom in the plate 18 and at the top in the cap plate 28, the central cam portion 32, shown in dotted lines in Fig. 1, being adapted to engage the spacers 26 and squeeze them tightly up against the clamping block 25, a suitable handle 33 being provided on the upper end of the cam spindle.
- 34 is a worm wheel fixedly secured to the vertical shaft 14 about mid-way between the bracket member 8 and the table 2.
- 35 is a collar encircling the lower end of the bushing 16.
- 36 is a collar journaled on the bushing 16 between the collar 35 and flange 37 and having a lug 39 projecting from one side thereof.
- 40 is a plate resting upon the table 2 and having a downwardly extending lug portion 41 extending through the segmental opening 6 in the said table and secured to the lug 39. The plate is thus rotatably supported to revolve concentrically about the center of the table 2.
- 42 is a plate member adjustably secured to the upper face of the plate 40 by the bolts 43 extending through the slots 44 in said plate 42.
- 45 is a boss rising from the plate 42 having a horizontal recess 46 in its front side forming a jaw.
- 47 is an arm pivotally secured within the recess 46 upon the bolt 48 secured in the boss 45.
- 49 is a swaging block secured to the free end of the arm 47 and formed with a horizontal semi-cylindrical groove 50 adapted to fit around the outer periphery of the tube to be bent extending beyond the clamping block 25.
- 51 is a cam having its spindle journaled in the raised portion 52 of the plate 42, said spindle having a handle 53 secured to its upper end. The cam 51 is operated to bear against the back of the arm 47 and press the swaging block 49 into engagement with the tube. When the cam is released the arm 47 is swung inwardly by the pressure of a spiral spring 54 encircling a bolt 55 extending through said arm and secured in the plate 42.
- 56 is a transverse guide-way formed on the outer upper side of the plate 40 and having a centrally arranged longitudinal groove 57.
- 58 is a bracket member slidably supported in the guideway 56 having a tongue 59 extending into the groove 57 and adjustably secured in position by the bolts 60 extending through the longitudinal slots 61 in said bracket. The outer upwardly extending end 62 of the bracket 58 is formed with a horizontal jaw opening 63.
- 64 is a sleeve fitting in the jaw opening 63 and having the annular flanges 65 at the ends overlapping the edges of the jaw.
- 66 is a block adapted to fit into the jaw opening and abut the sleeve 64 holding it securely in place.
- 67 is a link pivotally secured in a recess 68 in the lower part of the jaw 63 and is adapted to swing upwardly to engage the block 66 and to extend through a slot 69 in the top jaw member.
- 70 is a cam lever pivotally secured to the outer end of the link 67 and adapted to engage the top of the jaw to hold the link securely in place.
- 71 is the forming mandrel which is formed of a round bar of tool steel of a diameter to fit the interior of the tube to be bent, said mandrel extending through the sleeve 64 and being supported thereby and having its outer end 72 threaded and provided with a lock nut 73 for the purpose of adjustment. The inner end 74 of the mandrel is preferably formed tapering to a point, the taper being arc shaped and conforming to the arc of the circle of the outer radius of the inside of the tube when bent around the forming block. The mandrel is adjusted to position so that the line marking the change between the full diameter and the tapering portion is directly in alignment with the transverse radius of the forming block as clearly illustrated in the detail in Fig. 6. The mandrel is supported from the plate 40 and swings about the center of the

former block so that the point of the full diameter of the mandrel at the tapered end always remains in radial alinement with the center of said former block as the plate swings. The importance of this feature will be more fully dealt with farther on in the specification.

It will be seen from the drawings and description that as the plate 42 and bracket 58 are laterally adjustable they may be moved any desired distance from the transverse center line of the machine in order to bring the swaging block and mandrel into proper central alinement with the center of the tube held between the forming and clamping blocks. A suitable scale 75 is provided on the plate 40 adjacent to the edge of the bracket 58 to facilitate the setting of the machine. The worm wheel 34 is rotated by means of a suitable worm 76 carried on a shaft 77 horizontally journaled in the bearings 78 secured to the frame.

79 is a cone pulley rotatably supported on the shaft 77 and is formed with longitudinal webs 80 extending radially outward from the hub.

81 is a collar keyed to the shaft 77 and having a pin 82 removably secured therein, said pin having a reduced end 83 adapted to engage one of the webs of the pulley. The reduced end of the pin 82 is made sufficiently strong to transmit power to operate the machine but in the event of any undue stress occurring the pin will break and thereby save damage to the machine.

83<sup>a</sup> are a plurality of bosses formed integral with the worm wheel 34 adjacent to its periphery and equally spaced apart, said bosses extending above and below the radial arms 84 of said gear wheel. Each of the bosses 83<sup>a</sup> is bored vertically and the hardened steel bolts 85 are slidably arranged therein and adapted to project upwardly beyond the top of the bosses. Each of the bolts 85 is formed with notch 86 in one side thereof adjacent to the bottom and adapted to receive one of the arms 87 extending through the vertical slots 88 in the bottom portions of said bosses. The arms 87 are pivotally supported at their inner ends from the jaw members 89 rigidly secured to and projecting below the worm wheel 34. The arms 87 project outwardly beyond the bosses 83 and are provided at their outer ends with the rollers 90.

91 are caps secured to the lower reduced threaded ends of the bosses 83 having the recesses 92 therein filled at the bottom with a suitable shock absorbing material 93 forming cushions for the bolts 85.

94 is a bracket rigidly supported on one of the side frames and carrying a pivotal bracket member 95, said pivotal bracket member having an inwardly extending lat-

eral web portion 96 at the bottom which is adapted to engage the roller end 97 of the starting lever 98, said starting lever being pivotally supported on the stud 99 secured in the boss 9 and provided with a handle 100 extending through the opposite side of the frame.

101 is a cam plate rigidly secured to the vertical face of the pivotal bracket member 95 and formed with a curved and upwardly sloping track 102, said track being adapted to rest in the path of the rollers 90 on the outer ends of the arms 87 and to raise said arms as the gear rotates.

103 is a segmental member rigidly secured to the cross member 8 and to a rigid bracket 104 arranged at right angles to said cross bracket member, said segment having a plurality of bolt holes 105 arranged in its vertical web.

106 is a cam member having an angular shaped lower end 107 adapted to rest upon the segmental member 103 and to be secured thereto by the bolts 108 extending there-through into the bolt holes 105. The upper portion of the member 106 extends inwardly and forms a sloping track 109 which is adapted to engage the rollers on the ends of the arms 87 as the gear 34 rotates to draw them downwardly to their lowermost position.

In the operation of this machine, a forming block having the desired shape and diameter of recess to suit the size of pipe and diameter of bend required is placed in position on the vise block. The corresponding clamping block is then placed upon the vise plate 18 and a suitable number of spacers 26 are placed so that when the cam 31 is operated the clamp block 25 will grip the tube securely. The mandrel 71 is then placed in position and properly adjusted longitudinally and laterally and when this is set in position, the machine is ready for use. The operator inserts the tube to be bent between the former and clamping blocks and shoves it over the mandrel the desired length, a suitable stop collar 110 being adjustably secured on the mandrel. The cam 31 is then tightened by means of the handle 33 and the tube is clamped securely between the clamping block 25 and former block 22. The swaging block 49 is then brought into engagement with the outer surface of the tube by the operation of the cam 51 engaging the arm 47. The operator then pushes downwardly on the starting lever 100 thereby tilting the lever 99 by forcing the roller end 97 into engagement with the web 96, thereby swinging the pivotal bracket member 95 upwardly to bring the cam track 102 into its operating position. The raising of the cam track into the operating position brings it

into the path of the rollers 90 on the ends of the arms 87 and as the worm wheel 34 rotates constantly the first of the arms 87 coming in contact with the cam track will be swung upwardly. The upward movement of the arm 87 lifts the bolt 85 so that its upper end projects above the top of the boss and engages a hardened steel plate 111 secured to the underside of the rotatable plate 40. When the bolt 85 thus engages the plate 40 the said plate is swung on its pivot and as the mandrel 71 is carried on said plate the tube will be bent around the periphery of the former block. Immediately the tube starts to bend, the swaging and upsetting of the metal of the tube occurs but as the mandrel is provided with a tapering end formed with a radius corresponding to the radius of the interior wall of the outer side of the pipe bent, the metal of the said pipe will be supported thereby beyond the point where the swaging occurs. The swaging block 49 which is also carried upon the plate 40 follows around retaining a positive relative position in respect to the end of the mandrel and the metal is thus swaged or drawn to its shape. Owing to the peculiar formation of the mandrel the metal of the tube is supported from collapsing and the bend is completed with a smooth and regular surface free from dints, hollows and other imperfections.

When the operation of bending starts the operator releases the starting lever and the bracket member 95 and cam 102 swing downwardly out of the path of the rollers on the ends of the arms 87. The cam 106 is arranged at a suitable point on the segmental member 103 to engage the rollers on the ends of the arms 87 to swing said arms downwardly, thereby drawing the bolt engaging the plate 40 downwardly and finally withdrawing said bolt from engagement and releasing the plate. The plate 40 then stops and the bend is completed. The clamp cam 31 and swaging block cam 51 are then released and the former pipe is withdrawn from the end of the mandrel having a bend of the desired arc of a circle. The plate 40 which slides freely on the table 2 is then swung back to its original position and the device is ready for the bending of another length of tube, which is accomplished in the same manner. It will be readily understood that by shifting the cam 106 which actuates the release of the plate 40 by withdrawing the bolt 85, a bend of any desired arc may be given and by adjusting the gripping member and mandrel support and inserting a proper forming block, any desired radius of bend for any desired diameter of pipe within ordinary commercial limits may be made.

In Fig. 7 a modified form of mandrel end is shown. In this form the end is milled

off on one side on a radius and diameter corresponding with the desired bend and diameter of tube, so that the tube being bent will be supported for the maximum length on the horizontal center line.

With a machine such as described the bend is completed in one operation and a very great saving in both time and materials is thus effected. A further saving of time and the cost of production is made owing to the rapidity with which the machine may be operated.

What I claim as my invention is:—

1. In a tube bending machine, a table, a forming block secured to said table, means for clamping the tube to said forming block, a mandrel holder supported on said table and adapted to rotate about said forming block, a mandrel, a rotating member journaled beneath said table, and means carried by said rotating member adapted to be extended up through said table to engage and rotate said mandrel holder a part revolution.

2. In a tube bending machine, a table, a forming block secured to said table, means for clamping the tube to said forming block, a mandrel holder supported on said table and adapted to rotate about said forming block, a mandrel, a rotating member journaled beneath said table, means carried by said rotating member adapted to be extended up through said table to engage and rotate said mandrel holder, and means for disengaging said engaging means from said mandrel holder.

3. In a tube bending machine, a table supported on a suitable frame, a forming block centrally secured to said table, means for clamping the tube to said forming block, a vertical shaft journaled in said frame and centrally of said table, a plate member supported on said table and rotatably connected to said shaft, a forming mandrel rigidly supported on said rotatable plate and arranged in tangential arrangement with said forming block and adapted to extend into the tube to be bent, means secured to said shaft and adapted to engage and rotate said plate, and means for automatically arresting the movement of said plate.

4. In a tube bending machine a table supported on a suitable frame, a forming block centrally secured to said table, means for clamping the tube to said forming block, a vertical shaft journaled in said frame and centrally of said table, a plate member supported on said table and rotatably connected to said shaft, a forming mandrel rigidly supported on said rotatable plate and arranged in tangential arrangement with said forming block and adapted to extend into the tube to be bent, a horizontally arranged wheel secured to said shaft, means for ro-

tating said wheel, a vertically slidable bolt member carried on said wheel and adapted to project upwardly through an opening in said table and to engage said rotatable plate member, and means for automatically withdrawing said bolt to release said plate member.

5. In a tube bending machine, a table supported on a suitable frame and having a segmental central opening therein, a forming block centrally secured to said table, means for clamping the tube to said forming block, a plate member supported on said table and adapted to rotate concentrically thereon, a forming mandrel rigidly supported on said rotatable plate and arranged in tangential arrangement with said forming block and adapted to extend into the tube to be bent, a horizontally arranged wheel concentrically journaled below said table and having a plurality of vertically arranged bosses, said bosses having vertical cylindrical orifices therethrough and transverse slots at the bottom and extending radially across said orifices, bolt members slidably arranged in the orifices in said bosses and adapted to be extended upwardly above the top thereof, said bolt members having notches formed therein adjacent to the bottom and registering with the vertical slots, arms pivotally supported at their inner ends from said wheel and extending radially outward through the slots in said bosses and the notches in said bolts and projecting beyond said bosses, means for rotating said wheel, a cam member arranged in the path of movement of the outer ends of said radial arms and adapted to engage and swing said arms upwardly to move said bolts upwardly to engage the rotary plate member, and a cam member supported on said frame and adapted to engage the outer ends of said arms to swing them downwardly to withdraw said bolts from engagement with said plate member.

6. In a tube bending machine, a table supported on a suitable frame and having a segmental central opening therein, a forming block centrally secured to said table, means for clamping the tube to said forming block, a plate member supported on said table and rotatably connected to said shaft, a forming mandrel rigidly supported on said rotatable plate and arranged in tangential arrangement with said forming block and adapted to extend into the tube to be bent, a horizontally arranged wheel concentrically journaled below said table, a plurality of bolts vertically and slidably arranged in said wheel adapted to project upwardly to engage said rotatable plate member, radial arms pivotally supported at their inner ends on said wheel and engaging said bolts, a bracket member pivotally supported

from the frame of the machine, an upwardly inclined cam track secured to said pivotal bracket, a lever pivotally supported on the frame and adapted to swing said pivotal bracket upwardly to move said cam track into the path of the outer ends of said radial arms to engage said arms and swing them upwardly, means for rotating said wheel, and a cam member adjustably supported on said frame and adapted to engage the outer ends of said arms and to swing them downwardly.

7. In a tube bending machine, a table supported on a suitable frame and having a segmental central opening therein, a forming block centrally secured to said table, means for clamping the tube to said forming block, a plate member supported on said table and centrally journaled thereon, a forming mandrel rigidly supported on said rotatable plate and arranged in tangential arrangement with said forming block and adapted to extend into the tube to be bent, a horizontally arranged worm wheel journaled concentrically below said table, a plurality of bolt members vertically and slidably arranged in said worm wheel, pivotal arms engaging said bolts, means adapted to operate said arms to raise said bolts to engage the rotatable plate member, means adapted to operate said arms to withdraw said bolts from engagement with said rotatable plate, a driving shaft horizontally journaled in said frame and having a suitable worm meshing with said worm wheel, and a suitable pulley secured to said worm shaft.

8. In a tube bending machine, a table supported on a suitable frame and having a segmental central opening therein, a forming block centrally secured to said table, means for clamping the tube to said forming block, a plate member supported on said table and rotatably connected to said shaft, a forming mandrel rigidly supported on said rotatable plate and arranged in tangential arrangement with said forming block and adapted to extend into the tube to be bent, a horizontally arranged worm wheel concentrically journaled below said table, a plurality of bolt members vertically and slidably arranged in said worm wheel, a plurality of radial arms pivotally supported at their inner ends upon said wheel and engaging said bolts to slide them vertically, means adapted to swing said arms upwardly to bring said bolts into engagement with the rotatable plate on said table, a segmental member horizontally arranged and rigidly supported on the frame, a bracket adapted to be secured to said segmental member in various positions thereon, said bracket having an inclined cam track adapted to engage the outer ends of

said radial arms carried on said worm wheel and to swing them downwardly withdrawing the bolts from engagement with said rotatable plate member.

5 9. In a tube bending machine, a table supported on a suitable frame and having a segmental shaped orifice opening through the top thereof, a vise plate rigidly secured to the table and having an upwardly projecting forward end arranged adjacent to  
10 said table, a forming block formed with a straight portion adapted to rest on said vise plate and abut the said upwardly extending front portion thereof and formed with an  
15 arc shaped end arranged in concentric relation with said table and having a semi-circular groove formed in its vertical face, a clamping block having a horizontal semi-cylindrical groove in its vertical face and  
20 arranged on said vise plate and adapted to clamp the tube against the straight portion of said forming block, spacing blocks resting on said vise plate and engaging said clamping block, a cam member journaled on  
25 said vise plate and adapted to engage said spacing blocks, a plate rotatably supported concentrically on said table, a mandrel adjustably supported on said rotatable plate and adapted to be adjusted into central  
30 alinement with the tube held between the forming block and the clamping block, a gear wheel concentrically journaled below said table and rotating in a horizontal plane, means carried on said gear wheel adapted to  
35 be extended upwardly to engage said rotatable plate to cause said plate to rotate with said gear thereby swinging the mandrel around the circular end of said forming block, means for withdrawing said engaging  
40 means carried on said gear wheel from engagement with said plate, and means for rotating said gear wheel.

10. In a tube bending machine, a table supported on a suitable frame and having a  
45 segmental shaped opening through the top

thereof, a vise rigidly secured to the top of said table, a forming block secured to said vise having an arc shaped portion centrally arranged in relation to said table, means for clamping the tube to said forming block, a  
50 rotatable plate resting on said table and adapted to rotate centrally thereon, a bracket supported on said rotatable plate member and transversely adjustable thereon, said bracket having a rigid upstanding  
55 jaw portion at its outer extremity, a mandrel adjustably secured in said jaw and extending inwardly in tangential arrangement with the arc shaped end of the forming block and adapted to extend into the tube to  
60 be bent, means adapted to engage and rotate said rotatable plate, and adjustable means for disengaging said rotating means.

11. In a tube bending machine, a table supported on a suitable frame and having a  
65 segmental shaped opening through the top thereof, a vise rigidly secured to the top of said table, a forming block secured to said vise having an arc shaped portion centrally arranged in relation to said table, means for  
70 clamping the tube to said forming block, a rotatable plate resting on said table and adapted to rotate centrally thereon, a mandrel adjustably supported on said plate, a  
75 plate adjustably secured on said rotatable plate, a swaging block adjustably secured to said adjustable plate and adapted to engage the periphery opposite the forming block, means for holding said swaging block  
80 in engagement with the tube as it is being bent, means for rotating said rotatable plate, and means for arresting said rotating plate.

Signed at the city of Toronto, county of York, Province of Ontario, in the Dominion of Canada, this 13th day of July 1912.

JOHANNES RUCKSTINAT.

Witnesses:

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