

No. 755,436.

PATENTED MAR. 22, 1904.

L. O. BENTEL.
ART OF MANUFACTURING TUBES.

APPLICATION FILED FEB. 12, 1903.

NO MODEL.

2 SHEETS—SHEET 1.

Fig. 1.

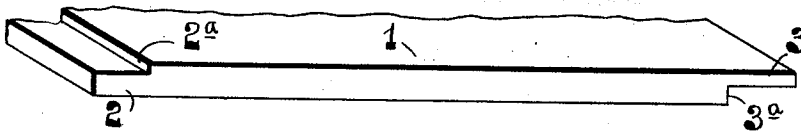


Fig. 2.

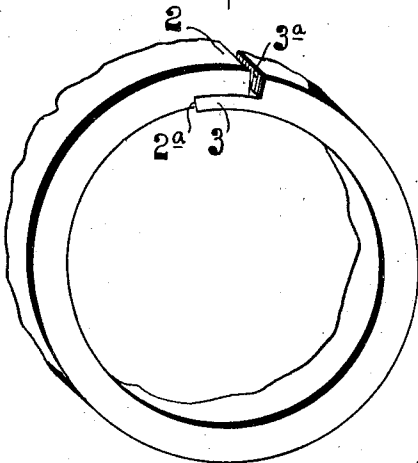


Fig. 3.

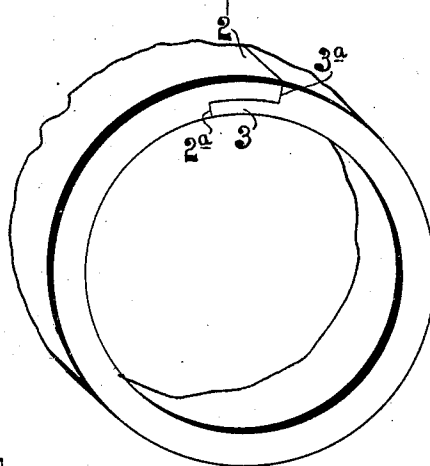


Fig. 4.

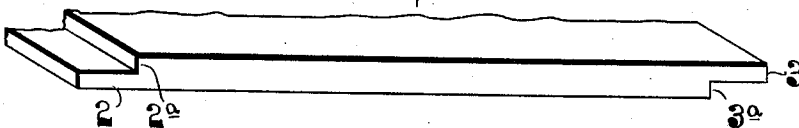
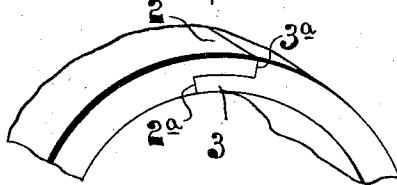


Fig. 5.



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2 SHEETS—SHEET 2.

Fig. 6.

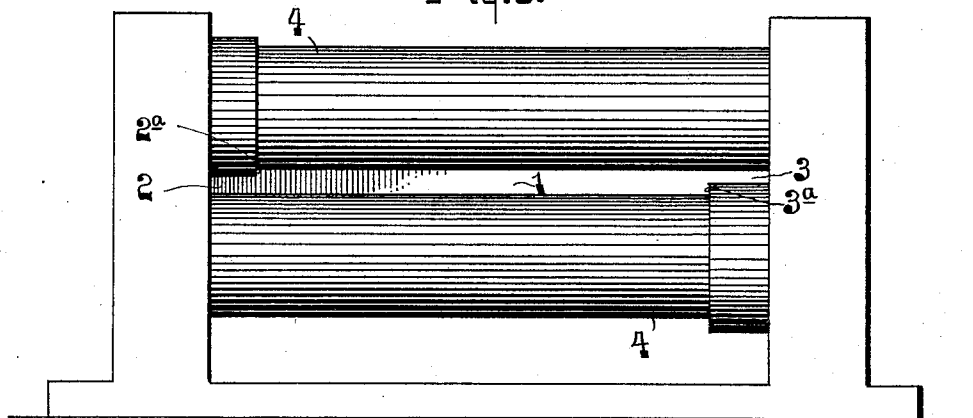
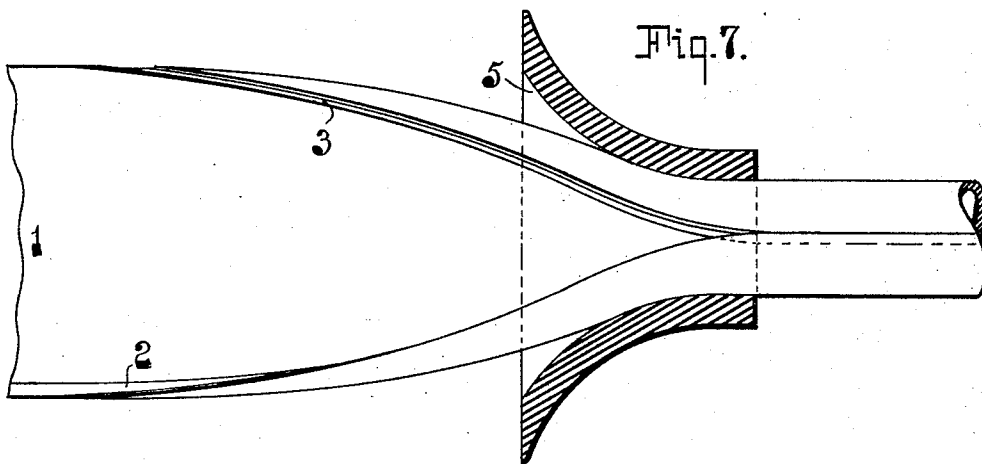


Fig. 7.



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UNITED STATES PATENT OFFICE.

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ART OF MANUFACTURING TUBES.

SPECIFICATION forming part of Letters Patent No. 755,436, dated March 22, 1904.

Application filed February 12, 1903. Serial No. 143,005. (No model.)

To all whom it may concern:

Be it known that I, LEWIS O. BENTEL, a citizen of the United States of America, and a resident of the city of Pittsburg, county of Allegheny, and State of Pennsylvania, have invented certain new and useful Improvements in the Art of Manufacturing Tubes, of which the following is a specification.

In the drawings which make part of this specification, Figure 1 is an end view in perspective of the form of metal sheet used in connection with my invention. Fig. 2 is a like view showing the sheet skelped or bent up into annular form. Fig. 3 is a like view showing the sheet welded into a tube. Fig. 4 is an end view in perspective showing a modified form of sheet. Fig. 5 is a like view showing said sheet skelped and welded. Fig. 6 is a front elevation of a rolling-mill, showing the sheet in the process of being rolled into a cross-section, as shown in Fig. 1; and Fig. 7 shows the sheet in the skelping and welding bell, the bell being shown in vertical section.

My invention, generally speaking, consists in certain new and useful improvements in the art of manufacturing pipes or tubes from flat sheets or plates of metal. Two methods for manufacturing such products are now in general use, known, respectively, as the "lap-weld" and the "butt-weld." In the lap-weld the sheet is skelped or bent up into annular form, with the lateral edges thereof somewhat overlapping, and these overlapping edges are then welded together, while in the butt-weld the lateral edges of the sheet are made to abut against each other and welded together in such position.

The process of forming a lap-welded pipe is as follows: A sheet of the proper width and length is first placed in a heating-furnace and heated to a bending heat. Second, the sheet is run through the skelping mechanism and bent into annular shape with the lateral edges overlapping, but spaced apart some distance to permit the heat to enter the inside of the sheet in the next step. Third, the skelped sheet is then placed in a second furnace, wherein the temperature is much higher than in the first furnace, and the sheet is brought to a white

or welding heat. Fourth, the sheet is then run through a bell or welding-rolls and the overlapping edges are welded together between the inner surface of the bell or rolls and the cannon-ball or rubber within the pipe.

The process of forming a butt-welded pipe is resorted to only in the manufacture of pipe of small size and is as follows: First, a sheet of suitable dimensions is placed in a heating-furnace wherein the temperature is very high, so that the sheet is brought to a white or welding heat throughout. Second, the sheet is then run through a bell or set of welding-rolls and the sheet skelped or bent up, so that its lateral edges abut and are forced together into a weld.

It is evident that two furnaces are required in the lap-weld process, one being maintained at the temperature required to bring the sheet to a bending heat and the other at the very much higher temperature required to bring the sheet to a welding heat throughout. Two distinct mechanisms are also required, one to skelp the plate, and the other to weld the overlapping edges together. In the case of butt-welding, while only one furnace is required this furnace must be maintained at such a high temperature as to enable the sheet to be heated therein to a welding heat throughout, and only the smaller sizes of pipe can be successfully made in this manner. In the use of both of these methods only one line of welded union is obtained, so if any defect or fissure exists in the weld the pipe is thrown aside as scrap at the testing-machine. In the case of butt-welded pipe the percentage of waste scrap is especially large.

On the other hand my method of manufacturing pipe or tubes may be termed a "combination butt and lap weld," in which the benefits of a reinforced union is coupled with great economy in manufacture. I use but one furnace and that heated only to the moderate degree required to bring the sheet to the relatively low temperature required for bending or skelping the same—viz., a red heat. I moreover in one and the same step or operation skelp and weld the sheet into the finished tube, thus doing away with the separate skelping

and welding mechanisms required in lap-welding. I therefore effect a great saving not only in the number of furnaces and mechanisms with their attendant crews of men, but also in the amount of fuel required to heat the sheets, which is a great element of cost in the manufacture of pipes and tubes. I accordingly not only reduce the time, labor, and plant required by at least one-half, but also diminish the amount of fuel required by an even larger percentage. The fact that my weld is a combined butt and lap insures more than one line of union, so that should any imperfections exist in either the lap or butt line of weld the other portion of the union will reinforce the same and still render the welded pipe mechanically perfect, so that it will successfully pass the testing-machine.

The following is a detailed description of my invention, reference being had to the drawings.

1 is the form of sheet or plate used, upon the lateral edges of which are lips 2 and 3, which may be formed thereon in the process of rolling the sheet as shown in Fig. 6 by filleted rolls 4 and 4, or other suitable means, leaving two shoulders 2^a and 3^a, respectively. The lip 2 being adjacent to the lower face of sheet 1, which face when said sheet is skelped or turned up into annular form forms the exterior of the tube, and lip 3 being adjacent to the upper face of said sheet 1, which face when said sheet is skelped forms the interior of the tube. The lips may be of the same dimensions as shown in Fig. 4; but I prefer, as explained below, to make the lip 2 of somewhat less width and greater thickness than lip 3, as shown in Fig. 1, the combined thickness of the two lips being preferably slightly greater than the thickness of the sheet itself. When the lips are of the same dimensions, as shown in Fig. 4, in this case also their combined thickness should be slightly greater than that of the sheet. In the manufacture of one and one-half inch pipe I prefer to make lip 2 about one-eighth of an inch narrower and from one thirty-second to one-fourth of an inch thicker than lip 3, the idea being, as explained below, to furnish sufficient metal to make an integrally perfect weld.

After forming my plate 1 by rolling or other suitable means I place the same in a furnace of the proper temperature and heat said plate or sheet to a red or bending heat, when it is passed through a bell 5 or like device, such as welding-rolls, thus skelping the sheet into an annular form and at the same time pressing together the lateral edges of said sheet. During the process of heating the relatively thick sheet to a red or bending heat the thinner lips 2 and 3 become heated to a white or welding heat, so that the bell 5 being of proper diameter the lips 2 and 3 will slide by each other until the wider lip 3 impinges against shoulder 2^a, wherewith it will at once form a butt-weld. As the compression

in the tapered bell continues, the lip 2 will be worked down and spread out until said lip impinges against shoulder 3^a, forming a second butt-weld, said lip being compressed as the sheet advances into the bell. It is evident that in the meanwhile lips 2 and 3 will be compressed together, forming a lap-weld, while the working down and flattening out of the exterior lip 2 and the compression on the interior lip 3 will produce at the same time sufficient metal and resistance to firmly weld the lips and shoulders into an integral whole filling up all interspaces or fissures. By making the interior lip 3 of somewhat greater width than the exterior lip I enable it to form the first weld, and inasmuch as the sheet is heated only to a bending or red heat its stiffness and resistance to the compression and skelping operation coupled with the above-described primary weld between lip 3 and shoulder 2^a enables a complete and perfect weld to be made without a cannon-ball or rubber being used against the interior of the tube. However such interior support may be readily used, if desired. The comparative sizes of lips 2 and 3 are controlled by the amount of metal required to make a perfect union between the lateral edges of the sheet.

If the two lips 2 and 3 are of equal dimensions, they readily slide past one another when the sheet is forced into the bell until their edges impinge against the opposing shoulders and butt and lap welds are formed.

The object in making the combined thickness of the two lips slightly greater than that of the plate is to thereby furnish greater resistance and compression at the welding-point and also sufficient metal to form a perfect weld.

It will be readily seen that by my process I obtain more than a single line of weld, as in the well-known butt or lap welds, having both butt and lap welds. It follows that the union thus obtained is more uniform than could be effected by either of the old methods, inasmuch that if any imperfection exists in either the butt or lap line of union the other line or lines of union will reinforce the same and insure a mechanically perfect pipe. Moreover, the working down of the metal of the edges in forming the union welds the adjacent parts into an integral whole. It is also evident that the weld being so uniform and perfect the threads may be tapped on the extremities of the pipe across the line of weld with as uniform and perfect result as on the remaining circumference of the pipe.

The lips can be readily rolled on the sheets when the same are being manufactured from the billets, so no additional cost in manufacture is incurred.

In case sheets of such great size are used so as to present too much friction to be skelped and welded in one and the same operation such sheets may be first skelped and then welded. In such cases the sheets would still require

heating only to the bending or red heat, as the relatively thin lips would thus be heated at one and the same time to a welding heat. In this manner my weld can be successfully applied to all cases where a reliable welded union between two surfaces or edges is desired.

The advantages of my invention are twofold, in that by its use the cost of manufacture is not only reduced about fifty per cent., but a much more reliable article of manufacture is produced.

The reduction of the number of furnaces and mechanisms for skelping and welding with their crews of men is also attended by a like reduction in the time of manufacture. Again, one of the most costly elements in maintaining a tube or pipe plant is the fuel required, artificial gas being generally used for the heating-furnaces. By my method I do away with the furnace used in the old methods to raise the sheets to a welding heat throughout, thus making a saving of over one-half in the amount of fuel required.

My product also, owing to the perfectly welded joint effected, will show a smaller percentage of waste at the testing-machine, thereby eliminating a large item of expense to the manufacturer.

Although I have described minutely the details of my invention, I do not wish to limit myself thereby, but claim broadly—

1. In the art of manufacturing tubes, the method of making a tube which consists of forming lips on the lateral edges of a tube-sheet, the lips on one of said edges being narrower than said other edge, said lips being

respectively adjacent to the opposite faces of said sheet and their combined thickness being greater than the thickness of said sheet, whereby when said sheet is bent up into tubular form, and said lips overlap, a recess is left between the edge of said narrower lip and the opposing shoulder on the opposite edge of said sheet, and subjecting said lips to a welding action whereby the surplus thickness of metal in said lips is so forced down that said recess is filled and said lips are united into a combined butt and lap weld.

2. In the art of manufacturing tubes, the method of making a tube which consists in forming lips upon the lateral edges of a tube-sheet, the lip on one edge of said sheet being narrower and of greater thickness than said other lip, said lips being respectively adjacent to the opposite faces of said sheet and their combined thickness being greater than the thickness of said sheet, whereby when said sheet is bent up into tubular form, and said lips overlap, a recess is left between the edge of said narrower lip and the opposing shoulder on the opposite edge of said sheet, and subjecting said lips to a welding action whereby the surplus thickness of metal in said narrower lip is forced down into said recess, thereby forming a combined butt and lap weld tube.

Signed by me at Pittsburg, Pennsylvania, this 7th day of February, 1903.

LEWIS O. BENTEL.

Witnesses:

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