

(No Model.)

C. G. P. DE LAVAL.

METHOD OF MANUFACTURING PIPES WITHOUT WELDED JOINTS.

No. 574,740.

Patented Jan. 5, 1897.

Fig. 1.

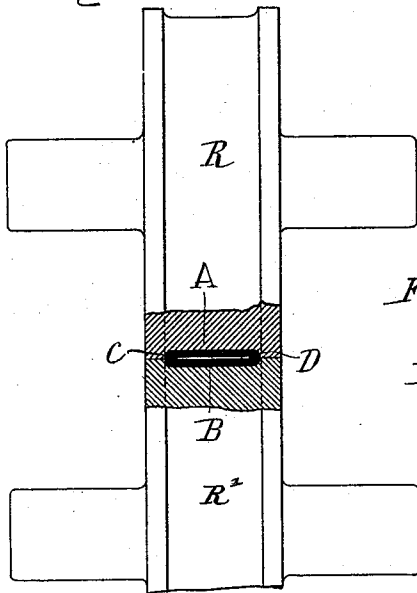


Fig. 1a.



Fig. 2.

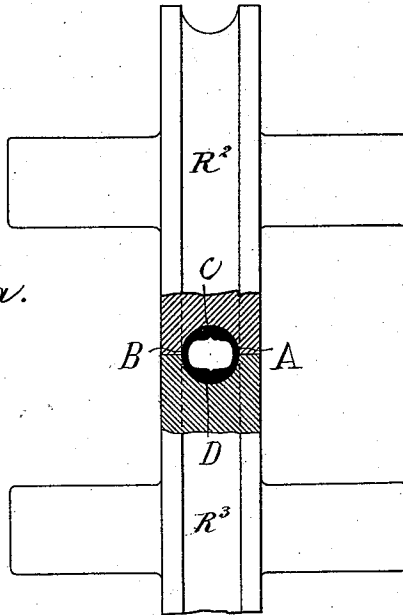


Fig. 3.

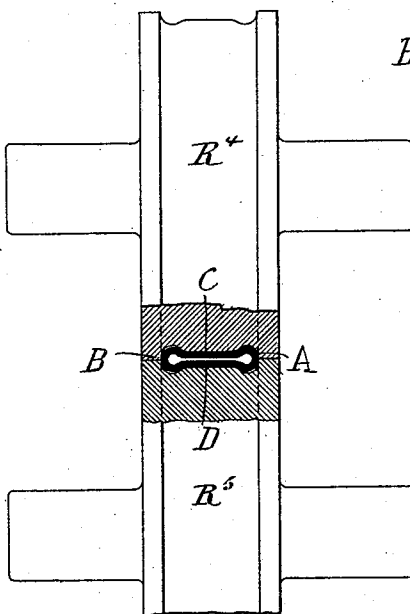
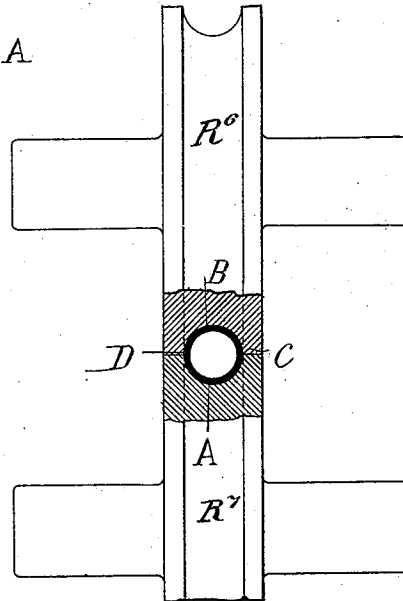


Fig. 2a.



Fig. 4.



WITNESSES.

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CARL GUSTAF PATRIK DE LAVAL, OF STOCKHOLM, SWEDEN.

METHOD OF MANUFACTURING PIPES WITHOUT WELDED JOINTS.

SPECIFICATION forming part of Letters Patent No. 574,740, dated January 5, 1897.

Application filed December 31, 1894. Serial No. 533,422. (No specimens.) Patented in Sweden November 15, 1894, No. 5,920; in Germany December 19, 1894, No. 83,553, and in England April 16, 1895, No. 7,643.

To all whom it may concern:

Be it known that I, CARL GUSTAF PATRIK DE LAVAL, a citizen of Sweden, residing at Stockholm, Sweden, have invented certain
5 new and useful Improvements in Processes of Making Seamless Tubes, (for which I have obtained Letters Patent in Sweden, No. 5,920, dated November 15, 1894; in Germany, No. 83,553, dated December 19, 1894, and in Eng-
10 land, No. 7,643, dated April 16, 1895,) of which the following is a specification.

Pipes and other hollow bodies were heretofore manufactured in such a manner that a hollow bar is rolled from a hollow cast or
15 punched body of metal, which bar is changed afterward by any approved process into a circular pipe. One method of producing this change into a circular pipe was that one end of the hollow bar is closed while steam or gas
20 of high pressure is introduced into the other end, so that in this manner the pipe is enlarged into circular shape. Whatever be the method of transforming the shape of the hollow bar it is subject to the objection that the
25 finished tube shows at the points which before were the corners of the hollow bar not the same thickness as at the remaining points—in other words, that depressions remain at those points and the material is not subjected at
30 those points to the same treatment to which the remaining parts of the tube are subjected. These points therefore offer less resistance to strain and impart thereby a certain degree of weakness to the tubes.

35 The object of this invention is to obviate the defects referred to and to produce in manufacturing seamless tubes from a hollow body a uniform thickness throughout the cross-section of the tube, so that it will have a uni-
40 form durability throughout.

The invention consists, therefore, in first rolling a hollow metallic body into a flat bar, then subjecting the body to a round rolling at right angles to the former rolling so as to
45 open the body, then subjecting the body to a flat rolling in the same direction as the round rolling, so as to flatten the body and reduce the thickness of the same uniformly throughout its cross-section, and finally subjecting
50 the body to a round rolling at right angles to the last flat rolling. By the successive roll-

ings the bar is worked upon at those points which heretofore formed a ridge, so that the thickness of the material is reduced even at those points to the required degree. This
55 successive rolling of the bar in directions at right angles to each other can be repeated several times, so as to produce the final uniform thickness of the tube. The changing of the bar into a circular seamless tube can
60 be produced in a very convenient manner in that the bar, instead of being expanded into a tube, as before described, is placed on its edge, is then carefully rolled down until the bar has been opened sufficiently, and then
65 the same is finished.

For clearly illustrating my invention the accompanying drawings represent different stages of my improved process.

Figure 1 represents the first rolling of the
70 hollow body into a flat bar; Fig. 2, the second rolling of the flat bar so as to open the same again. Fig. 1^a represents a cross-section of the bar while the same is in process of being rolled from the flat shape shown in Fig. 1 to
75 the circular shape shown in Fig. 2. Fig. 3 represents the closing down of the opened tubular body into a flattened bar. Fig. 2^a represents an intermediate stage of this step of the rolling process. Fig. 4 represents the
80 final opening and completing of the seamless tube by subjecting the flattened bar shown in Fig. 3 to an opening and final conversion into a tube of uniform thickness.

Similar letters of reference indicate corre-
85 sponding parts.

In carrying out my improved process of making seamless tubes a hollow body of suitable metal is subjected first to a rolling action between rolls R R', having shallow circum-
90 ferential grooves, so that a flattened bar is obtained in which the material is mainly acted upon by the rolls at the points A and B. The rolling action on the flat bar is preferably continued until the same receives a thickness
95 which corresponds to double the thickness of the wall of the finished tube. When the body is thus rolled out into the flattened bar shown in Fig. 1, the edges of the bar at the points C and D have a greater thickness of material,
100 so that unevennesses would appear in the tube if the bar were rolled out directly into a fin-

ished tube. For obviating this defect the flattened bar is passed through a second pair of rolls $R^2 R^3$, having nearly semicircular grooves, which gradually change the shape of the flattened bar to a circular shape, in which the points B and A are of less thickness, while the edges C and D are thicker and show slight interior longitudinal depressions. Before the flattened bar, however, assumes the shape shown in Fig. 2 it passes through the oval form shown in Fig. 1^a, that is to say, the flattened bar is gradually opened until it assumes the tubular shape shown in Fig. 2. By rolling the bar between a pair of rolls having semicircular grooves the bar is finally changed into a tube which has an exterior cylindrical shape, as shown in Fig. 2. For the purpose of removing the thicker parts C and D and the interior longitudinal depressions in said thicker parts C and D it is necessary to subject the tube to another rolling by subjecting the same to the action of a pair of rolls $R^4 R^5$, having flat grooves with deeper depressions near the edges of the grooves, as shown in Fig. 3.

While the tube of the cross-section shown in Fig. 2 is subjected to the rolling action of the pair of rolls shown in Fig. 3 it passes through the shape shown in Fig. 2^a until it finally assumes the shape of a flattened bar having rounded-off edges, as shown in Fig. 3. By the rolling of the tube into this hollow flattened shape the thicker portions and interior depressions at C and D disappear entirely, so that the tube is changed into a flattened bar of uniform thickness throughout with rounded-off edges at the points A and B, as shown in Fig. 3. This flattened bar is rolled out until the required thickness of the finished tube is obtained. The flattened bar is then transferred to another set of rolls $R^6 R^7$, having semicircular grooves corresponding to the exterior radius of the tube to be

manufactured, and is subjected to a careful rolling action by the same, so that the flattened bar shown in Fig. 3 gradually opens again and forms a tube of uniform thickness and exterior and interior cylindrical shape, as shown in Fig. 4. If, however, a smaller thickness and a greater diameter in the finished tube is to be produced, then the flattened bar shown in Fig. 3 is again rolled out into a flat bar and then opened again by rolling it alternately in directions at right angles to each other until the required diameter and thickness of the tube are obtained.

I am aware that seamless tubes have been produced heretofore by rolling a cast piece of metal into a flat bar, which is opened to a round tube by rolling the same on its edge, and I therefore do not claim the same broadly.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

The process herein described of making seamless tubes, which consists in first flat-rolling a hollow metallic body, secondly, round-rolling the flattened body in a direction at right angles to that of the flat-rolling, thirdly, flat-rolling the round body only for a portion of its width, and along the center of the same, in the same direction as was the act of round-rolling, so as to flatten the body along its center and not at the edges, whereby the thickness of the body is reduced uniformly throughout its cross-section, and finally round-rolling the body at right angles to the flat-rolling, whereby the body is opened out into practically perfect annular cross-section, substantially as set forth.

In testimony whereof I affix my signature in presence of two witnesses.

CARL GUSTAF PATRIK DE LAVAL.

Witnesses:

TYRKO ROBSAHM,
WALDEMAR BOMAN.