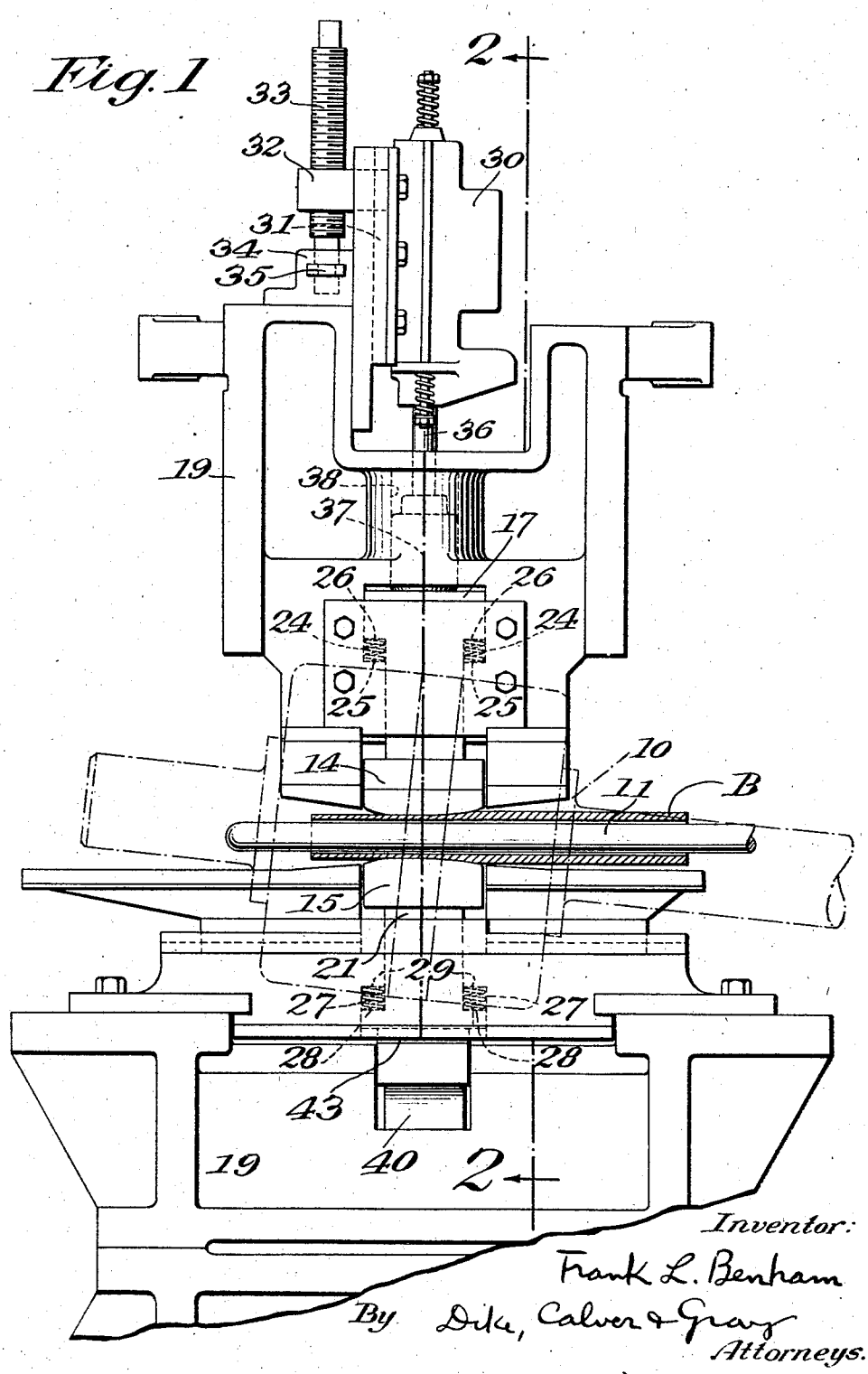
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APPARATUS FOR REDUCING AND ELONGATING TUBES

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Fig. 1



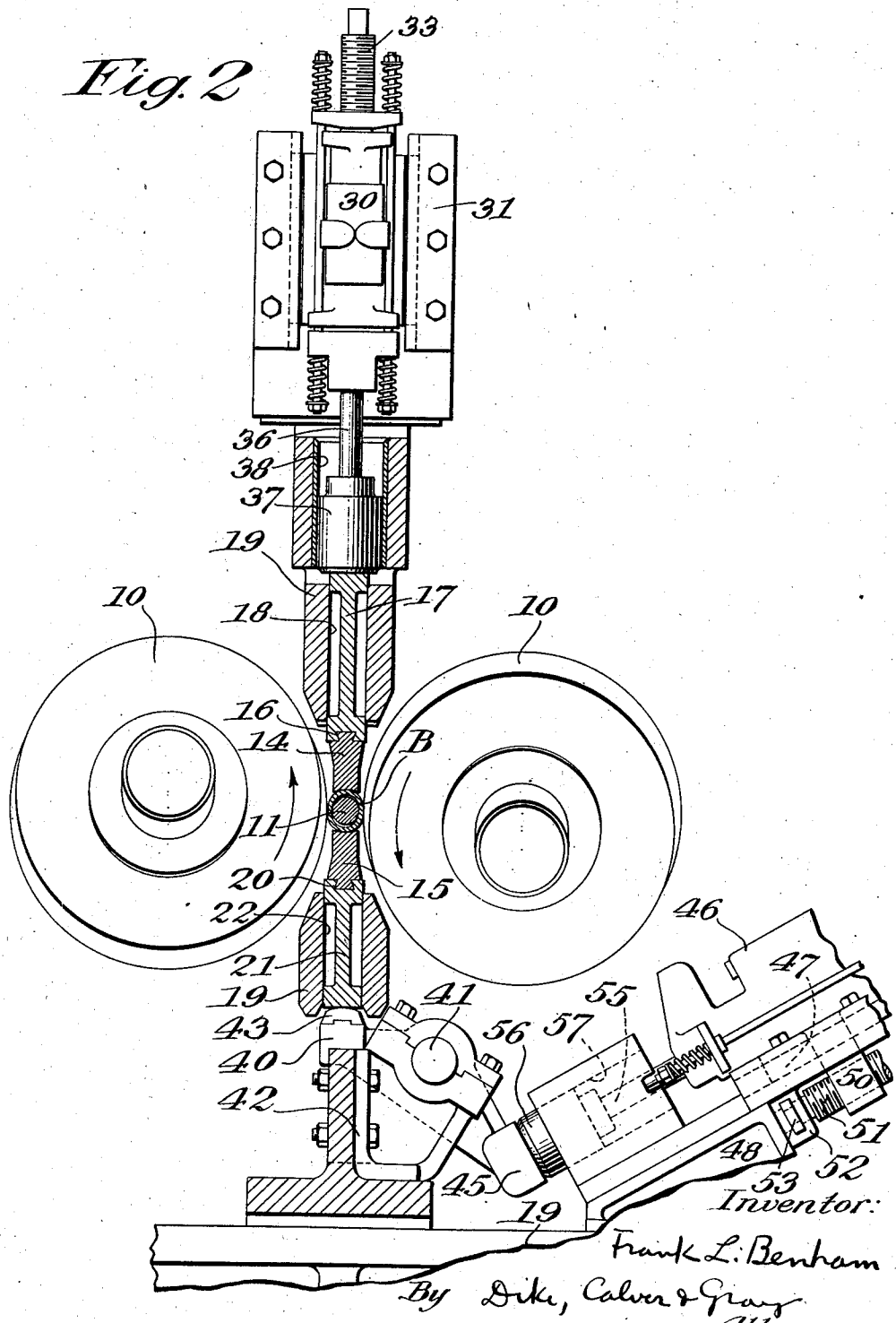

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Fig. 2




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# UNITED STATES PATENT OFFICE

2,026,666

## APPARATUS FOR REDUCING AND ELONGATING TUBES

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2 Claims. (Cl. 80—13)

One of the principal methods of manufacturing seamless tubes involves feeding a tubular blank supported upon a mandrel longitudinally between pressure rolls, the axes of which are disposed at an angle to each other and to the axis of the blank. These rolls reduce the wall thickness of the blank but, inasmuch as they are disposed at an angle to the axis of the tube, the pressure applied has a component acting laterally of the blank which causes the metal to flow laterally and the tube to bulge and become oval. Unless the lateral flow or circumferential growth of the metal is controlled, the tube will not elongate to any marked degree. It has been attemepted to control the bulging of the tube by fixed guides positioned between the pressure rolls at opposite sides of the tube and engaging the bulged portions of the tube. When these guides are adjusted so as to control the lateral growth of the tube and cause it to elongate, the friction upon the surface of the tube is so great that the surface often is defective and commercially unsatisfactory.

The present invention contemplates the provision of an apparatus for the manufacture of seamless tubes whereby the tubular blank is subjected to a reducing action causing it to bulge laterally and the bulging is limited and controlled and the lateral flow of the metal is diverted longitudinally by the application of pressures periodically to the bulged portions of the tube. The procedure followed is such that the tube can change its shape intermittently from oval to practically round. The pressures are applied periodically at such a rapid rate and in a manner such that a given portion of the tube is worked repeatedly and the resulting elongated tube is practically cylindrical and has an internal diameter slightly greater than that of the mandrel and the frictional resistance to which the surface of the tube is subjected is reduced to a minimum.

In accordance with the preferred practice of the invention, the tubular blank is fed longitudinally over a mandrel and between cross rolls of any well known type, the axes of which are inclined to each other and to the axis of the blank. As the blank is subjected to the reducing pressures of the cross rolls it is caused to bulge laterally as a result of the peripheral flow of the metal. The bulging of the tube is limited in a predetermined amount by guides which are reciprocated rapidly into and out of engagement with the bulged portions on opposite sides of the tube between the cross rolls to exert pressures on the bulged portions repeatedly as the blank is fed.

The invention will be more clearly understood from the following description in conjunction with the accompanying somewhat diagrammatic drawings; in which

Fig. 1 is an elevational view of an apparatus embodying the invention; and

Fig. 2 is an elevational view, partly in section, taken upon the line 2—2 of Fig. 1.

Before explaining in detail the present invention it is to be understood that the invention is not limited in its application to the details of construction and arrangement of parts illustrated in the accompanying drawings, since the invention is capable of other embodiments and of being practiced or carried out in various ways. Also it is to be understood that the phraseology or terminology employed herein is for the purpose of description and not of limitation, and it is not intended to limit the invention claimed herein beyond the requirements of the prior art.

In the practice of the invention a cross rolling machine of any well known type is utilized in combination with a swaging machine. The cross rolling machine includes, as illustrated in the accompanying drawing, a pair of cross rolls 10 spaced apart and having their axes disposed at an inclination to each other and to the axis of a tubular blank B supported upon a mondrel 11 positioned in the pass between the rolls 10. Although the rolls 10 are shown as of general barrel shape, they may be of mushroom or any other suitable shape commonly employed in the usual cross rolling machine.

The swaging portion of the apparatus comprises upper and lower guides 14 and 15 adapted to engage opposite portions of the blank B between the cross rolls 10. The upper guide 14 is suitably secured, as by a dovetail connection 16, to a guide holder 17 which is mounted for reciprocation in a suitable guideway 18 formed in a frame 19 of the apparatus. Likewise, the lower guide 15 is suitably secured, as by a dove-tail connection 20, to a die holder 21 mounted for reciprocation in a suitable guideway 22 formed in the frame 19. A pair of springs 24, positioned between shoulders 25 and 26 formed in the frame 19 and guide holder 17 respectively, tend to hold the upper guide 14 out of engagement with the blank B. A pair of springs 27, positioned between shoulders 28 and 29 formed in the frame 19 and guide holder 21 respectively, tend to hold the lower guide 15 out of engagement with the blank B.

The upper guide 14 is moved into engagement with the blank B by a pneumatic hammer 30 which is mounted in suitable guideways 31 upon the frame 19 for adjustment therein by a screw 33. The casing of the pneumatic hammer 30 is provided with a threaded lug 32 adapted to be engaged by the screw 33, the shaft of which is mounted for rotation in a suitable bearing 34 in the frame 19. Axial movement of the screw 33 is prevented by a key 35 extending through a slot in the frame 19 into an annular groove in the shaft of the screw. The pneumatic hammer 30 is provided with a plunger 36 which carries at its end a hammer head 37 adapted to reciprocate in a suitable guideway 38 formed in the frame 19 so as to engage the upper end of the die holder 17.

The lower guide 15 is moved into engagement with the blank B by a rocker arm 40 which is actuated by a pneumatic hammer 46. The rocker arm 40 is mounted to rotate upon a shaft 41 fixed in a bracket 42 carried by the frame 19. One end of the rocker arm 40 is provided with a hardened face 43 adapted to engage the lower end of the die holder 21. The other end of the rocker arm 40 is provided with a hardened face 45. The pneumatic hammer 46 is mounted in suitable guideways 47 in a bracket 48 carried by a frame 19 for adjustment therein by a screw 51. The casing of the hammer 46 is provided with a threaded lug 50 adapted to be engaged by the screw 51, the shaft of which is rotatably mounted in a suitable bearing 52 formed in the bracket 48. Axial movement of the screw 51 is prevented by a key 53 extending through a slot in the frame 19 into an annular groove in the shaft of the screw. The hammer 46 is provided with a plunger 55 which carries at its end a hammer head 56 adapted for reciprocation in a suitable guideway 57 formed in the bracket 48 so as to move into engagement with the hardened face 45 of the arm 40.

In operation, the cross rolls 10 are rotated in the usual manner to exert a reducing pressure upon the blank B and to cause the latter to be fed longitudinally. Inasmuch as the axes of the cross rolls 10 are disposed at an inclination they exert a reducing pressure upon the blank B having a component laterally of the mandrel causing the metal of the blank to flow peripherally and bulge. At the same time the pneumatic hammers 30 and 46 are actuated to reciprocate the hammer heads 37 and 56 rapidly and move the upper guide 14 and the lower guide 15 into engagement with the bulged portions of the blank B several hundred times per minute thereby intermittently limiting the bulging and diverting the circumferential growth of the tube longitudinally to elongate the tube.

Because of the intermittent engagement of the dies with the blank, the frictional resistance between the same is greatly reduced and the blank is reduced and elongated without detrimentally affecting the surface of the tube. Each guide is herein shown, for example, as being about nine inches in length with its working surface slightly curvilinear, being formed, for example, on a radius of about thirty-four inches. Consequently, a considerable length of the operative surfaces of the guides, three inches for example, is substantially straight and parallel to the axis of the mandrel or tube which it supports. This fact together with the rapid reciprocation of the guides assures working of each point of the tube a number of times. By adjusting the pneumatic hammers to obtain the desired limit of movement of the guides toward the mandrel, the diameter of the tube may be controlled so that it will be slightly larger than that of the mandrel and the tube will be substantially cylindrical.

From the foregoing it will be seen that reduction and elongation of the tubular blank are secured by virtue of the present invention in an improved manner while largely eliminating disadvantages resulting as heretofore from the use of vertically fixed guides located intermediate the cross pressure rolls. As a result of the present invention, it is not necessary, as heretofore, to set a pair of vertically fixed guides, either of the stationary or rotary type, with a constant opening between the working points of the pressure rolls. Where, as heretofore, a fixed vertical distance between the working surfaces of the guides is necessitated, uniform control of the tube ovality or circumferential growth is difficult, particularly on account of the excessive wear of the working surfaces of the guides. This will be readily understood when it is considered that the extent of elongation is decreased in accordance with the increase in the extent of the tube ovality between the pressure rolls.

In accordance with the present invention, by providing reciprocating or vibrating members functioning both as guides and swaging dies, the maximum degree of ovality of the tubing will not appreciably increase during operation. Although the guides are shown as reciprocating in a vertical direction it will be understood that the apparatus may be designed or arranged so that the guides will reciprocate or vibrate angularly with respect to the horizontal or to the plane of the pressure rolls. In practice it is preferable that the guides reciprocate in a plane substantially or nearly at right angles to the plane of the pressure rolls. On the other hand, the tube does not remain constantly oval since the opening between the guides is not a constant. The tube is worked between the vibratory guides and tends to become intermittently round and oval. This operation in fact accelerates the elongation of the tubing. Since the pressure on the tubing in the locality of the vibratory guides is not constant, as heretofore, it is therefore apparent that the frictional resistance of the tubing is materially less. Hence, wear of the surfaces of the guides is greatly reduced and in consequence thereof impairment of the exterior tube surface is minimized.

I claim:

1. In an apparatus for reducing the wall thickness and elongating a tubular metal blank having means for feeding the blank longitudinally and for subjecting opposite sides of the blank to reducing pressures including a mandrel within a blank and pressure rolls acting upon opposite sides of the exterior of the blank causing the blank to bulge laterally away from the mandrel, the combination therewith of guides mounted to engage opposite sides of the blank between said pressure rolls, means for reciprocating said guides in a straight line path toward and from each other and into and out of engagement with the blank as it is fed longitudinally to cause said guides alternately to limit and permit bulging of the blank, and adjustable means for changing the limits of movement of said guides with relation to said mandrel.

2. In an apparatus for reducing the wall thickness and elongating a tubular metal blank having means for feeding the blank longitudinally and for subjecting opposite sides of the blank

to reducing pressures including a mandrel within the blank and pressure rolls having their axes inclined to each other and to the mandrel adapted to subject opposite sides of the blank to pressures causing the blank to bulge laterally away from the mandrel, the combination therewith of guides mounted to engage opposite sides of the blank between said pressure rolls, means for moving said guides into and out of engagement with the blank as it is fed longitudinally to cause said guides alternately to limit and permit bulging of the blank, and adjustable means for changing the limits of movement of said guides with relation to said mandrel.

FRANK L. BENHAM.