June 10, 1930. C. N. MATTHEWS 1,762,234

TUBE BENDER

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Fig. 1

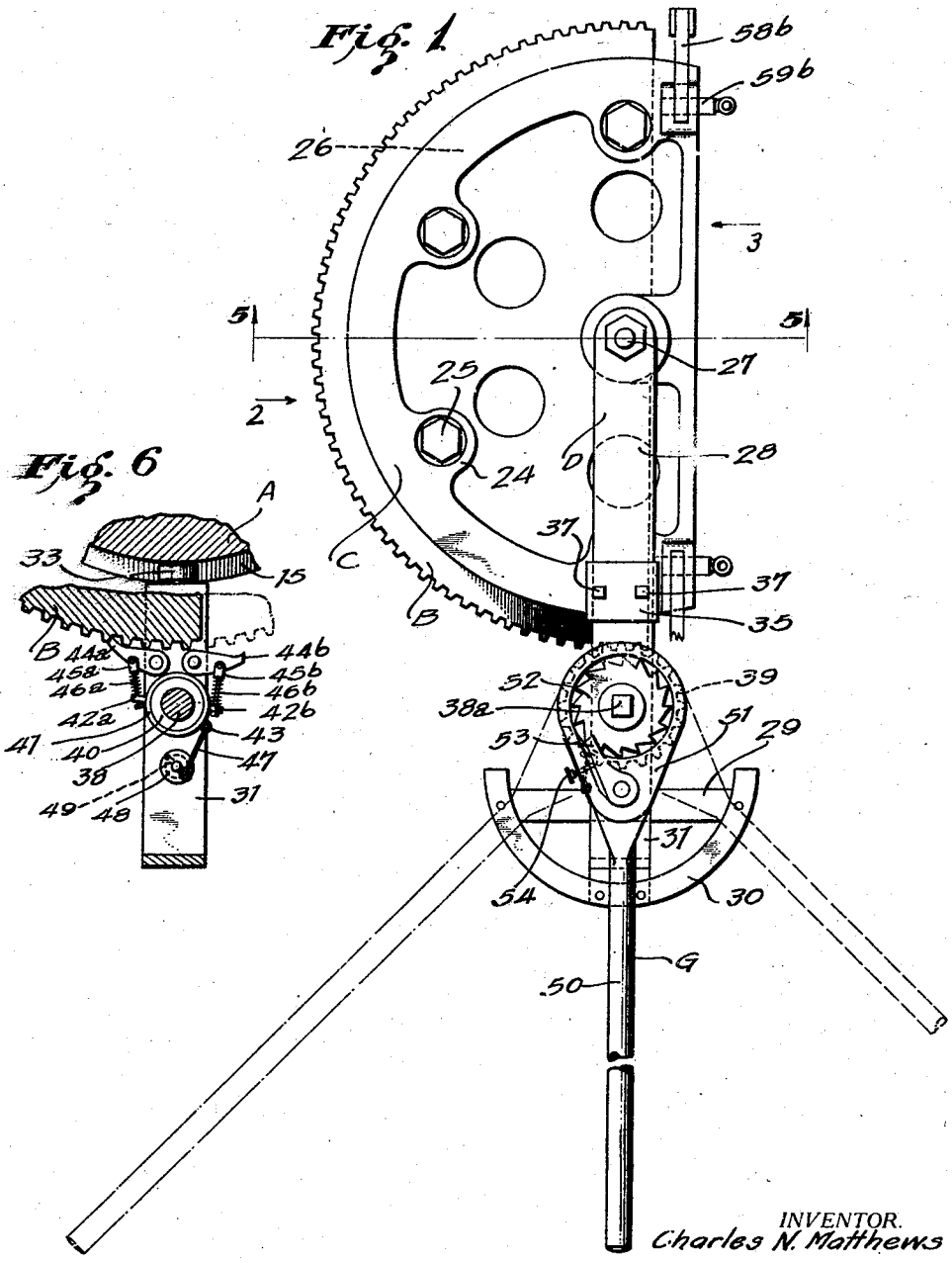


Fig. 6

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Fig. 2

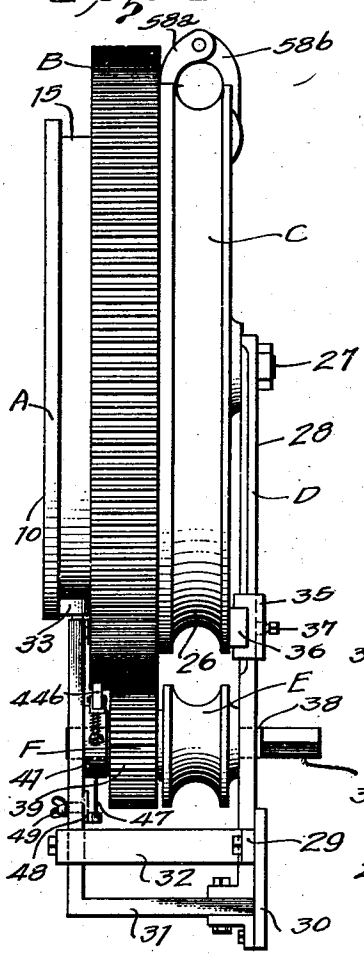


Fig. 3

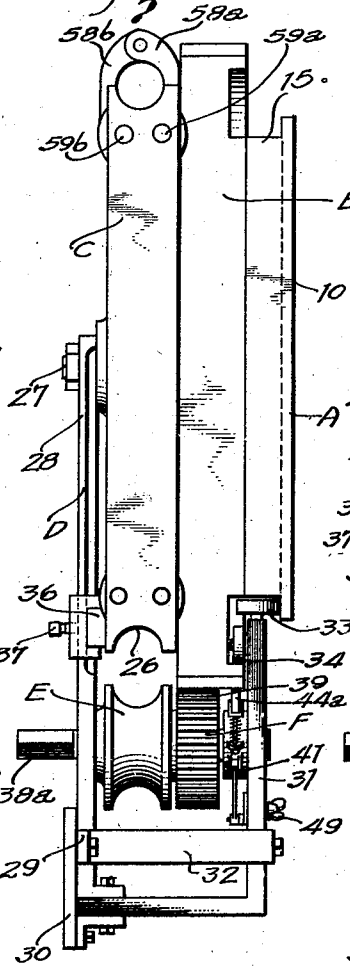


Fig. 4

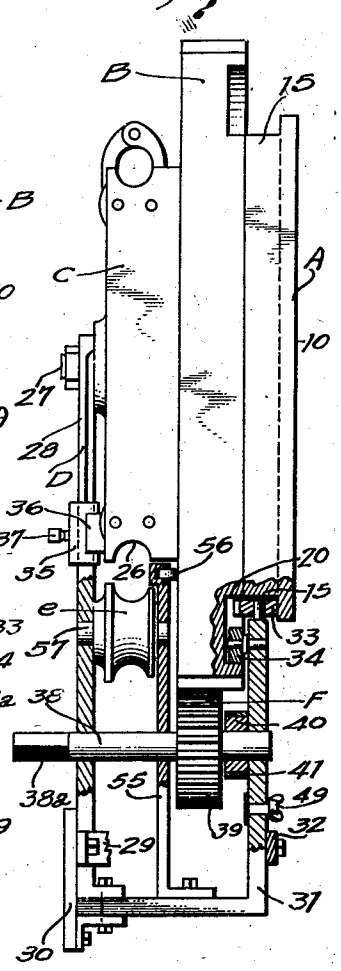
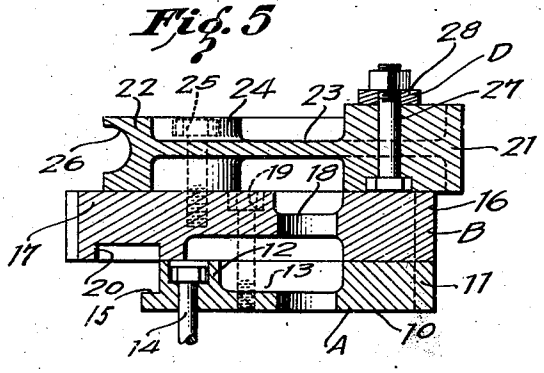


Fig. 5



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UNITED STATES PATENT OFFICE

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TUBE BENDER

Application filed December 27, 1928. Serial No. 328,750.

This invention relates to a bending machine designed to bend bars, tubes and the like in a curve. Heretofore, it has been common practice to provide a curved former having a grooved seat for a tube or bar, a lever pivotally mounted and carrying a bending roller. The tube or bar to be bent is clamped in position against the former between it and the bending roller and the lever swung to bend the bar or tube against the seat. This requires considerable force to be exerted to swing the lever. Furthermore, each machine has been limited to one size of bar or tube and one radius of curvature for the bend.

The objects of this invention are to provide a bending machine having power amplification means to cause travel of the bending roller over the bar or tube seat; to provide a bending machine having a former and roller arranged to be detachable and interchangeable with other formers and rollers to accommodate the machine to different sizes of bars and to different curvatures of bends. In addition to the broader objects of this invention, there are certain details of design contributing to simplicity, compactness and strength of construction.

These objects together with other objects and corresponding accomplishments are obtained by means of the embodiments of my invention illustrated in the accompanying drawings, in which:—

Fig. 1 is a plan view of a complete assembly, the upper cover plate of the ratchet handle being removed to better illustrate the ratchet structure; Fig. 2 is a front view as seen looking in the direction of the arrow 2 in Fig. 1; Fig. 3 is a rear view looking in the direction of the arrow 3 in Fig. 1; Fig. 4 is a view similar to Fig. 3 showing another size of former and its coacting roller, parts being shown in section to better illustrate the invention; Fig. 5 is a section as seen on the line 5—5 of Fig. 1; and Fig. 6 is a fragmentary section in plan showing the reversible ratchet.

Referring with more particularily to the drawings, A indicates a semi-circular base plate arranged with suitable bolt holes and serving for attaching the base plate to a bench or table in horizontal position. The base plate has bolted thereto a semi-circular rack B which comprises a segmental gear. Detachably bolted to the rack B is a former marked C in Figs. 1, 2, 3 and 5 and *c* in Fig. 4. Pivotally secured to the former is a lever indicated generally by D. Journalled on the lever is a bending roller to coact with the former seat marked E in Figs. 1, 2 and 3 and *e* in Fig. 4. A pinion F is journalled on the lever and meshes with the rack, it having a stub shaft to receive a ratchet handle G.

The base plate A corresponds in curvature to the rack. It has a flat lower face 10 so as to lie flush against the table or bench surface to which it may be bolted. There is a hub portion 11 and a rim portion 12 with an intermediate cut-away portion 13. The upper surface of the rim and hub are in alinement. Bolt holes with sockets for the heads of bolts to be sunk therein are provided, and bolts 14 mounted therein for securing the base plate in position upon a bench. A peripheral recess 15 serves as a track for a roller as is later described.

Rack B has a hub portion 16 and a rim 17 joined by a web 18. In the web are bolt holes registering with corresponding bolt holes in the base to receive bolts 19 for securing the rack and base together. Gear teeth are provided on the periphery of the rim. On the under face of the rim is a recess 20 serving as a track for a roller. A former C is shown bolted to the rack in Figs. 1, 2, 3 and 5. This former has a hub 21 and a rim 22 joined by a web 23. Bosses or projections are provided adjacent the rim as indicated by 24 which have bolt holes and sockets for the heads of bolts 25 securing the former to the rack, there being alined tapped bolt holes in the rack. The former *c* shown in Fig. 4 is of like construction, but smaller in curvature and there are bolt holes in the rack which will register with the bolt holes in the former *c*. In other respects, former *c* is like former C except as to dimensions. In the periphery of the former is a semi-circular groove 26 serving

as a seat for the tube to be bent. An opening is provided in the hub 21 concentric with the periphery of the rack B for receiving a bolt 27 serving as a spindle for the bending lever D.

Referring particularly to Figs. 1, 2 and 3, the lever D comprises an arm 28 mounted upon spindle 27. Secured to the end of the arm 28 is a cross member 29 having a guide track 30 for the ratchet handle G. Bolted to the under side of the rail 30 is an L shape arm 31, there being a brace 32 to add to the stability. Journalled upon a trunnion extending from the end of arm 31 is a roller 33 riding in way 15 of the base plate. A roller 34 is journalled on a spindle mounted on top of arm 31 and travels in way 20. Slidably mounted upon arm 28 is a block 35 carrying rollers 36 which ride upon the upper surface of the former. Block 35 is adjustable as to position so that it may be accommodated to the particular former used, it being held in adjusted position by set screws 37. Journalled in arms 28 and 31 is a shaft 38 having a squared end 38^a to receive ratchet handle G. Keyed or otherwise secured to shaft 38 is a pinion 39 meshing with the teeth on rack B. Obviously, by turning the pinion, the lever A will be caused to swing.

To prevent retrograde movement of the lever, a pawl mechanism is provided consisting of a bushing 40 upon which is rotatably mounted a ring 41. Ring 41 has diametrically opposed ears 42^a and 42^b and a lug 43. Pawls 44^a and 44^b are pivotally mounted upon the arm 31, being secured to the corresponding ears 42^a and 42^b by links 45^a and 45^b which slidably pass through holes in the ears, the links being provided with abutment heads. Compression springs 46^a and 46^b embrace the links and act between the ears and pawls. The construction is such that the ring 41 may be positioned so as to maintain one pawl in engagement with the teeth on the rack and the other pawl retracted as shown in Fig. 6 or the positions of the pawls may be reversed by turning the ring. Turning of the ring is accomplished by means of a connecting link 47 secured to lug 43 at one end and at the other end to a pin on a disk 48. Disk 48 has a spindle journalled in arm 31 to which a wing 49 is affixed so that by turning the disk, the pawl mechanism may be disposed to prevent movement of the lever either in one direction or the other.

The ratchet handle comprises a handle portion 50 with a head 51 in which is journalled a ratchet wheel 52. The ratchet wheel 52 has a square opening to detachably receive the end 38^a of the pinion shaft. A pawl 53 is provided for engaging the teeth of the ratchet wheel and a manually operable post 54 provides for releasing the pawl from the ratchet. The particular details of the ratchet handle forms no part of the present invention and may be varied in its details.

In Figs. 1, 2 and 3 a bending roller E is shown journalled upon shaft 38, there being a sufficient space between the grooves in the bending roller and in the former to accommodate a tube. If a smaller former is used as shown in Fig. 4, the lever is demounted and a bar 55 bolted to arm 31. Bar 55 carries a roller 56 which rides upon the upper face of the rack. Suitable holes are provided in the arm 28 and corresponding holes in the bar 55 for receiving a shaft 57 upon which is journalled bending roller *e* to cooperate with the former *c*. Obviously, various sizes of formers may be used and bending rollers will be correspondingly mounted between arm 28 and bar 55.

In order to clamp the bar or pipe in position upon the former a clamp comprising jaws 58^a and 58^b is secured by pins 59^a and 59 to the former at the rear. Provision is made for securing the clamp at either side of the former so that bending may be performed from either end. A corresponding clamp for the smaller former is shown in Fig. 4.

In order to bend a pipe or bar, the latter is inserted in the clamp opening and between the bending roller and the former. The ratchet handle is then oscillated, the reversible pawl having been positioned to prevent retrograde movement. Oscillation of the ratchet handle causes rotation of the pinion and travel of the latter around the rack. This causes the lever to be swung and with it the bending roller so that the tube is pressed against the grooved seat in the former and bent to the desired shape.

What I claim is:

1. A bending machine comprising a peripherally curved rack, said rack having an undercut way, a former detachably secured to said rack including a peripherially arcuate tube seat concentric with said rack, a bending lever pivotally and detachably secured to said rack and former at the center of their arcs, said lever including a yoke arm having rollers journalled thereon and riding in said way, a pinion journalled on said lever and meshing with said rack, means to rotate said pinion to cause said lever to turn, and a bending roller journalled on said lever to coact with said seat.

2. A bending machine comprising a peripherally arcuate rack, said rack having an undercut way, a former detachably secured to said rack and including a peripherially arcuate tube seat concentric with said former, a bending lever pivotally and detachably secured to said rack and former at the center of their arcs, said lever including a yoke arm having rollers journalled thereon

and riding in said way, a pinion journalled on said lever and meshing with said rack, means to rotate said pinion to cause said lever to turn, a pawl mounted on said lever and engaging the teeth of said rack to prevent retrograde movement of said lever, and a bending roller journalled on said lever to coact with said seat.

3. A bending machine comprising a peripherally arcuate rack, a former detachably secured to said rack and including a peripherally arcuate tube seat concentric with said rack, a bending lever pivotally and detachably secured to said rack and former at the center of their arcs, a bending roller journalled on said lever to traverse said seat and coact therewith, a pinion journalled on said lever and meshing with said rack, said rack having an undercut way, said lever including a yoke arm having rollers journalled thereon and riding in said way, said pinion having a shaft provided with a stub end, a ratchet handle on said stub end to rotate said pinion and turn said lever, and a reversible pawl mechanism mounted on said lever and engaging the teeth of said rack to prevent retrograde movement of said lever.

In witness that I claim the foregoing I have hereunto subscribed my name this 15th day of December, 1928.

CHARLES N. MATTHEWS.