

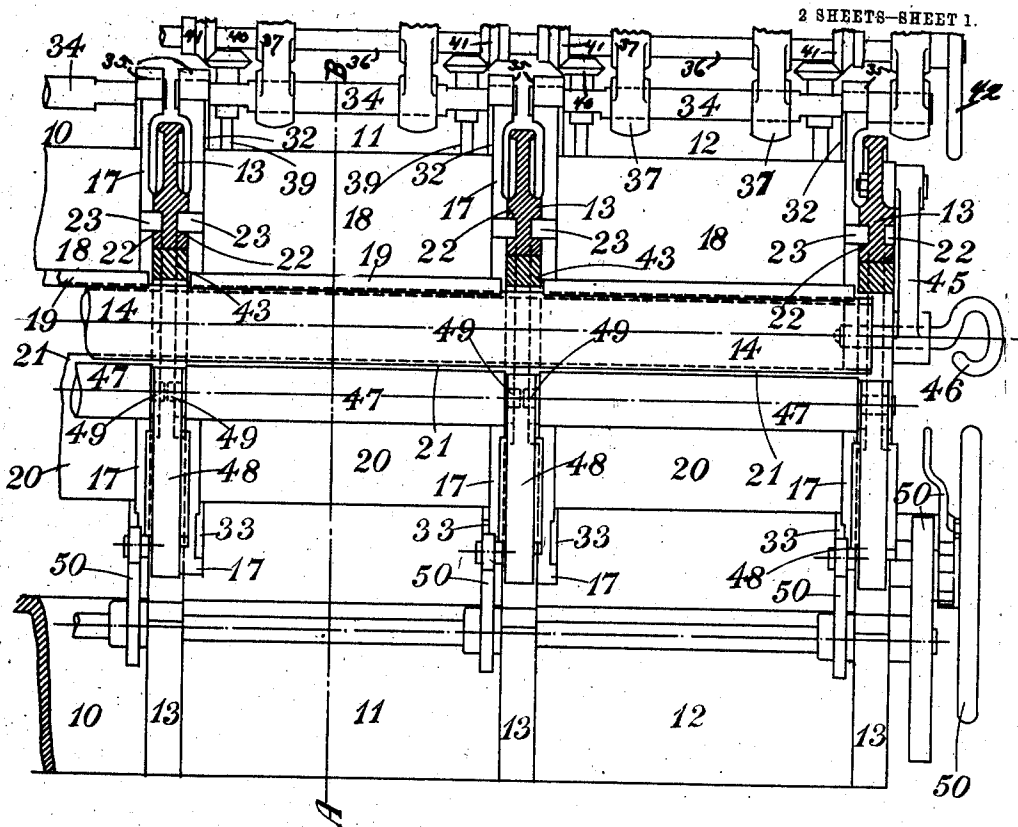
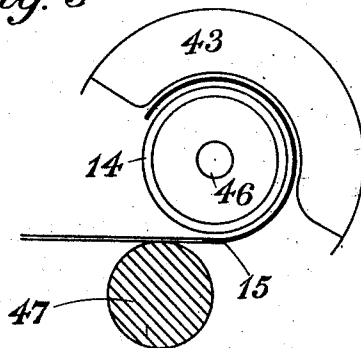


Fig. 1.

Fig. 5



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TUBE ROLLING MACHINE.
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2 SHEETS—SHEET 2.

Fig. 2.

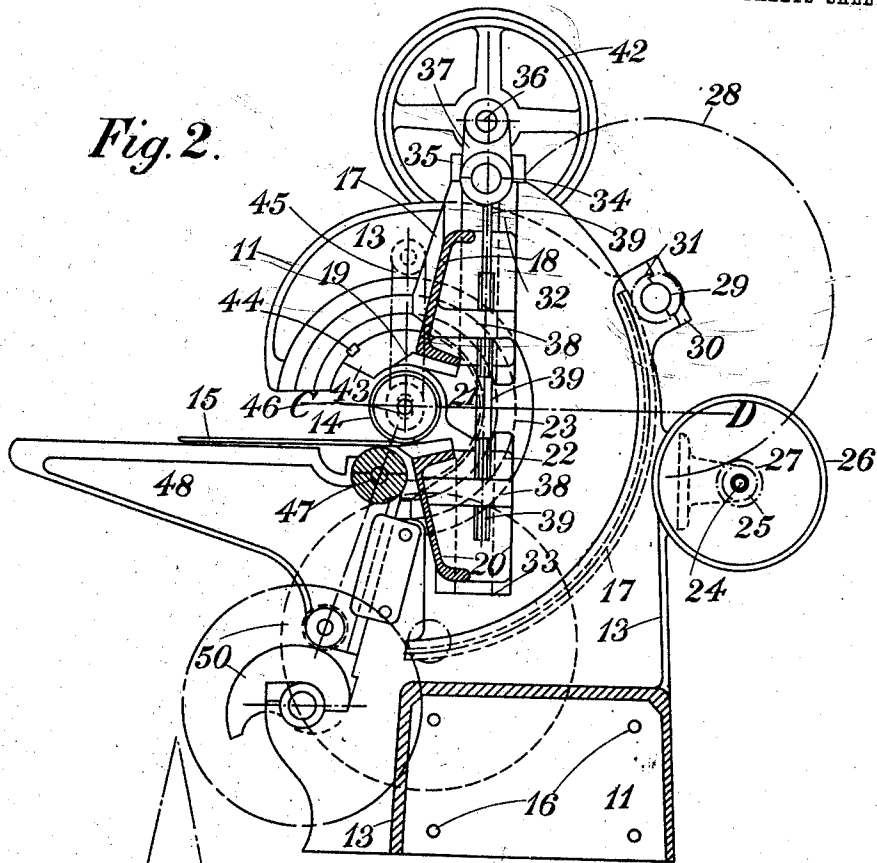
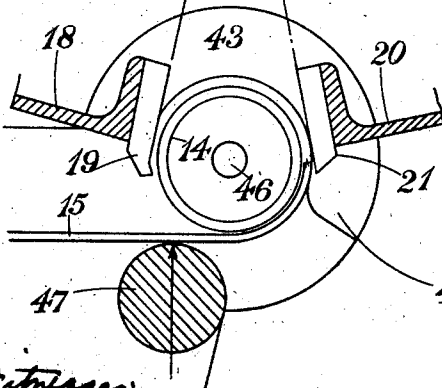
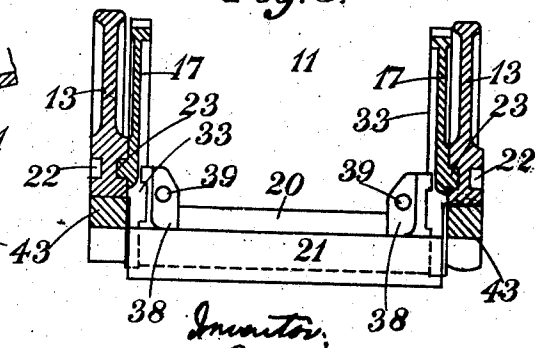


Fig. 4.



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Fig. 3.



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TUBE-ROLLING MACHINE.

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Specification of Letters Patent.

Patented Mar. 21, 1911.

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To all whom it may concern:

Be it known that I, OTTO PFRENGLE, subject of the German Empire, and resident of 28 Alleenstrasse, Stuttgart, Germany, have invented certain new and useful Improvements in Tube-Rolling Machines, of which the following is a specification, reference being had to the accompanying drawings.

My invention relates to machines for bending metal plates cold, and it is directed to that well-known class comprising a plurality of practically independent organisms or elements—in other words a series of separate small machines—which are secured end-to-end and combined with a mandrel and with operating mechanism, both common to each organism or element, thus constituting one long machine capable of being extended or reduced lengthwise to accommodate long or short plates.

The object of my invention is to produce long tubes of comparatively small diameter that will be of true shape throughout and therefore ready, when removed from the machine, to be welded, soldered, riveted or otherwise dealt with, without necessitating any subsequent treatment other than that attendant upon such operations.

To achieve my object each organism or element, according to my invention, comprises, essentially, a pair of bending devices which are slidably arranged radially of the mandrel at opposite sides thereof so that they can be advanced toward, or receded from, the same, and can also be moved forward and backward circumferentially thereof by mechanism common to all the organisms or elements, to shape the plate situated between the bending devices and the mandrel. My invention, further, comprises certain conjunctive members all tending to produce a machine of simple and compact construction, and one that will efficiently attain my purpose, as I will now explain with reference to the accompanying drawings whereof:—

Figure 1 is a longitudinal sectional elevation showing two of the constituent organisms or elements complete, and part of a third one. Fig. 2 is a vertical transverse section on the line A—B in Fig. 1. Fig. 3 is a horizontal section on the line C—D in Fig. 2 of some of the components. Fig. 4 is a fragmentary vertical transverse section representing one operative position of the aforesaid bending devices and the resulting

shaping of the plate. Fig. 5 is likewise a fragmentary vertical transverse section illustrating the shaping of the plate after a further operation of the said bending devices. Figs. 1, 2, and 3 are drawn to the same scale, as also are Figs. 4 and 5, though the latter are drawn to a larger scale than the other figures, but in all the same reference numerals are employed to denote the same parts.

The organisms or elements are marked 10, 11, and 12 respectively, and each comprises a standard 13 which, as shown in Fig. 1, in the case of the intermediate organisms or elements is common to a pair of them. This standard 13, as depicted in Fig. 2, is of box-like form at the base, and of segmental contour at the top to permit the passage of the concentric mandrel 14 and the plate 15, both of which are supported in any usual way as I will presently point out. These several standards 13 . . . 13 are secured together in any suitable fashion, such as by bolts 16—16 as indicated in Fig. 2.

The standards 13 . . . 13, as illustrated best in Fig. 1, support, *inter alia*, rotatable segmental racks 17—17—a rack being situated close to each side of every standard—and by, and between, each adjoining pair of these racks 17—17 are supported the aforesaid slidable bending devices, each consisting of an upper cheek 18 with a jaw 19 at one side of the mandrel 14 and a lower cheek 20 with a jaw 21 at the other side thereof. These several parts are arranged as I will now explain.

Every standard 13 is provided at both sides with a segmental groove 22 for the reception of a tongue 23 provided on the rack 17, and in this way is the rack guided as it is rotated backward and forward around the mandrel 14 as it is intended to be simultaneously with the others, to effect the corresponding movement of the respective bending devices 18—19 and 20—21. This rotation is accomplished by any suitable mechanism, such as that indicated in Fig. 2, which consists of a common shaft 24 supported as at 25 on the standards 13—13 and carrying a pair of loose pulleys—one of which is shown and marked 26—adapted to be connected to, and disconnected from, the shaft 24 by clutches and be driven from a suitable source of power by open and crossed belts. The motion thus imparted to the shaft 24 is transmitted to the racks 17—17 by a toothed wheel 27 mounted on

the shaft 24 and driving a toothed wheel 28 mounted on a shaft 29 supported as at 30 on the standards 13—13, which shaft is common to all the racks 17—17 and carries a corresponding number of toothed wheels 31—31 for gearing with and thereby operating the racks 17—17.

As previously remarked, and as clearly illustrated in Fig. 1, a cheek 18 and a cheek 20 are supported by, and between, every pair of the racks 17—17, such racks being those adjoining on the corresponding sides of every pair of the standards 13—13. For this purpose each rack 17 is at the side remote from its standards 13 provided with an upper groove 32 and a lower groove 33, both of which are straight and at right angles to the axis of rotation. These grooves 32 and 33 receive the ends of the respective cheeks 18 and 20 which are designed to slide therein radially inward and outward with respect to the mandrel 14 under the influence of hand mechanism as will be subsequently described. The racks 17, 17 are thus maintained in position to a certain extent on the standards 13, 13 by the interposition of the cheeks 18 and 20, and to a further extent by a rod 34 carried by, and between, their upper extremities as indicated at 35, which parts 34 and 35, according to the illustration, also serve to support the hand mechanism of the cheeks 18 and 20 for operating them in unison. This mechanism (which of course may be of other kind than that shown) comprises a shaft 36 common to all the cheeks 18—18 and 20—20 and supported by arms 37—37 on the rods 34—34. Each cheek 18 and 20 is provided with a nut 38 at each end for co-acting with a common screw 39 furnished at one part for the nut 38 of one cheek with a right-handed thread, and at another part for the nut 38 of the other cheek with a left-handed thread. This screw 39 is also furnished at the upper end with a bevel wheel 40 for gearing with a complementary wheel 41 on the shaft 36 which is fitted with a hand wheel 42 for operating it. Therefore it will be seen on rotating the shaft 36 by the hand wheel 42 the several cheeks 18—18 and 20—20 with their respective jaws 19—19 and 21—21, through the medium of the bevel wheels 40—40 and 41—41, and screws 39—39 either approach the mandrel 14 or recede from it in unison. Further it will be manifest that as this mechanism is carried by the racks 17—17 through the agency of the rods 34—34, it revolves therewith around and concentric with the mandrel 14 and can be actuated to operate the cheeks 18—18 and 20—20 whatever the position they may be in consequent on the rotation of the racks 17—17.

In the segmental cavity of each standard 13 and concentric with the mandrel 14, a

semicircular guide-piece 43 is fixed so that it may be removed, for which purpose it is secured in place by keys (one of which is shown at 44 in Fig. 2) or in any other way. The purpose of these guide-pieces 43—43 is to prevent the metal springing at the standards 13—13 while being bent, and the object of having them removable is to permit of them being changed to suit different diameters of tube. To also prevent springing of the tube in course of production the jaws 19—19 and 21—21 on the cheeks 18—18 and 20—20 respectively are, as illustrated in Figs. 2 and 4, arranged angularly to each other and to the mandrel 14.

As previously remarked the mandrel 14 and plate 15 may be supported in any customary fashion, and well-known ways are illustrated. The mandrel 14 is suspended from the extreme end standards 13—13 as represented at the right hand end of Fig. 1 by a link 45 pivoted on the standard 13 and a complementary removable pin 46. The plate 15 is carried by rollers 47—47 and by brackets or tables 48—48. A roller 47 is situated between every pair of the standards 13—13, being journaled at each end in the contiguous standard as indicated at 49. A bracket or table 48 is applied to each standard 13, and it is arranged so that it may be adjusted in height as usual by the mechanism marked generically 50 which, as it is of the ordinary type, need not be described, further, than to say, that in the specific example illustrated, it comprises lifting-and table-supporting cams fixed on a rotary shaft provided with means for rotating the same to shift the cams with respect to rollers carried by the table and resting on the cams. The table is freely slidable vertically and is upheld by said rollers resting on said cams and following the curvature thereof to raise or lower the table as the cams are rotated.

Having described the construction of the machine I will now explain its operation.

Assuming the production of a tube is about to be commenced, then the various parts are in the positions depicted in Fig. 2, excepting that it is to be supposed the plate 15 is not in the position shown, and that the bending devices, consisting of the cheeks 18—18 with their jaws 19—19 and the cheeks 20—20 with their jaws 21—21, are farther apart. First, then, the plate 15 is slid over the brackets or tables 48—48 and rollers 47—47 and inserted between the mandrel 14 and the jaws 21—21 of the lower cheeks 20—20. Now the cheeks 18—18 and 20—20 are simultaneously advanced to bring the jaws 21—21 of the latter cheeks into contact with the plate 15, by turning the hand wheel 42 and thereby operating the mechanism comprising the shaft 36, the bevel wheels 40—40 and 41—41, and the screws 39—39. Thus the position illustrated in

Fig. 2 results. Now the machine is set going, that is to say the power is transmitted to the shaft 24 and thence through the toothed wheels 27 and 28, the shaft 29 and the toothed wheels 31—31 to the racks 17—17 which thus are turned in unison around the mandrel 14, and, in consequence of their connection with these racks 17—17, so are the cheeks 18—18 with their jaws 19—19 and the cheeks 20—20 with their jaws 21—21 along with their hand operating mechanism, hence the cheeks 20—20 with their jaws 21—21 operate on the plate 15 to bend it conjointly with the mandrel 14. This operation is continued for a quarter of a revolution or thereabout when the position will be as indicated in Fig. 4, whereupon the cheeks 18—18 with their jaws 19—19 and the cheeks 20—20 with their jaws 21—21 are actuated to separate them by correspondingly operating the hand-wheel 42 and through it the allied mechanism, and likewise the motion of the shaft 24 is reversed and thus the racks 17—17 together with the cheeks 18—18 and 20—20 with their conjunctive parts are turned back to the original position—that shown in Fig. 2—the mandrel 14 and partially-bent plate 15, however, remaining in place. Next the jaws 19—19 and 21—21 are again closed as before, and the racks 17—17 likewise operated for another quarter of a revolution or thereabout, when the condition of the plate 14 illustrated in Fig. 5 will ensue, whereupon the operation is reversed, and the operations already explained again carried out successively until the bending is completed. To remove the finished tube, the pin 46 at one end of the mandrel 14 is withdrawn and the link 45 swung aside.

What I claim is:—

1. In a bending machine for making metal tubes comprising a plurality of independent organisms or units secured end-to-end and combined with a mandrel and with operating mechanism, both common to said organisms, the combination is one such organism with said common mandrel and said common operating mechanism, of a pair of bending devices slidably arranged radially of said mandrel at opposite sides thereof so that

they can be advanced toward, or receded from, the same, and also rotatable forward and backward circumferentially and concentrically thereof, to shape the plate situated between said bending devices and said mandrel.

2. A bending machine for making metal tubes comprising, in combination, a plurality of standards, a mandrel suspended from, and led through, said standards, segmental racks rotatably arranged at both sides of each of said standards, bending devices consisting of a pair of cheeks with jaws slidably supported by, and between, every pair of said racks and radially at either side of said mandrel, mechanism for operating said racks in common, and mechanism for operating said bending devices in common.

3. A bending machine comprising, in combination, a plurality of standards having segmental grooves and provided with removable curved guide pieces, a mandrel arranged transversely of said standards, segmental racks having cheek-receiving grooves and arranged beside said standards and having means slidably engaging said grooves thereof, cheeks slidably in said cheek-receiving grooves of said racks and arranged radially of said mandrel and provided with angularly arranged jaws, mechanism for operating said racks in unison, and mechanism for operating said cheeks in unison.

4. A bending machine for making metal tubes comprising, in combination, a plurality of standards, a mandrel suspended from, and led through, said standards, segmental racks rotatably arranged at both sides of each of said standards, bending devices slidably supported by, and between, every pair of said racks and radially of said mandrel, mechanism for operating said racks simultaneously, mechanism for simultaneously operating said bending devices, guide-pieces on said standards, brackets or tables on said standards, and rollers journaled between said standards.

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Witnesses.

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