June 7, 1955 G. SANDERSON 2,709,935

DEVICE FOR STRAIGHTENING SEAMLESS METAL TUBING

Filed June 5, 1947

FIG. 1.

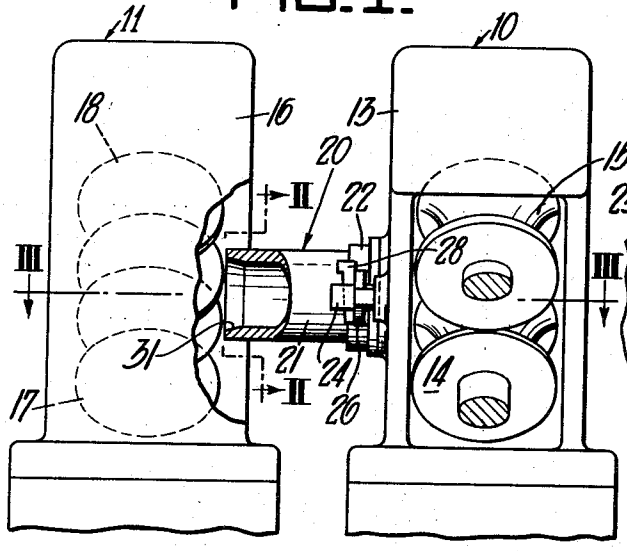


FIG. 2.

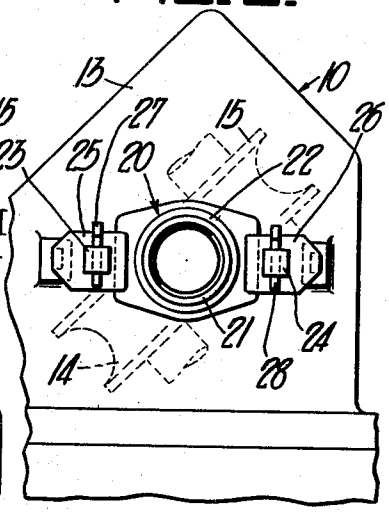
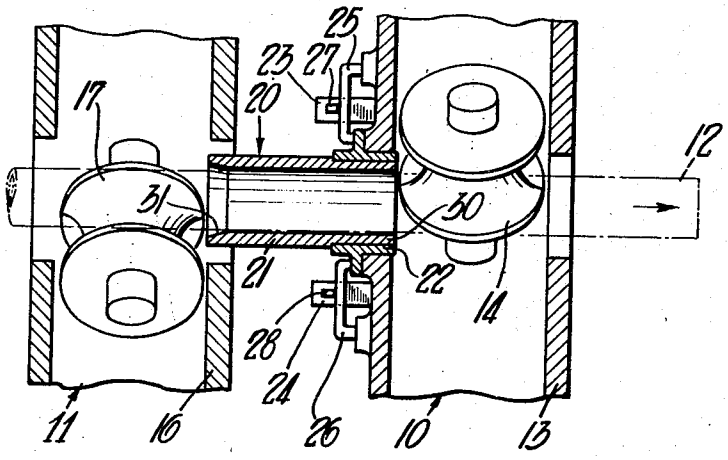


FIG. 3.



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United States Patent Office

2,709,935

Patented June 7, 1955

2,709,935

DEVICE FOR STRAIGHTENING SEAMLESS METAL TUBING

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Application June 5, 1947, Serial No. 752,661

2 Claims. (Cl. 80—51)

This invention relates to methods and devices for straightening seamless metal tubing during manufacture, and particularly for straightening short irregularities not corrected by usual straightening equipment.

In typical seamless tubing manufacture, the stock, after piercing, rolling and reeling, and while still hot, passes through sizing mills. These mills comprise a number of spaced stands of power driven, mating rolls. The roll surfaces are grooved, spaces between mating roll surfaces being oval on all but the last two stands. The roll pass circumference decreases on successive stands, so that tubing passing through the sizing mill is reduced in diameter to the desired final dimension.

The last rolls commonly are identical with those of the stand next preceding. Thus there is no further reduction in diameter as tubing passes through the last stand, but rather this stand serves to finish or "round up" the tubing.

Often there are bends or other irregularities in tubing as it leaves the last stand of the sizing mill. Separate equipment is commonly provided for removing long bends, but is ineffectual for removing short irregularities, under about 18 inches in length. Typical of the latter are "hooked" ends, often found at the forward end of tubing.

When tubing ends are hooked in the direction of the contact plane of the last rolls, engagement with these rolls may pinch the tubing surface and produce fins or "shear marks." Hooked ends, as well as prominent shear marks, must be removed before tubing is threaded. It is customary to crop short lengths (3 or 4 inches) from tubing for test purposes and to square the ends. The prior art has resorted to the wasteful practice of cropping additional lengths (as much as 18 inches) to remove hooks, fins and shear marks.

The principal object of the present invention is to provide improved methods and devices operable in conjunction with sizing mills for removing short irregularities in tubing.

A further object of the invention is to provide improved methods and devices for eliminating hooked ends without cropping excessive lengths, thereby promoting economy in tubing manufacture.

A further object of the invention is to provide devices as described which may be installed on standard sizing mills and which eliminate hooked ends prior to engagement of the tubing with the last rolls.

In accomplishing these and other objects of the present invention, I have provided improved methods and structural details, a preferred embodiment of the device being shown in the accompanying drawing, wherein:

Figure 1 is a side elevational view of the last two stands of a sizing mill having installed thereon a straightening device embodying features of the present invention;

Figure 2 is a sectional view taken substantially on line II—II of Figure 1; and

Figure 3 is a sectional view taken substantially on line III—III of Figure 1.

Referring more in detail to the drawing:

In Figure 1 there is shown a portion of a sizing mill that includes a last stand **10** and a stand **11**, preceding said last stand and spaced therefrom. Tubing **12** passes through the mill from left to right as viewed in Figure 1.

Stand **10** includes a housing **13** and grooved power driven rolls **14** and **15**. Stand **11** includes a housing **16** and rolls **17** and **18**, identical to rolls **14** and **15**, but having their axes of rotation perpendicular thereto. As hereinbefore explained, the tubing diameter is not reduced in the last stand. The structure thus far described is usual in sizing mills, and hence is not described in greater detail.

In accordance with the present invention, a straightening device **20** is mounted in the space between stands **10** and **11**, the details of which are best shown in Figure 3.

Straightening device **20** comprises a sleeve **21** supported at its forward end on housing **13** of the last stand for limited relative angular movement, and being unsupported at its rearward end adjacent stand **11**. The preferred sleeve mounting means includes a flanged bushing **22**, which is removably affixed to housing **13**. The means illustrated for affixing the bushing to the housing includes diametrically apertured studs **23** and **24** integral with the housing, clamp plates **25** and **26** placed over said studs and engaging the bushing flange, and wedges **27** and **28** extending through the stud apertures and engaging the faces of said clamp plates. However, it is obvious that other forms of affixing means could be employed without departing from the invention.

Sleeve **21** has a portion **30** of reduced outside diameter received in bushing **22**. Preferably the tolerance between the outside diameter of sleeve portion **30** and the bore diameter of bushing **22** is in the order of 0.010 inch, an amount sufficient to permit limited angular movement of the rearward end of the sleeve.

In order to "iron out" short irregularities in tubing **12**, the sleeve bore has a close tolerance over the outside of the tubing. The extreme range that I have found useful is a diameter tolerance of 0.038 to 0.095 inch. The lower portions of this range are used for smaller sizes of tubing and upper portions for larger sizes. For example, I prefer a range of 0.038 to 0.065 inch for tubing of 2⅛ inches outside diameter and a range of 0.050 to 0.095 inch for tubing of 3½ to 8⅝ inches outside diameter.

The rearward end of the sleeve bore is flared, as indicated at **31**, to facilitate entry of the tubing. As shown in Figures 1 and 3, the span of sleeve **21** is as nearly as possible co-extensive with the length of space between stands **10** and **11**.

In operation, tubing passing through the sizing mill traverses the bore of sleeve **21**. Short irregularities, of length up to the bore length, are thereby ironed out. Hooked ends are examples of irregularities removed by this operation. Since these irregularities are eliminated before tubing enters the last rolls, engagement with these roll produces no fins or shear marks.

Some freedom of angular movement in the rearward end of the sleeve is desirable so that the sleeve yields slightly under impact of tubing which strikes flared portion **31** of the sleeve bore. Unless provision is made for such yielding, impact of tubing striking the sleeve on entry thereto may cause breakage of the sleeve or its mounting.

It is desirable that the sleeve span be the maximum possible to remove bends having length as nearly as possible up to the distance of spacing between the last two stands. This distance approaches the length of bend which conventional straightening equipment effectively removes.

Sizing mill rolls commonly are removably mounted in order to adapt the mill for different sizes of tubing by

merely changing rolls. For similar reasons, and to facilitate replacement of worn sleeves, it is preferred to employ a readily removable mounting for the sleeve.

It is seen that straightening methods and devices of the present invention are of simple construction and may be installed readily on standard sizing mills. They enable short irregularities in tubing to be eliminated both expeditiously and economically and are particularly advantageous in eliminating hooked ends.

While I have shown and described only a single embodiment of the device and a single method, it is apparent that modifications may arise. For example, equivalent methods and devices may be employed in connection with the manufacture of products other than seamless tubing, such as butt-welded tubing or bar stock. Therefore I do not wish to exclude such further use of the invention, nor to be limited otherwise by the disclosure set forth, but only by the scope of the appended claims.

I claim:

1. In a seamless tubing sizing mill which includes a plurality of spaced apart roll housings, and a pair of grooved rolls rotatably mounted in each of said housings and furnishing a series of aligned roll passes, the last two of which are of substantially circular cross section and have equal diameters, the combination with the last of said roll housings of a straightening device comprising support means carried by the entry side of said last roll housing, and a sleeve carried at its exit end by said support means for limited angular movement in all directions and being substantially axially aligned with the roll passes, said sleeve extending back with its entry end being free and situated adjacent the exit side of the roll pass next preceding the last and thus substantially spanning the space between the last two pairs of rolls, the bore of said sleeve being flared at its entry end and the remainder of the bore being of substantially uniform inside diameter exceeding the diameter of the last two roll passes by 0.038 to 0.095 inch.

2. In a seamless tubing sizing mill which includes a plurality of spaced apart roll housings, and a pair of grooved rolls rotatably mounted in each of said housings and furnishing a series of aligned roll passes, the last two of which are of substantially circular cross section and have equal diameters, the combination with the last of said roll housings of a straightening device comprising a bushing, fastening means removably fixing said bushing to the entry side of said last roll housing, and a sleeve having a portion of reduced outside dimensions at its exit end received in said bushing and supporting the sleeve for limited angular movement in all directions and substantially in axial alignment with the roll passes, said sleeve extending back with its entry end being free and situated adjacent the exit side of the roll pass next preceding the last and thus substantially spanning the space between the last two pairs of rolls, the bore of said sleeve being flared at its entry end and the remainder of the bore being of substantially uniform inside diameter exceeding the diameter of the last two roll passes by 0.038 to 0.095 inch.

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