(No Model.)

J. P. SERVE.

MANUFACTURE OF RIBBED TUBES.

No. 440,512. Patented Nov. 11, 1890.

FIG. 1

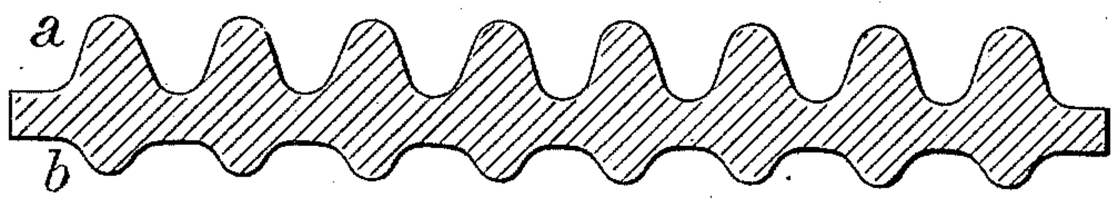


FIG. 2

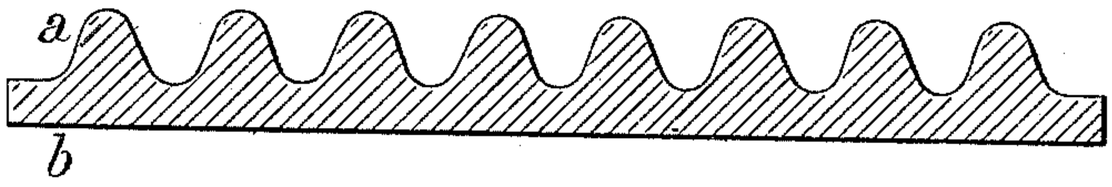


FIG. 3

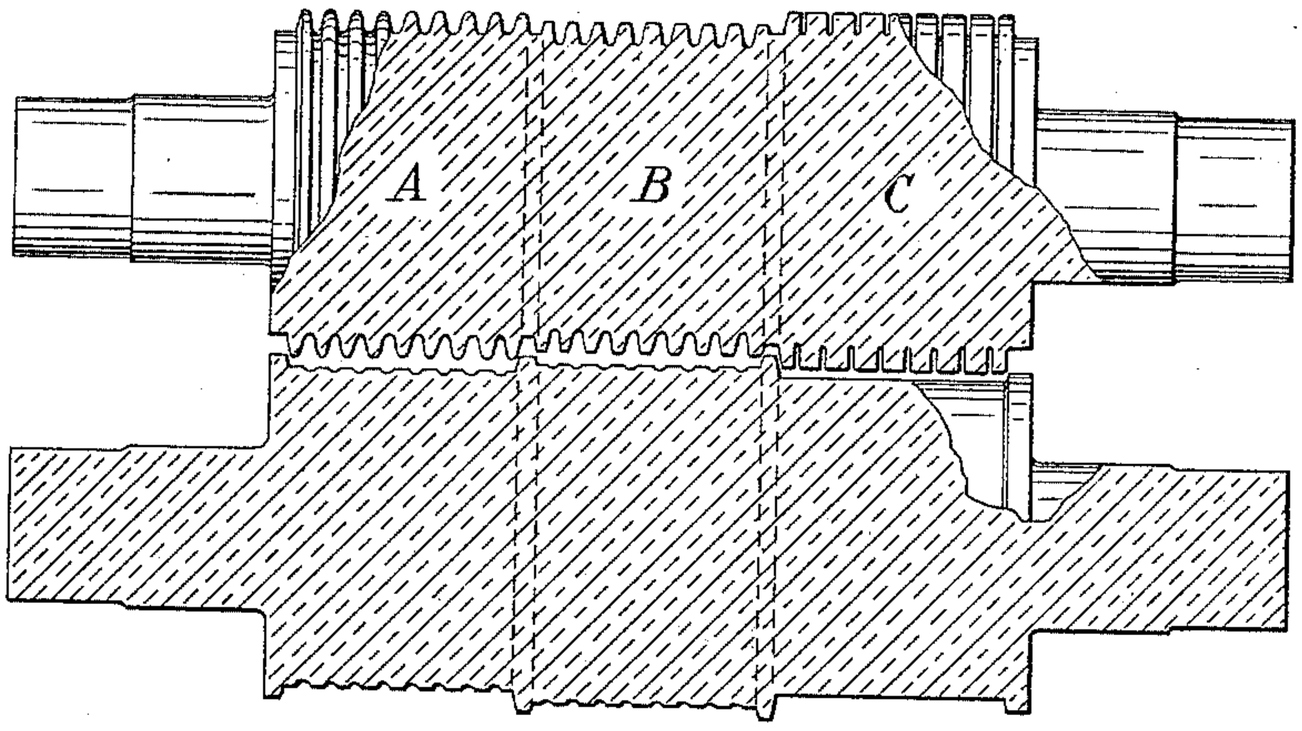


FIG. 4

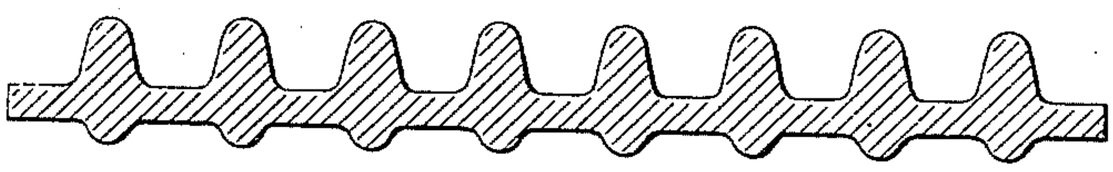


FIG. 5

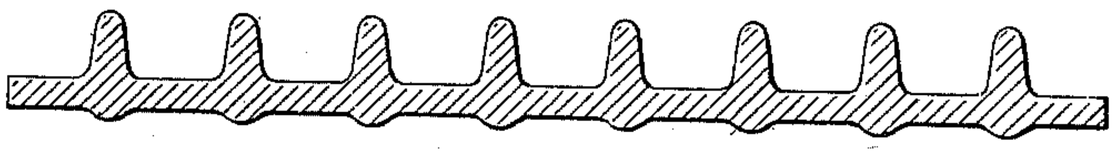
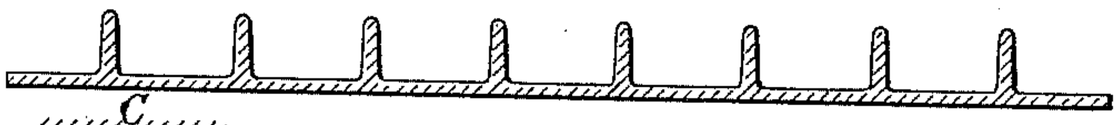


FIG. 6



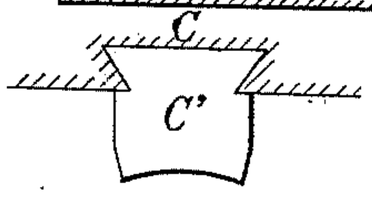


FIG. 7

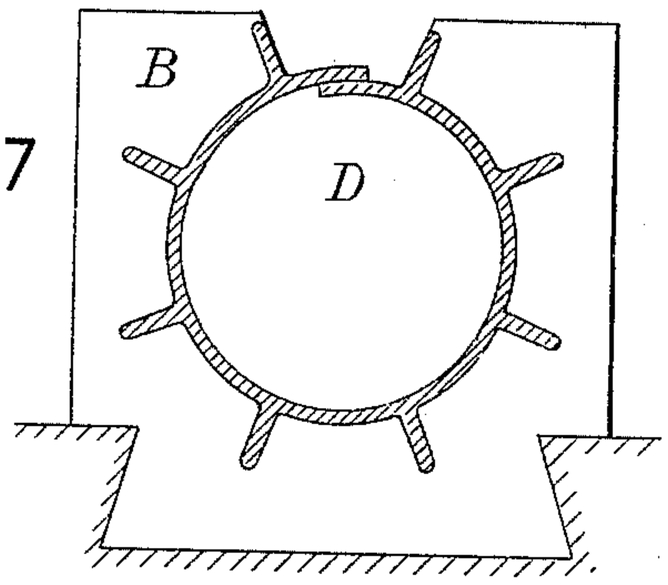
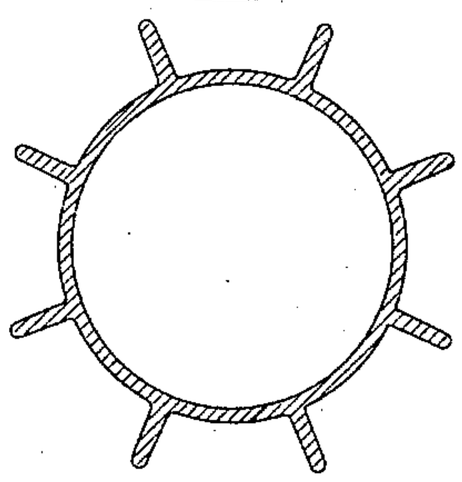


FIG. 8



Witnesses

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UNITED STATES PATENT OFFICE.

JEAN PIERRE SERVE, OF GIVORS, FRANCE.

MANUFACTURE OF RIBBED TUBES.

SPECIFICATION forming part of Letters Patent No. 440,512, dated November 11, 1890.

Original application filed August 7, 1889, Serial No. 320,045. Divided and this application filed November 8, 1889. Serial No. 329,634. (No model.) Patented in England May 26, 1888, No. 7,709; in France February 20, 1889, No. 196,197; in Belgium April 23, 1889, No. 85,937, and in Italy July 1, 1889, No. 25,747.

To all whom it may concern:

Be it known that I, JEAN PIERRE SERVE, manufacturer, a citizen of the Republic of France, and a resident of Rue des Servettes, Givors, (Rhône,) France, have invented new and useful Improvements in the Manufacture of Ribbed Tubes for Boilers, Condensers, and other Similar Purposes, (for which I have obtained patents in the following countries: in France, No. 196,197, dated February 20, 1889; in Belgium, No. 85,937, dated April 23, 1889; in Italy, No. 25,747, dated July 1, 1889, and in Great Britain, No. 7,709, dated May 26, 1888,) of which the following is a specification, reference being had to the accompanying drawings.

This application is a division of an application filed by me in the United States Patent Office August 7, 1889, Serial No. 320,045.

In the United States Patent No. 349,060, granted to me on the 14th of September, 1886, I claimed a system of ribbed tubes for boilers, condensers, and the like, devised for the purpose of increasing their power of transmission of either heat or cold.

The present invention relates to improved means for manufacturing such ribbed tubes of iron or steel by a welding process.

In making ribbed tubes of iron or steel by a welding process a plate is taken as a "starting" piece, (or blank,) obtained directly either by hammering or by casting or by drawing an ingot of rectangular or other form of a thickness at least equal to that of a finished plate, including the depth of the ribs. It is unnecessary further to dwell upon the method of making this blank, obtained either by hammering or by casting, or by treating a suitable ingot in a rolling-mill. It should be borne in mind that this piece may either be provided with projections on one surface and left flat on the other, or have projections on both sides. It may be hammered into shape or cast or produced by means of a mill in which the upper roll is alone provided with grooves, while the lower roll is smooth, or in which both the upper and the lower roll are grooved (or fluted.) The initial pieces (or blanks) being thus obtained by well-known methods, what is further required is to give them a tubular shape and to weld their edges together. Now this is the object of the present invention.

In the accompanying drawings, Figure 1 is a cross-section of a plate or blank provided with projections on both sides, as shown in *a* and *b*. Fig. 2 is a cross-section of a plate or blank provided with projections *a* on one side, while its other side or surface *b* is flat. Fig. 3 is a vertical section of the finishing-mill, into which the said blank is placed.

The grooves in each successive pair of rolls decrease in width, each pair corresponding to one pass and the last pair delivering the plate in a condition adapting it to be rolled up, it being provided with ribs on one side, while the other side is smooth. In the specimen shown in the drawings I have divided the finishing-mill into three parts A, B, and C, corresponding to three passes. Fig. 4 represents as a specimen, on an enlarged scale, the shape assumed by the blank after its passage through portion A of the mill. Fig. 5 is a similar specimen, also enlarged, of the shape assumed by the blank after passing through portion B of the mill; and Fig. 6 is an enlarged view of the plate when finished—*i. e.*, on issuing from portion C of the rolling-mill, whereupon it is fit to be rolled up and welded. In this instance I have only shown the type of plate which is provided with grooves on both sides. Where the blank has projections or ribs on one side only while the other side is flat, the series of operations it has to undergo is exactly the same, except that in that case the lower rolls of the finishing-mill are smooth instead of being grooved. In either case, when all the operations are completed a finished plate is obtained, as shown in Fig. 6, fit to be rolled up and welded.

Fig. 7 is a cross-section of a specimen tube with external ribs, placed upon a support in position for its edges to be welded together by the action of a steam-hammer, or by any other suitable machinery. Fig. 8 is a cross-section of the finished tube with external ribs.

I wish it to be understood that I do not ex-

tend the claims to the method indicated of forming the initial piece or blank, but confine such claims to the production of the ribbed plates and to the process of welding together the edges of the same. This being stated, I shall now proceed to describe in the main the manner in which I operate.

To obtain a tube with longitudinal ribs sufficiently deep—*i. e.*, projecting inwardly a sufficient distance to enable them to transmit the greatest part of the heat contained in the gases or vapors passing through the tubes, as shown in Fig. 8—the initial piece or blank, as shown in Figs. 1 and 2, is first obtained by hammering, casting, or cogging, as shown in Figs. 1 and 2. This initial plate is thicker in the parts when the ribs or projections are to be formed, and projections or protuberances are formed on both sides of the plate opposite each other, those marked *b* on the one side being smaller than those marked *a* of the other side. In determining the proportions of these projections or protuberances care should be taken that they consist of a sufficient quantity of metal to form the ribs it is eventually desired to obtain, so as to obviate the necessity of borrowing the metal required, or any smallest quantity of metal, from the body of the plate itself. Such plate is then made to go through the ordinary passes of a rolling-mill, Fig. 3, the upper rolls corresponding to projections *a* being provided with grooves becoming narrower in each succeeding roll, so as to make the projections gradually thinner as the plate is elongated by the action of the rolls. On the other hand, the grooves of the lower roll corresponding to projections *b* constantly decrease in depth and finally disappear at or near the last pass of the plate between the rolls, the metal of these projections being destined to form the ribs on the other side of the plate. During the rolling operation the thickness of the plate and projections is gradually reduced until the plate assumes the shape shown in Fig. 6. By these successive reductions projections *a* are reduced in thickness in proportion as the plate is elongated, the metal required for the ribs being supplied by the projections *a* and *b*, Fig. 1, and the metal forming the body of the plate being provided by the body of the blank itself, which serves to commence the operations. These counter projections or protuberances *b* destined to disappear are not absolutely necessary, and the plate, as shown in Fig. 6, may, if required, be obtained by the employment of a smooth lower roll during the whole of the operation. In that case the type of blanks shown in Fig. 2 should be used. The ribbed plate being thus obtained, one of its ends is first slightly turned down by means of a hammer. The plate is then drawn hot through a species of funnel-shaped draw-plate so as to give it a cylindrical shape and to fit together the edges, which must be welded to complete the tube. The longitudinal junction of the edges is made in the smooth portion between the ribs, the edges of the rolled-up tube being made to meet and overlap each other, whereupon they are welded together by means of an appropriate hammer.

To weld the longitudinal edges of the tubes with inner or outer ribs, or with both inner and outer ribs, by means of a hammer I preferably employ the following arrangement, as shown in Fig. 7: Supposing the tube to be provided with external ribs only, the tube heated white-hot in a furnace is inserted into a bed or support B, Fig. 7, provided with suitable grooves for the reception of the ribs and fixed to the anvil of the hammer C, the head of which does not exceed the width of the interval between the ribs. An inner mandrel D is inserted into the tube so as to enable it to resist the blows of the hammer C, which welds together the edges of the tube as the latter advances within support B. Tubes with inner ribs may be welded in the same manner, except that mandrel D is provided with grooves instead of support B.

In the case of tubes provided with inner and outer ribs both the support and the mandrel should be provided with gooves.

What I claim is—

1. The ribbed plate having its edges properly fitted together, in combination with a bed or support provided with grooves for the reception of the ribs of the plate, which are embedded therein for the welding together of the edges of said plate, substantially in the manner described and shown.

2. The ribbed plate having its edges properly fitted together, and a bed or support provided with grooves corresponding to the ribs of the plate, in combination with a hammer provided with a plate or frame, substantially as described and shown.

3. The ribbed plate with edges suitably fitted together, in combination with a bed or support provided with grooves corresponding to the ribs of the plate, a hammer, and an inner mandrel or core for the purpose of obtaining a tube with external ribs, as described.

In testimony whereof I have hereunto signed my name in the presence of two subscribing witnesses.

JEAN PIERRE SERVE.

Witnesses:
GEORGES FREYDIER DUBREUL,
XAVIER JANICOT.