(No Model.)

C. A. MARSHALL.

TUBE BLANK AND METHOD OF MAKING THE SAME.

No. 377,317. Patented Jan. 31, 1888.

Fig. 1.

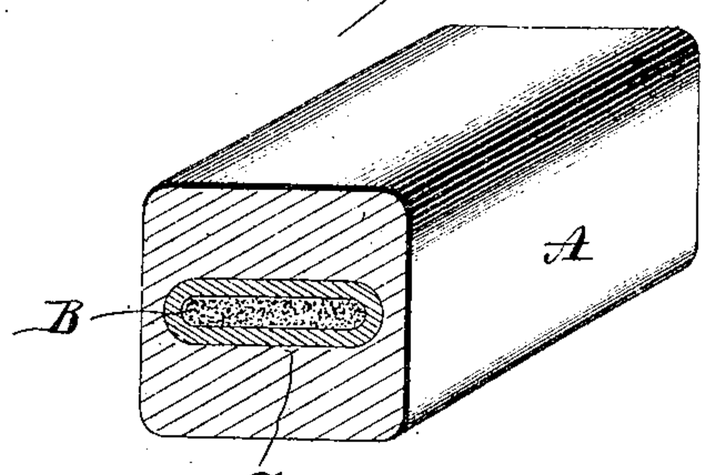


Fig. 2.

Fig. 3.

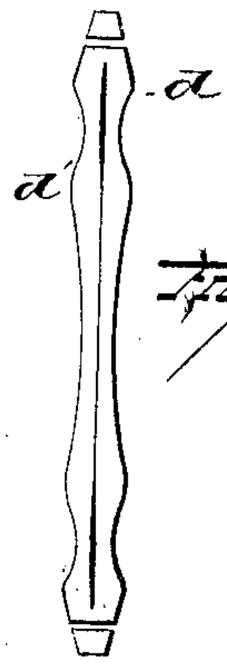


Fig. 4.

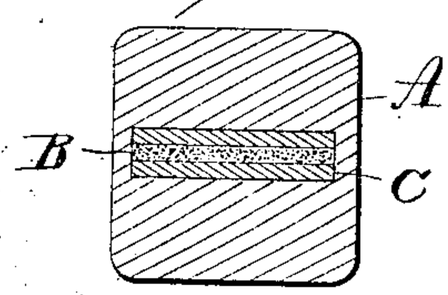


Fig. 5.

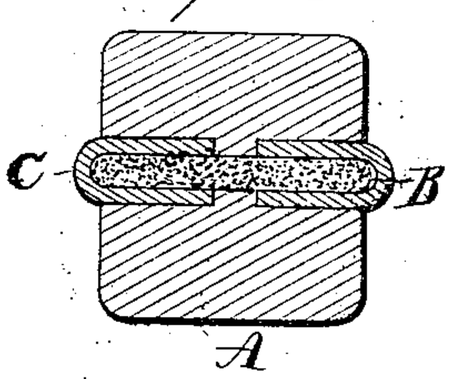


Fig. 6.

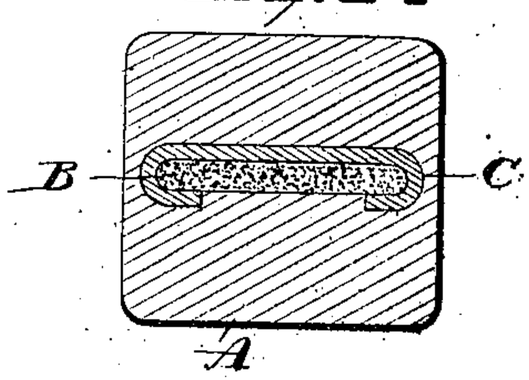


Fig. 7.

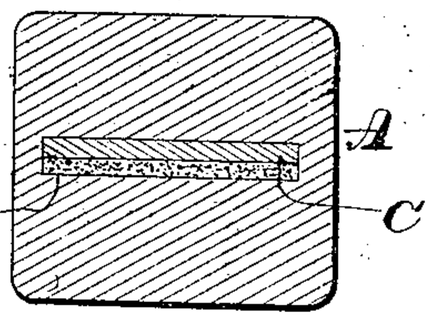


Fig. 9.

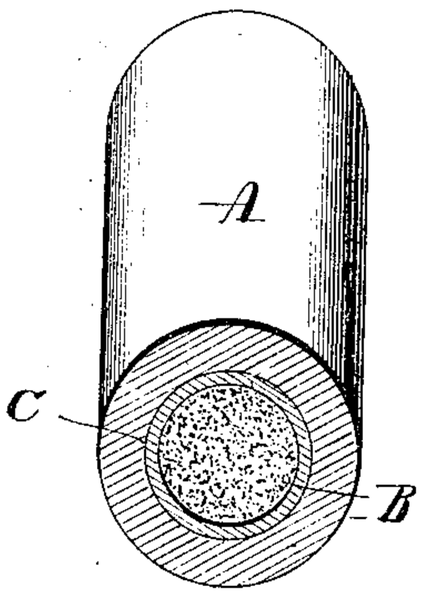


Fig. 8.

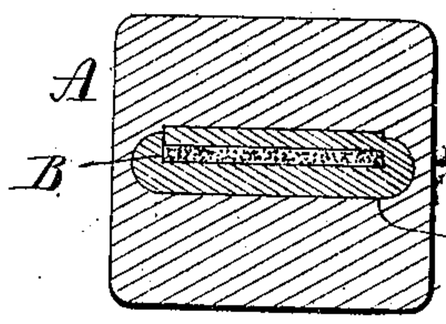
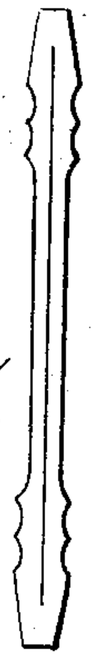


Fig. 10.

Fig. 11.



WITNESSES

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TUBE-BLANK AND METHOD OF MAKING THE SAME.

SPECIFICATION forming part of Letters Patent No. 377,317, dated January 31, 1888.

Application filed March 19, 1886. Serial No. 195,830. (No model.)

To all whom it may concern:

Be it known that I, CHARLES A. MARSHALL, of Johnstown, in the county of Cambria and State of Pennsylvania, have invented certain new and useful Improvements in Tube-Blanks and in the Method or Process of Making the Same; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to an improvement in tube-blanks and in the method or process of making the same.

The object is to provide a tube-blank, particularly of iron or steel, which may be opened up into a seamless tube having an interior surface of superior finish, walls of a uniform thickness or of a regularly increasing or decreasing thickness, and free from tendency to split.

With these ends in view my invention consists in first casting an ingot around a core of yielding refractory material, and then, by flat rolling, or by flat and edge rolling combined, reducing the cast ingot with yielding refractory material therein to a flattened blank.

My invention further consists in first casting an ingot around a core of yielding refractory material partially or entirely surrounded by previously-worked metal and then reducing the cast ingot to a flattened blank.

My invention further consists in first casting an ingot around a core of refractory material; secondly, reducing the ingot to a flattened form, and, finally, trimming the edges of the flattened form to complete the blank.

My invention further consists in a flattened tube-blank having a partial or complete core lining of superior metal welded thereto.

My invention further consists in certain steps of procedure and in features of construction, which will be hereinafter more fully described, and pointed out in the claims.

In the accompanying drawings, Figure 1 is a view of the ingot cast around a core of refractory material, the latter being completely incased within a primitive tube of previously-wrought metal. Fig. 2 represents the same reduced to a flattened form, and Fig. 3 represents the same with edges trimmed or the completed blank. Figs. 4, 5, 6, 7, 8, 9 represent ingots having modified forms of core, and Figs. 10 and 11 represent modified exterior forms of blanks.

In the several figures, A represents the ingot metal; B, the core of yielding refractory material; C, the core-casing or ingot-lining or previously-worked metal, and D the completed blank.

In forming the ingot I preferably employ a core, B, of powdered or finely-divided refractory material. When the said core is incased in previously-worked metal, which may be hereinafter referred to as "superior" metal, it may consist of powdered or finely-divided graphite mixed with powdered ~~or finely-di~~vided dry fire brick or clay. When used without such casing, it may consist of powdered or finely-divided graphite with powdered or finely-divided fire-clay mixed sparingly therewith, the clay having been mixed in a damp state and the water having been expelled by subsequent baking. The latter steps are for the purpose of rendering the core sufficiently coherent to retain its form while the ingot metal is being cast around it.

I prefer to cast the ingots with the core inclosed at the ends by ingot metal. When this is not done, the ends may be plugged with metal or forged together or closed in any way that will prevent escape of the refractory material during the first few passes. By my method of flat and edge rolling the ingot or blank the tendency of the refractory material to escape at the ends is soon neutralized by the friction of the particles one with another and with the interior surface of blank.

When working with my preferred form of ingot, the matter of closing the ends is of minor importance, except in the case of the edge thickness being very small, when the solid ends aid to prevent splitting. Other forms of ingot I work so as to reduce the core to the form of a thin layer as soon as practicable.

A core so formed will readily disintegrate when external pressure is applied to the ingot.

The above constituents, while forming an efficient core, are selected from numerous substances which might be employed either alone or in mixed forms with satisfactory results.

The extent to which the refractory core material is to be incased by the superior metal casing or lining, which may be anything be-

tween no casing whatever and a complete casing, would naturally determine the degree of coherence required of the refractory core.

The core-casing or ingot-lining consists, preferably, of wrought metal—iron or steel—freed as far as possible from redshortness and having its surface toward the ingot metal bright and in good condition for forming a weld.

The object of the core of refractory material is the same when the casing of superior metal is used as when the core material is used alone, in so far as it prevents the interior walls of the casing from welding during the reducing process. The amount of refractory material required for this purpose when a casing of superior metal is used naturally depends upon the thickness of the casing and the properties of the ingot and casing metal. For example, a casing of mild and quite pure wrought-iron or steel surrounded by ingot metal high in carbon might be reduced without the use of refractory material within the casing; but a tube constructed from such a combination of metals would not in general be desirable.

The advantages of the partial casing for the core are, first, it strengthens the weakly coherent (friable) core, thus enabling a more friable core of a given size to be employed or a larger core of a given degree of friability than could be employed without such partial casing; second, it furnishes a smooth regular and dense interior to the ingot. This in most cases is of greater importance at the edges of the slit than elsewhere, since it is at those points that the greater strain will come in opening the blank, and there is where the greater danger of splitting occurs both in flat rolling and in opening.

In cases where the edge strengthening is not necessary, because of the final shape of the tube or little strain in opening, the casing forms a finished interior and welds to the ingot metal so perfectly as to almost or quite lose its identity.

The refractory core, either alone or with its partial or complete superior metal casing, having been located within a mold, the ingot metal is cast around it, producing an ingot such, for example, as shown in Fig. 1, the shape preferred being rectangular in cross-section, with corners beveled or rounded.

The shape of the core is preferably a flat oval in cross-section, as shown in said Fig. 1, and the sides of the ingot at points opposite the extremities of the longer transverse axis of the cavity are preferably thinner than at intermediate points, since the former admits of the pressure from the rolls in flat rolling being exerted more directly on the core material, and thereby prevents the crowding of core material or the ingot metal, or both, laterally during the rolling, while the thinning of the ingot metal at the edges of the core admits of reducing the ingot to a completed blank with but slight edge-finishing, or possibly without any edge-finishing.

The ingot as thus formed is reduced, either by hammering or by flat rolling, or by flat and edge rolling combined, to a flattened form—such as is represented in Fig. 2, for example. The reducing-rollers are preferably so shaped or applied in such a manner that the reduced ingot, as represented in Fig. 2, will have the metal disposed so that there will be a somewhat increased thickness of metal at the ends *d* and at one or more corresponding points, *d'*, on opposite sides of the blank between the ends. The object of the increased thickness at the ends is to furnish the additional metal required in opening up the ends without reducing the general thickness of the tube-wall at those points, and the exterior bulging of the metal at intervening points is for the purpose of providing work, and hence bite for a pair of rolls to draw the blank over a ball or mandrel. The bulging of the metal is preferably at points about one-half the distance from the edges to the center of the flattened form, as shown in Fig. 2; but they might be located at other points, and more or less than two pairs of such ribs might be formed.

When the relative thicknesses of the ingot metal opposite the edges and sides of the core are determined carefully with a view to economy in material and a saving in the rolling process, the flattened form shown in Fig. 2 may become the completed blank ready to be opened up into a tube without further finish; but when such care has not been taken or has failed to produce the desired results, the blank is completed by trimming the edges of the flattened form, and thereby making the metal at the ends of the completed blank the desired thickness.

During the process of casting the ingot, or during the process of reducing the ingot to the flattened form, or partly during both, the lining or casing of superior metal becomes welded to the ingot metal, and the completed blank has the appearance of a homogeneous mass of metal provided with an interior slit.

The modified form of core shown in Figs. 4, 5, 6, 7, 8, and 9 represents a few of the numerous forms which may be employed in forming the ingot, and the modifications shown in Figs. 10 and 11 represent two of the many forms which the blank may have as it comes from the rollers.

The particular form of blank which is adapted to be opened into a circular tube is not herein particularly pointed out and distinguished from blanks adapted for other forms of tubes, as the same is intended to form the subject-matter of a separate application, and, so far as the explanation herein made may be applicable to the circular form only, I wish to reserve the privilege of making the same a part of said separate application.

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

1. In the process of making a tube-blank, the following steps, viz: first, casting an ingot around a core, the wall of which consists wholly

or partially of superior metal, and, secondly, reducing the ingot to a flattened blank by external pressure.

2. In the process of making a tube-blank, the following steps, viz: the construction of a core of yielding refractory material incased wholly or partially within a layer of superior metal, casting an ingot around the said core, and reducing the ingot so constituted to a flattened blank by external pressure.

3. In the process of making a tube-blank, the following steps, viz: casting an ingot around a core of refractory material partially or wholly incased in superior metal and reducing the ingot so constituted to a flattened form by "flat and edge rolling."

4. In the process of making a tube-blank, the following steps, viz: casting an ingot about a core, two diametrically opposite points of which extend nearer the outer faces of the ingot than the intermediate points, and reducing the ingot so cast and with its core therein to a flattened blank by external pressure.

5. In the process of making a tube-blank, the following steps, viz: casting an ingot having an interior lining of superior metal, reducing the ingot to a flattened form by flat and edge rolling, and trimming the edges.

6. A blank for making a seamless tube, consisting, essentially, of a flattened metallic band having a partial or complete lining of superior metal, substantially as set forth.

7. A blank for making a seamless tube, consisting, essentially, of a flattened metallic band having a partial or complete lining of superior metal and provided with walls thickened at intervals, substantially as set forth.

8. A blank for making seamless tubes, consisting, essentially, of a flattened metallic band having a partial or complete lining of superior metal and trimmed edges, substantially as set forth.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

CHAS. A. MARSHALL.

Witnesses:
J. J. MALONEY,
A. MONTGOMERY.