3 Sheets—Sheet 1.

J. B. ROOT.

MACHINE FOR MAKING SPIRAL-JOINTED METALLIC TUBING.

No. 183,328. Patented Oct. 17, 1876.

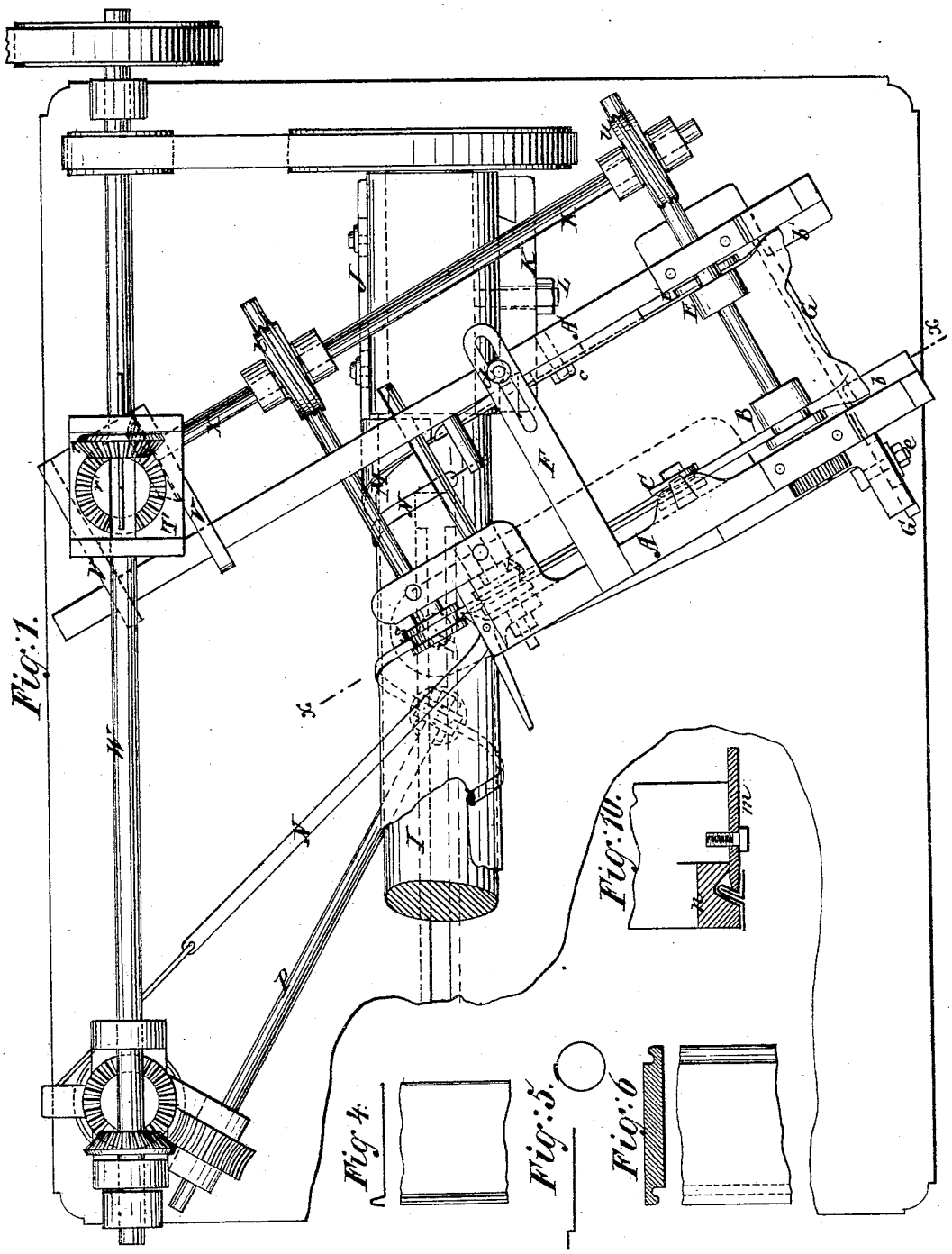

Fig: 1.

Fig: 10.

Fig: 4.

Fig: 5.

Fig: 6.

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3 Sheets—Sheet 2.

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Fig: 1.

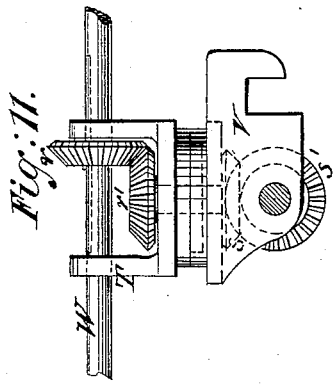

Fig: 2.

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Fig: 3.

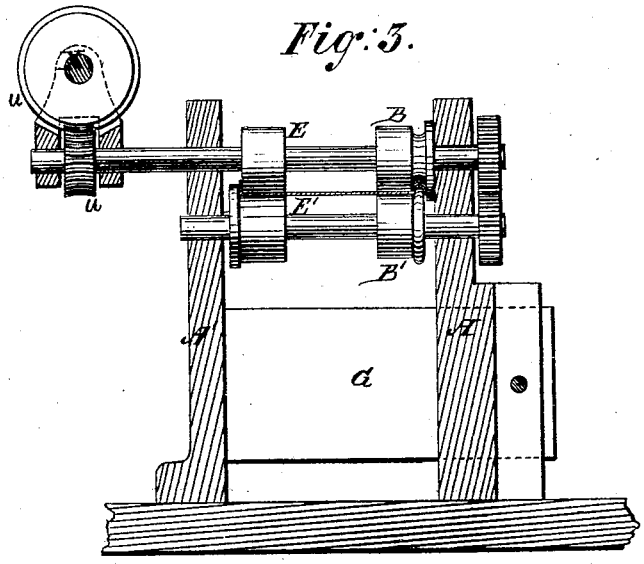


Fig: 9

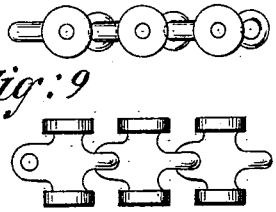
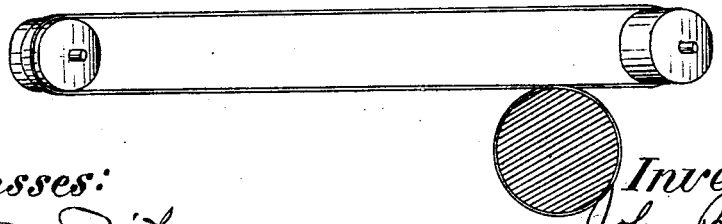


Fig: 7.

Fig: 8.



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UNITED STATES PATENT OFFICE.

JOHN B. ROOT, OF NEW YORK, N. Y.

IMPROVEMENT IN MACHINES FOR MAKING SPIRAL JOINTED METALLIC TUBING.

Specification forming part of Letters Patent No. **183,328**, dated October 17, 1876; application filed April 10, 1876.

To all whom it may concern:

Be it known that I, JOHN B. ROOT, of the city and State of New York, have invented certain new and useful Improvements in Machines for Making Metal Tubes, of which the following is a specification:

The machine to which this invention relates is designed for the manufacture of that class of metal pipes or tubes in which the seam formed by the joining of the edges of the skelp or blank assumes a spiral form—a mode of construction that not only gives great strength and stiffness to the pipes, thus permitting a much lighter gage of metal to be used than would be possible where the longitudinal seam is adopted, but also greatly facilitates, and thus cheapens, the manufacture.

The machine hereinafter described and illustrated in the accompanying drawings is capable of shaping up into tubular form a blank of any desired width, and of making tubes of any desired diameter. It will also produce tubing of any required length, the length of the finished article being determined only by that of the blank fed into the machine; and this blank, in turn, may be formed by locking or riveting or otherwise fastening one plate or sheet of metal to another to any indefinite extent.

Referring to the accompanying drawings, which illustrate the essential parts of the machine, Figure 1 is a plan thereof. Fig. 2 is a side view, partly in elevation and partly in section, the section being along the dotted line *x x* of Fig. 1. Fig. 3 is a vertical transverse section of the roll-frame along the axes of the first set of beading and flanging rolls. Fig. 4 is a plan and section of a blank of sheet metal, the edges of which have been prepared for forming an interlocking seam by passing through the rolls of a roll-frame. Fig. 5 shows a transverse section of a sheet-metal blank shaped for forming a lap-joint; also, a transverse section of a pipe formed from such blank. Fig. 6 is a plan and section of a blank of heavier metal, prepared for forming a different kind of lock-joint. Fig. 7 is a plan of a traveling belt or chain for guiding the blank around the mandrel. Fig. 8 is an elevation of the same. Fig. 9 shows, in plan and elevation, a series of friction-trucks adapted to form the guide-chain around the mandrel. Fig. 10 is an enlarged view of the tucker and grooved shoe, by means of which the folds of the interlocking seam are prepared for the action of the seaming-roll. Fig. 11 shows the sliding brackets and miter-gears that form the self-adjusting connection between the roll-frame and the main shaft.

The machine is composed of three general subdivisions: First, the guide or roll-frame, by means of which the blank is supported and guided in its passage to and entry upon the mandrel, and which, if occasion requires, is to be provided with suitable beading and flanging rolls for giving the edges of the blank the proper shape for producing the desired form of interlocking and overlapping seam; second, the revolving mandrel and its accessories, upon and by means of which the blank is wound spirally into a tubular form; third, the finishing-rolls and connected appliances, by means of which, after the blank has been brought into the tubular form, the seam is closed and finished.

Referring to the drawings, A A′ represent a guide or roll frame provided with a series of beading and flanging rolls specially designed for shaping a plain sheet-metal blank into the form shown in plan and section in Fig. 4.

B B′, C C′, and D D′ are three sets of ribbed and grooved rolls, by means of which one edge of the blank is brought into the beaded form, the edge of the blank passing between the ribbed and the grooved roll of each set, and the rib and groove of each succeeding set of rolls being made somewhat sharper than in that immediately preceding, so that the change of form will be effected gradually. E E′ are the flanging-rolls, by means of which the other edge of the blank is turned up into a flange. These flanging-rolls, preferably, are upon the same shafts as the first set of beading-rolls.

With view to assist the feed of the blank, the first set of rolls may be connected by worm-wheels, miter-gears, or otherwise with the driving-shaft, and the number of sets of beading-rolls used in any given machine will depend upon the form to be given to the edge of the blank, and upon the character of the metal employed.

To compensate for any inequality in the

thickness of the blank, particularly for the seam produced by locking the edges of two sheets of metal together in extending the blank lengthwise, the bearing of the upper roll of each set should be made adjustable by means of springs, as shown at *a a* in Fig. 2, and a similar adjustability should be given to the seaming-roll hereinafter described.

Suitable lugs, as shown at *b b'* of Fig. 1, are provided on the interior faces of the roll-frame for supporting the blank, and for the purpose of partially turning over the flange formed upon the one edge of the blank by the flanging-roll, a guide may be attached to the inner face of the frame behind the flanging-rolls, the groove in such guide being, for this purpose, made somewhat inclined on its face.

This guide may also, by means of a set-screw, *c*, working in a slot, be made adjustable to and from the mandrel, so as to be kept always in proper working relation to the mandrel in the different positions which the roll-frame may be made to assume.

Instead of using beading and flanging rolls of the forms shown in the drawings, which would reduce the blank to the shape shown in section and plan in Fig. 4, any other forms may be used, according to the requirements of the special style of joint which it is desired to make. Fig. 5 shows a lap-joint, to produce which calls for rolls of a very simple character. In Fig. 6 there is shown in plan and section still another form of edges, and one which is specially adapted to heavy metal.

These edges may be brought into this form by proper reducing-rolls or milling-tools before the blank is fed into the rolls of the guide-frame, in which event these rolls may be made perfectly plain; or these rolls may be formed into milling-tools, and thus be made to shape the edges of a skelp of heavy metal upon the same machine that winds the skelp up into tubular form.

In order to accommodate the roll-frame to blanks of different widths, the side A' is made adjustable toward and from the side A, by means of the slotted arms F and G, which are properly gibbed to the opposite sides of the frame, the required adjustment in any given case being secured by means of set-screws *d* and *e* working in the slots in these connecting-arms, or in any other available way.

Any lateral adjustment of the operative width of this roll-frame calls for a corresponding adjustment upon their shafts of the flanging-rolls, (when flanging-rolls are used,) which may be effected in the ordinary way.

The guide or roll frame must always be placed at such an angle to the mandrel, (dependent in any particular case upon the diameter of the mandrel and the width of the blank,) that the advanced edge of the blank, after making one turn around the mandrel, will properly interlock or connect with the other edge of the blank where it is just passing off from the guide-frame and onto the mandrel.

Accordingly, whenever with a mandrel of a given diameter a change is made in the width of the blank, a corresponding change must be made in the angle at which the blank feeds upon the mandrel; and the same necessity will be found to exist whenever, with a blank of given width, the diameter of the mandrel is changed. This necessity is provided for by pivoting the guide or roll frame to the bed of the machine, as at H, which permits the frame to be brought at any desired angle with the mandrel. The frame can be held in proper position, when once adjusted, by means of set-screws, bolts, or any of the usual appliances adapted therefor, or by means of a tangent screw located at the front of the machine, which also constitutes a very ready and accurate means of effecting the angular adjustment of the frame.

It will be understood, of course, that when the guide-frame has been properly adjusted for the working of a blank of any given width and the making of tubing of any given size, it is to remain stationary till a readjustment is required for a blank or a tube of different width or diameter.

By providing a slot in the bed of the machine for receiving the bolt H, which is the pivot of the roll-frame, this frame may be moved bodily to the right or left along the line of the mandrel, as circumstances may require. This slot is shown in dotted lines in Fig. 1. The mandrel I is placed at the tail of the roll-frame, and is caused to revolve by any suitable connection (as shown in the drawings, by means of belt and pulleys) with the main shaft. It has its bearing in a collar, J, which is gibbed to the fixed support K, and can be adjusted at any desired height upon such support by means of the slot and set-screw L, or by means of an elevating-screw and nut. The object in thus making this mandrel-bearing vertically adjustable is to permit of the use of mandrels of different diameters, according to the size of pipe which it is desired to make, which calls for a lowering or raising of the bearing with each change of the mandrel, in order that the upper face of the mandrel may always occupy the proper position relatively to the delivery end of the guide-frame. The mandrel may be provided with a spiral guide, M, for giving direction to the blank after it leaves the roll-frame. This spiral guide is made detachable, as it must be changed with each change of mandrel. Also, it is attached to the collar which forms the mandrel-bearing by means of a slotted arm and set-screw. This enables the guide always to be accurately adjusted to the edge of the metal as it leaves the delivery end of the roll-frame. The face of this spiral guide may be made plain, as shown in the drawings, or it may be provided with friction-rolls to facilitate the movement of the blank. The mandrel is also provided with a metal band or strap, N, passing spirally around it, for causing the blank to hug the mandrel and wind upon it. It may be either stationary, as shown in Fig. 1, or arranged to

travel like a belt, as shown in plan and elevation in Figs. 7 and 8; and it may be a plain band or chain, or a series of trucks or friction-rolls, as shown in plan and side view in Fig. 9.

When the traveling band or chain is used, without friction-rolls, it should be driven by some suitable connection with the main shaft, in which case it not only serves as a guide, but also, by closely embracing the tubing, aids in drawing the work through the machine.

The guide band or chain herein provided for differs materially from the curved-plate guide sometimes used for kindred purposes, in that the band or chain can be made to encircle the mandrel completely, and can also be readily adjusted to mandrels of different sizes.

The outer end of the mandrel is supported upon a roll, O, which is mounted upon a shaft, P. This shaft may simply revolve in its bearings by frictional contact of the roll O against the tubing, or it may be driven by any suitable connection with the main shaft. One end of this roll-shaft has its bearings upon the standard R, and this standard is made vertically adjustable by means of screw and nut or otherwise, in order that its height may be varied according to the diameter of the particular mandrel used. This supporting-standard is also made adjustable longitudinally of the mandrel by means of a slot in the bed of the machine and a set-screw, the object of this lateral adjustment of the standard being to change its position according to the requirement of the special mandrel or the special width of blank used, so that the roll O will always be directly under the seam, which will cause the roll to act as a finishing-tool for the more completely closing the joint or seam. This vertical and lateral adjustability of the roll O and its supporting-standard R calls for a corresponding adjustability in the shaft P, which may be effected in any of the usual modes.

After the two edges of the blank have interlocked, as above described, the seam is to be set down by means of a seaming-roll, S, which is located at the rear of the roll-frame and directly over the mandrel, and to facilitate the closing of the joint when a thin sheet-metal sheet is used, and an interlocking joint is being made, a tucker, *m*, and grooved shoe *n* may be used, as shown in Figs. 1 and 2, an enlarged view of these devices being given in Fig. 10, which also shows their action on the partially-formed seam. The tucker is a pivoted lever, and should be so set in any given case as to crowd the folds of the seam firmly against each other, and, preferably, it should be held up to its work by means of a spring which will permit it to yield slightly to any irregularity in the thickness of the seam.

Instead of using the tucker a simple groove might be employed; but it should be made somewhat inclined, like that shown in the drawings, and should be a little wider on the side where the seam enters it than on the side where it leaves. When, again, a simple lap-joint is being formed, or a tube is being made from a skelp like that shown in Fig. 6, both the tucker and the shaping-groove in the shoe-piece may be wholly dispensed with.

After the seam has passed under the action of the tucker and shoe and of the seaming-roll, it is acted on by the roll O, which is thus made to serve as a finishing-roll; but this particular function of the roll O, while serviceable, is by no means indispensable.

It will be observed that the seaming and the finishing roll operate by clamping the tubing against the mandrel to draw the work through the machine; and to this end the surface-movement of these rolls and of the mandrel should be faster than that of the rolls in the roll-frame; otherwise the metal will be crowded forward too rapidly, and will buckle up or rumple. It will thus be seen that the main function of the first set of rolls in the guide-frame, so far as regards the feeding of the work, is limited, practically, to the first starting of the blank into the machine. In causing the mandrel to revolve, and thus utilizing it, as above set forth, for drawing the work through the machine, consists one of the peculiarities of the present invention. This mode of advancing the work, as compared with the use of a stationary mandrel and feed-rolls, by which the work is pushed forward over and around such mandrel, will be found productive of great economy of power, and will enable one to dispense with the appliances that otherwise would become necessary to prevent the metal from buckling.

By setting the finishing-roll O so that, instead of running exactly with the seam, it will run angling with it, it can be made to aid materially in drawing the tubing from the mandrel. As the seaming-roll, which is driven from the main shaft, must be capable of occupying different positions with the various changes of the roll-frame, it is connected with the driving-shaft by means of automatically adjustable or sliding connections; and the same is the case with the driven set of beading and flanging rolls. These self-adjusting connections consist of the two sliding brackets T and V and the miter-gears *r r'* and *s s'* and the worm-wheel gears *t* and *u*. The two brackets are swiveled together by a shaft, upon which the miter-gears *r'* and *s* are keyed, the faces of the brackets, where they are in contact, being also rabbeted together. The bracket T slides freely upon the main shaft W, the gear *r* being feathered to the shaft, so as to move freely with the bracket, while the bracket V and its gear *s'* slides in a similar manner on the counter-shaft X. The bracket V is supported in part by a bearing upon the extended arm of the side A' of the roll-frame, whereby it acquires greater steadiness. The worm-wheel gears *t* and *u* are constructed to slide upon their shafts, as required by the different adjustments of the roll-frame.

Ordinary miter or bevel gears may be used

instead of the worms and worm-wheels shown in the drawings.

The chief advantage in these self-adjusting connections between the guide or roll frame and the main shaft lies in the fact that they permit of an adjustment of this frame while the machine is running. This sometimes becomes exceedingly necessary, in order to relieve the binding of the work when it is found to be crowding or running too tight, which is specially liable to occur when first starting a new piece of work upon the machine.

What is claimed as new is—

1. The combination of the revolving mandrel, the stationary guide-frame for guiding the work onto the mandrel at an acute angle, and the seaming-roll, these parts being arranged to operate substantially as described.

2. In combination with the revolving mandrel, the beading and flanging rolls, by means of which the edges of the blank or skelp are shaped for forming a spiral lock-joint while passing over the roll-frame.

3. The spiral guide upon the heel of the mandrel, made detachable and adjustable, substantially as and for the purpose described.

4. In combination with the roll-frame, the vertically-adjustable mandrel-bearing, which permits the use upon the same machine of mandrels of different diameters, substantially as described.

5. In combination with the revolving mandrel, a guide band or chain encircling it, substantially as shown and described, and for the purpose set forth.

6. The tucking-lever and grooved shoe, or equivalent mechanism, for closing up and inclining the folds of the seam, preliminarily to the action of the seaming-roll, substantially as described.

7. The guide or roll frame, pivoted to the bed of the machine, so as to be adjustable to different angles relatively to the mandrel, substantially as and for the purpose described.

8. In combination with the pivoted and adjustable guide or roll frame, the swiveled hanging and sliding brackets, as a means of conveying power from the main shaft to the rolls of the guide-frame.

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