(No Model.) 3 Sheets—Sheet 1.

C. KELLOGG.

MANDREL FOR ROLLING SEAMLESS TUBES.

No. 424,213. Patented Mar. 25. 1890.

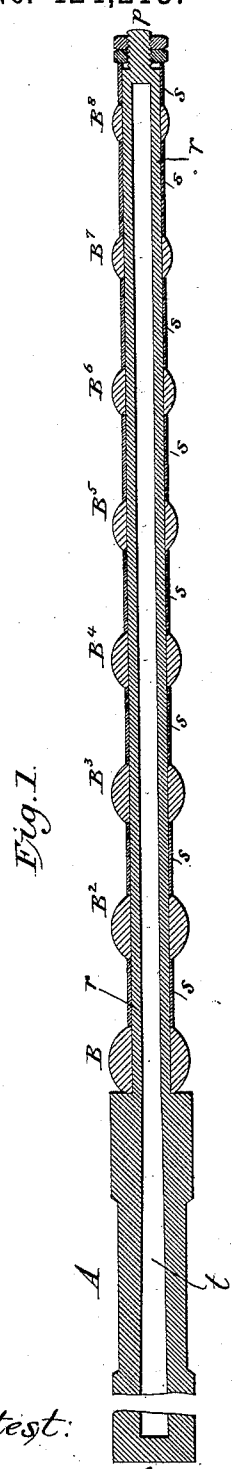


Fig. 1.

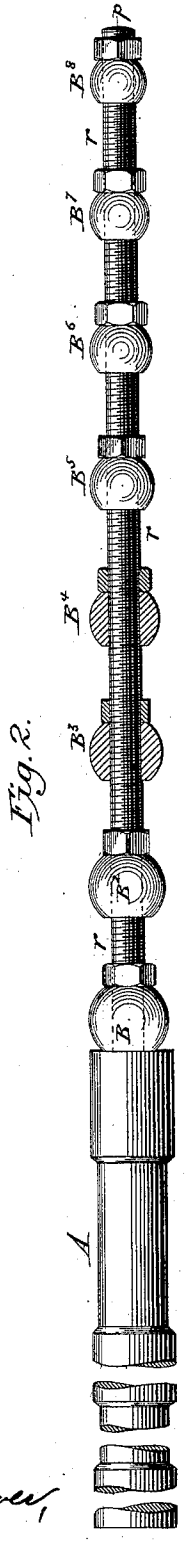


Fig. 2.

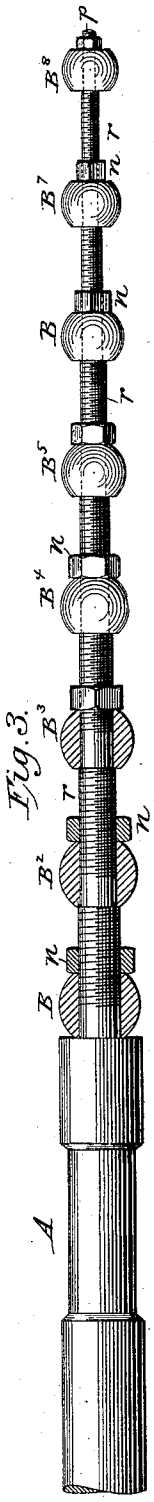


Fig. 3.

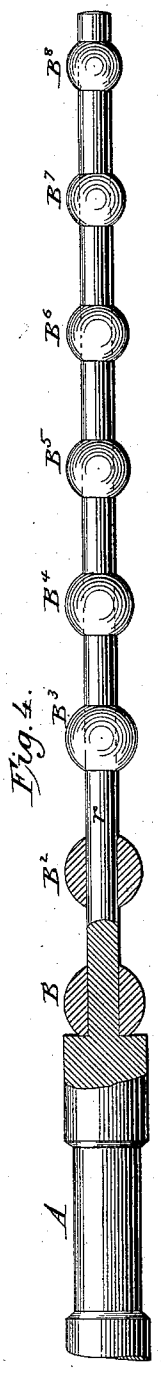


Fig. 4.

Attest:
B. N. Naylor
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Inventor:
Charles Kellogg
By Milton C. Dorr
Atty.

N. PETERS, Photo-Lithographer, Washington, D. C.

Model.)

3 Sheets—Sheet 2.

C. KELLOGG.

MANDREL FOR ROLLING SEAMLESS TUBES.

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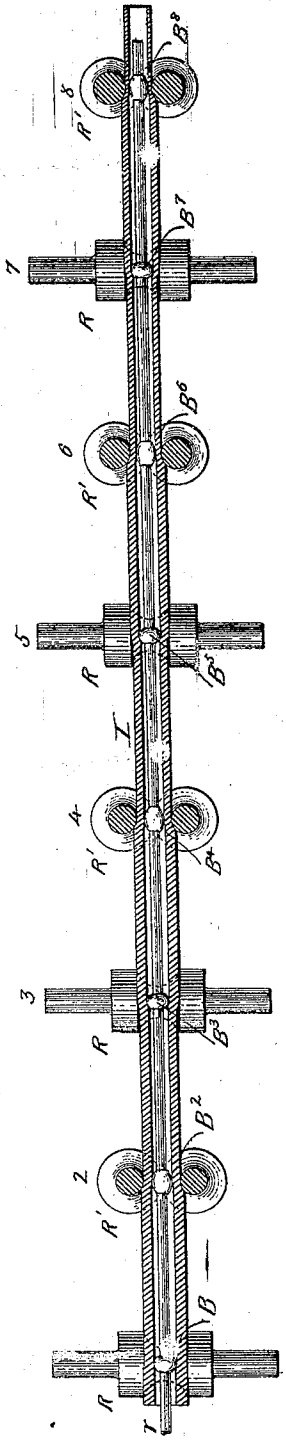


Fig. 5.

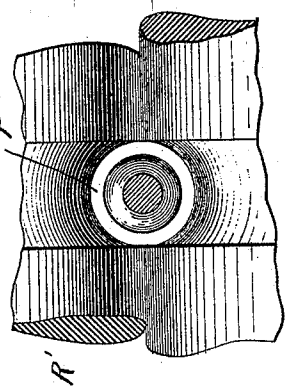


Fig. 7.

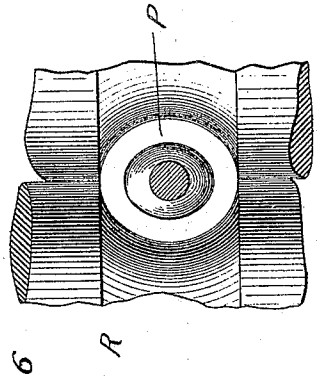


Fig. 6

Witnesses.
John F. Nelson.
Antonz J. Habermehl.

Inventor.
Charles Kellogg
By. Wright Brown & Quinby Atty

N. PETERS. Photo-Lithographer, Washington, D. C.

(No Model.) 3 Sheets—Sheet 3.

C. KELLOGG.

MANDREL FOR ROLLING SEAMLESS TUBES.

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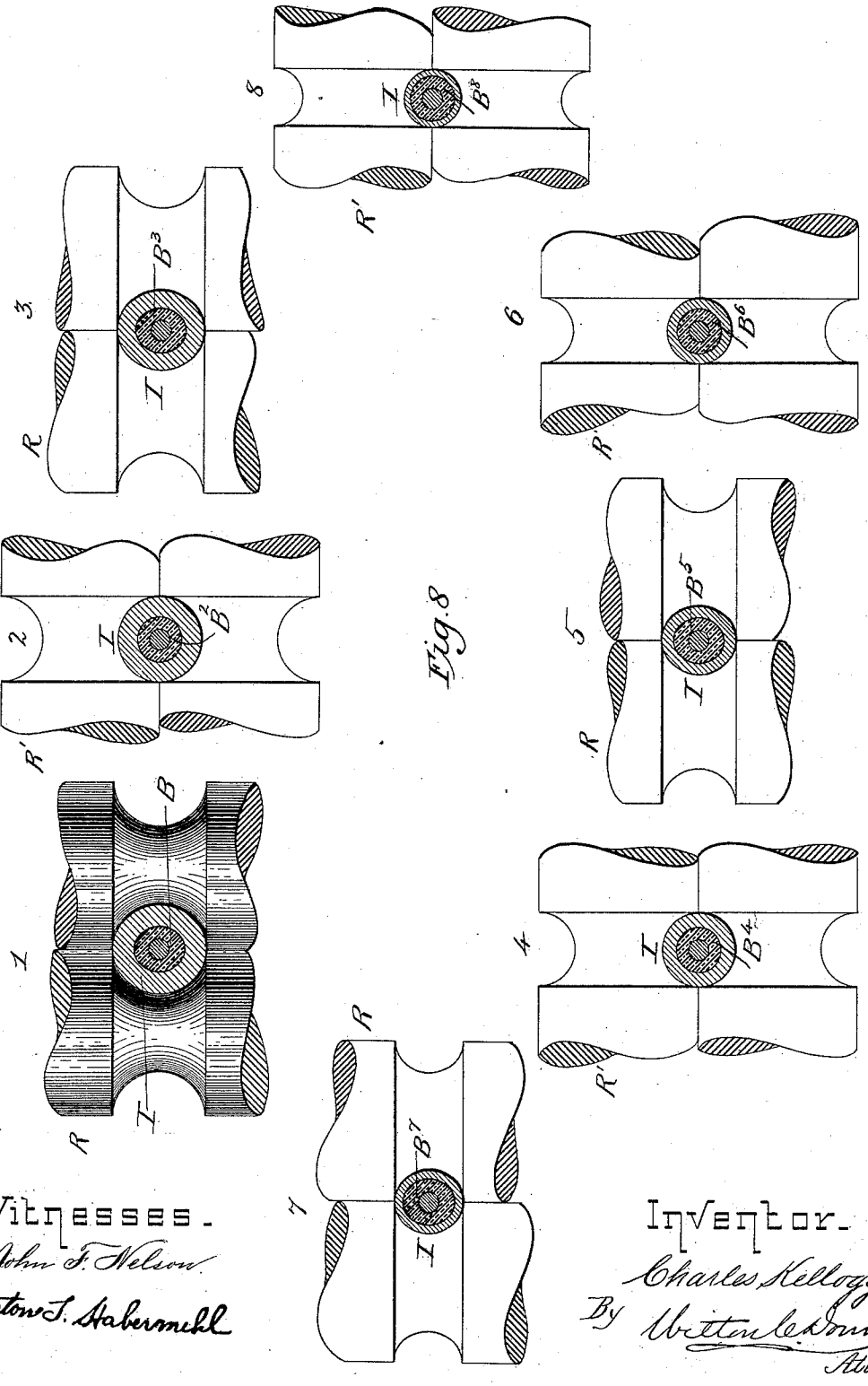


Fig. 8

Witnesses.
John F. Nelson
Anton J. Habermehl

Inventor.
Charles Kellogg
By Wetherbee & Dunn
Attys

N. PETERS. Photo-Lithographer, Washington, D. C.

UNITED STATES PATENT OFFICE.

CHARLES KELLOGG, OF FINDLAY, OHIO.

MANDREL FOR ROLLING SEAMLESS TUBES.

SPECIFICATION forming part of Letters Patent No. 424,213, dated March 25, 1890.

Application filed January 23, 1890. Serial No. 337,781. (No model.)

To all whom it may concern:

Be it known that I, CHARLES KELLOGG, of Findlay, in the county of Hancock and State of Ohio, have invented new and useful Improvements in Mandrels for Machines for Rolling Seamless Tubes, Pipes, and other Hollow Cylindrical Articles, of which the following is a specification.

This invention relates to the production of seamless pipes, tubes, columns, and other hollow cylindrical articles from hollow ingot-piles, &c., by reducing and elongating the ingots between a series of rolls and a mandrel placed between them.

In Letters Patent No. 397,724, granted to me February 12, 1889, for "machine for rolling seamless tubing," I have shown and described a machine consisting of a series of alternate vertical and horizontal grooved rolls geared to move with a gradually-accelerating speed, and in conjunction with said rolls a tapered mandrel whose diameter decreases uniformly and correspondingly to the decreasing area of the cavities or grooves in the rolls.

My present invention relates more particularly to the construction of the mandrel used in connection with the rolls and to the relation between the cavities or grooves in the rolls and the bearing points or surfaces of the mandrel which are located in the nips or passes of the rolls; and the object thereof is, first, to provide a mandrel for tube-rolling machines having the parts which are located between or in the passes of the rolls separate from each other, but connected with a mandrel-rod from which they may be detached or to which they may be permanently fixed, as may be preferred; secondly, to provide a mandrel in which the bearing-points between or in the passes of the rolls shall conform in cross-section to the shape or configuration of the grooves or cavities in the rolls and to the shape which the ingot assumes when passing through the rolls, so that when the ingot is drawn between the mandrel and the pass of the rolls the walls of the ingot will at every pass be reduced uniformly, and the thickness thereof will always be the same as the space between the mandrel and the nip or pass of the rolls through which it last passed, and thereby the walls of the ingot will be rolled to uniform thickness at every rolling and reducing point in the series; thirdly, to provide a mandrel in which the bearing-points in the passes of the several pairs of rolls shall be elliptical, ellipsoidal, or other equivalent form and round in cross-section alternately, so that when an ingot is drawn through the rolling and reducing rolls it shall be caused to assume an elliptical or other equivalent form and a round form alternately, and thereby the reducing and elongating of the ingot and the uniform reduction of its walls will be greatly facilitated.

In the accompanying drawings, Figure 1 represents a longitudinal section of one form of my improved mandrel. Figs. 2, 3, and 4 represent other forms of the said mandrel. Fig. 5 represents a longitudinal sectional elevation of the series of rolls with the mandrel placed between, and with the bearing-surfaces in the passes of the rolls alternately elliptical and round, also showing an ingot in the several stages of reduction and elongation. Fig. 6 represents in elevation the elliptical pass in one set of rolls and an elliptical mandrel-ball within the same, and Fig. 7 a similar view of a circular pass and mandrel-ball. Fig. 8 represents in elevation the several pairs of rolls in the series, and in transverse section the mandrel-balls and the ingot as it appears when passing through the successive pairs of rolls.

Referring to the drawings, the stem or tang A of the mandrel is arranged to be grasped by the grips (not shown) in the same manner as is described and illustrated in the specification of the patent above referred to. From this stem, which is hollow, a tubular mandrel-rod r extends, being made integral with the tang or otherwise, as may be preferred, and its outer extremity is closed and provided with a reduced screw-threaded projection p. The mandrel is cooled by water led into the same by means of the water-tube t and controlled by a system of valves operated by the closing and opening of the grips, as fully described in my said patent.

On the mandrel-rod r are placed spheroid bulbs or balls $B B^2$, &c. These balls are provided with a central hole or eye through which the mandrel-rod is passed, and they are of gradually-reduced size, corresponding in this respect with the extent of reduction

produced by the successive pairs of rolls. The adjustment of the balls with respect to the rolls is shown in Fig. 5, and consists in placing the transverse axes of the balls in line with the axes of the respective pairs of rolls, so that each ball has its greatest diameter exactly in the pass or nip of the pair of rolls between which it is placed.

The first ball B, counting from the grip end of the mandrel, is the largest, having about the same diameter as the stem of the rod. From that to the extremity of the rod they are reduced by regular graduations, the last one having a diameter corresponding to the internal diameter of the finished tube. The balls are held on the mandrel-rod in any of the various modes shown in the drawings.

In Fig. 1 the first ball is placed against the shoulder of the mandrel-rod stem, which holds it in front. Then a sleeve *s* is placed on the rod and shoved up against the ball, which is thus held between the shoulder and the end of the sleeve. The next ball is held between the rear end of the said sleeve and the front end of another sleeve *s*, and so on. Between each two balls is placed a sleeve that both holds the balls and spaces them, and against the last sleeve, at the small end of the mandrel, a nut is screwed on the stud or projection *p*, and thus holds all the balls on the rod.

In Fig. 2 the mandrel-rod is threaded and the balls are tapped, the balls being each held in place by a set-nut.

Fig. 3 shows another mode of fastening and locating the balls, consisting in reducing the mandrel-rod by steps instead of tapering it, thereby forming a shoulder for each ball and threading a part of each step. The first or largest ball is moved up against the shoulder of the stem A and a nut *n* is screwed against it. The next ball is moved up against the shoulder of the first step of the mandrel-rod and secured by another nut, and so on to the end of the series.

Fig. 4 shows still another mode of fastening the balls. In this case they are either shrunk or forged on the mandrel-rod and are immovable. In this figure also a solid mandrel-rod is shown.

In Figs. 5 and 8 is illustrated the alternate arrangement of elliptical balls in connection with the similarly-shaped grooves or passes of the rolls. The rolls are alternately vertical (R) and horizontal, (R′,) the adjacent pairs being placed at an angle of ninety degrees to each other, and, as described in my said patent, they are geared so as to move with gradually-increasing velocity. The first pair 1 (see Fig. 5) is vertical, and the grooves therein are of such shape that when the two rolls are placed together, as in Fig. 6, an elliptical pass is formed. In the succeeding pair 2 the grooves are semicircular in transverse section; hence they form a circular pass, (see Fig. 7,) and so on through the entire series, the odd-numbered rolls having elliptical passes and the even-numbered circular passes. The mandrel-balls B to B^8 are shaped to conform to the passes in the rolls. Thus the first ball B in the pass of the pair 1 is elliptical, while the second ball B^2 is round, and so on successively, as shown in Figs. 5 and 8.

By reference to Figs. 6 and 7 the passes of two adjacent pairs of rolls and the corresponding mandrel-balls are shown with the cavities between the mandrel-balls and the nips or passes of the rolls clearly defined.

The operation of this part of the invention is as follows: The heated ingot I, being passed over the grip end of the mandrel-rod, is fed to rolls 1, where it is rolled to an elliptical form with the walls of uniform thickness, as shown in pair 1, Fig. 8. It then passes to pair 2, where it is reduced and rolled to a circular form, then to pair 3, where it is again rolled to an elliptical form; then to pair 4, where it is again reduced to a circular form; then to pair 5, where it is again rolled to an elliptical form; then to pair 6, where it is again reduced to a circular form; then to pair 7, where it is again rolled to an elliptical form, and finally reaches pair 8, where the final circular form is given to it, and the finished tube, having the desired thickness of walls, is delivered from the machine. The several forms which the ingot assumes are clearly shown in Fig. 8. During the progress of the ingot through the machine, as above described, as the area of the nips or passes of the successive pairs of rolls and also the mandrel-balls in transverse section is gradually reduced, it follows that at every pass a reduction of area in cross-section of the ingot takes place and the walls of the ingot are gradually reduced in thickness, while the length of the ingot is increased correspondingly. In rolling seamless pipe, &c., by the machine described in my said patent the heated ingot is caused during its progress through the rolls to assume alternately an elliptical and a round form, as is shown by Fig. 8 of the drawings of the said patent, where the forms of the ingot after passing the successive pairs of rolls are represented. It will be seen by reference to the said drawings that in the elliptical forms the parts of the walls of the ingot in line with the longer axis of the ellipse are thicker than the parts in line with the shorter axis. Therefore by the mode of rolling and reducing the ingot described in said patent it is apt to occur that the walls of the ingot are not reduced with that uniformity which is desirable; but by the mechanism herein described—that is, by making the mandrel-balls at each pair conform to the shape of the pass in that pair—the walls of the ingot at each pass are brought to a uniform thickness, and it is therefore impossible that the walls of the pipe should be otherwise than true. Furthermore, by making the alternate rolls with round passes and the mandrel-balls of corresponding shape the elliptical form which the ingot receives from the elliptical ball and pass is rolled out

and a round form given to it, and thus the reduction of the ingot to the required diameter of the pipe is greatly facilitated.

While only elliptical passes and balls are mentioned above yet it must be understood that I do not limit myself to that specific form; but any other equivalent form that will have the effect of changing the ingot alternately from a round to an elongated form when viewed in cross-section may be substituted for the form shown.

I claim—

1. In tube-rolling machines, the combination of a series of pairs of grooved rolls, the grooves of each pair forming passes that decrease in area with each successive pair, and mandrel-balls located in the passes of the rolls, the transverse area of said balls decreasing correspondingly and in the same proportion as the passes of the respective rolls, substantially as specified.

2. The combination, with a mandrel-rod, of a series of mandrel-balls, means for holding the end balls, and sleeves placed on the mandrel-rod between the balls for spacing the balls and holding them immovable in connection with the devices that hold the end balls of the series, substantially as specified.

3. The combination of a series of pairs of grooved rolls, the grooves of each pair forming a pass, and a mandrel consisting of a series of balls corresponding to the said pairs of rolls and located in the passes of the rolls, and each ball having the same shape in transverse section as the pass in which it is located, substantially as specified.

4. The combination of a series of pairs of grooved rolls, the grooves of each pair forming a pass, and with alternately elliptical and circular passes, with a mandrel consisting of a series of alternately elliptical and round balls in transverse section corresponding to the passes in the said pairs of rolls, substantially as specified.

5. The combination of a series of pairs of vertical rolls provided with elliptical passes, alternating with pairs of horizontal rolls provided with suitable passes, with a series of mandrel-balls connected by a rod and located in the passes of the respective pairs of rolls, the balls in the passes of the vertical rolls being elliptical and corresponding with the passes of the said rolls, and the balls in the passes of the horizontal rolls corresponding in shape to the passes therein, substantially as specified.

In testimony that I claim the foregoing as my invention I have hereunto subscribed my name.

CHARLES KELLOGG.

In presence of—
THOS. J. FARRELL,
WILTON C. DONN.