P. H. BRACE.

PROCESS OF MAKING SEAMLESS TUBING.

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Fig. 1.

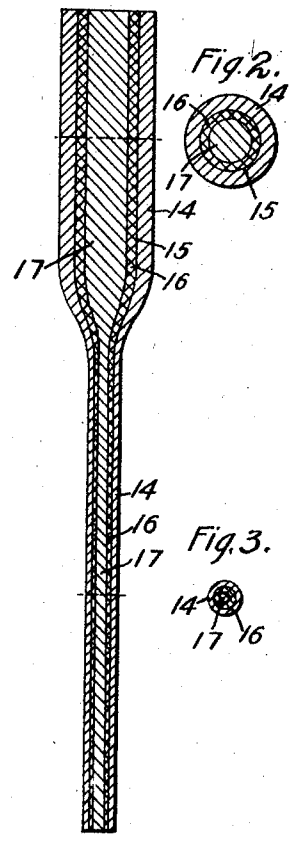


Fig. 2.

Fig. 3.

Fig. 4.



Fig. 5.



WITNESSES:

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PROCESS OF MAKING SEAMLESS TUBING.

1,396,918. Specification of Letters Patent. Patented Nov. 15, 1921.

Application filed January 16, 1919. Serial No. 271,548.

To all whom it may concern:

Be it known that I, PORTER H. BRACE, a citizen of the United States, and a resident of Wilkinsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Processes of Making Seamless Tubing, of which the following is a specification.

My invention relates to seamless tubing and more particularly to a method of making the same, and it has, for its primary object, the provision of a method by which seamless tubing may be made in any reasonable length.

A further object of my invention consists in providing a method of forming seamless tubing which will permit the manufacture of such tubing from practically any metal which may be worked by rolling or forging.

A still further object of my invention consists in providing a method by which a seamless tube of one metal may be formed with a seamless lining, of any desired thickness, of another metal.

Heretofore, seamless tubing has been produced by a variety of processes but the length of any one piece has been limited, because of various requirements of the processes employed, and difficulty has been experienced in applying some of the methods to certain desirable metals.

I have found that, if a hollow, cylindrical, metallic ingot is swaged, rolled or forged to form an elongate body, the interior diameter of the ingot will gradually decrease, in a more or less irregular fashion, finally becoming almost obliterated. On the other hand, if the bore of the ingot is filled with a core of another metal and the ingot and its inclosed core are then elongated by rolling, forging or the like, a composite rod will result in which the original proportion between the dimensions of the core and the ingot, has been very well preserved throughout the length of the rod.

In practising my invention, I may form a composite rod, in this manner, the core of which is more readily fusible than the outer body or sheath. Under these circumstances, it will be obvious that I may melt this core and remove it in any suitable manner to leave a length of seamless tubing.

The length of a tube which may be formed by this method will be limited only by the size of the ingot employed in its manufacture and by the difficulty which may be encountered in removing the column of molten metal in case the tube is very long and of small internal diameter.

Various metals may be employed in forming the tubes, and different metals may be used for making the cores. The choice of metal for making the core will, of course, be dictated by a consideration of such factors as the melting point of the ingot or outer body, the physical properties of the ingot metal, the rolling or forging temperature necessary and the tendency of the metals of the ingot and the core to alloy with one another at the melting point of the core metal. In general, the metal of the core should have physical properties approaching those of the ingot and, of course, a melting point below that of the ingot.

To insure a full comprehension of my invention, I will now describe certain of its applications, reference being had to the various figures of the drawings in which the several reference numerals indicate corresponding parts.

In the drawings, Figure 1 is a diametral, sectional view disclosing one method of practising my invention; Figs. 2 and 3 are transverse, sectional views taken through adjacent portions of the structure shown in Fig. 1 to more fully disclose my method; Fig. 4 is a diametral, sectional view of a finished tube formed by practising my invention; and Fig. 5 is a transverse, sectional view taken through the tube of Fig. 4.

In practising my invention, I may take an ingot of any suitable metal, such as a low-carbon iron, give it a preliminary working under a hammer or by rolls to prove its soundness and workability and then drill or bore an axial hole through the ingot and fill this hole with a core of another metal, of suitable character, such as aluminum, either by pouring in the molten metal or by driving in a tightly fitting rod of such metal.

In preparing the ingot and core, care should be taken that the diameter of the ingot has the same proportion to the diameter of the hole formed in it as the desired outside diameter of the tube to be formed bears to the desired inside diameter of the tube to be formed.

When the ingot and its core have been

assembled, they may be elongated and correspondingly reduced in diameter by any suitable means, such as swaging, rolling or forging, care being taken that the working temperature is not so high as to melt the core or weaken the ingot too much. For example, if the ingot is of low-carbon iron and the core is of aluminum, the working temperature should not exceed 500° C.

When the desired dimensions have been secured by thus elongating the ingot and its core, the core may be melted or fused and removed in any suitable manner to leave the desired tube. For example, the resultant rod, formed by elongating the ingot and its core, may be connected, at one end, to a supply of compressed air and may then be placed in a furnace and heated to a temperature above the melting point of aluminum, after which air pressure may be applied to expel the molten aluminum.

In addition to the forming of a seamless tube, I provide such a metal tube, together with a lining of another metal, of any desired thickness, by means of my present invention. To do this, I may employ an ingot 14, of the metal desired for the outer body of the tube, and I may form this ingot with an axial bore 15. I may dispose a snugly fitting, tubular body 16, formed of the metal desired as the lining of the tube, within the bore and within this tubular liner, I may then dispose a metal core 17.

The composite body thus formed may then be elongated, in any of the ways previously suggested, to form a rod having the external diameter of the desired tube. After this, the core 17, which is formed of a metal or alloy having a lower melting point than that of either the metal of the ingot 14 or the metal of the lining 16, may be melted and removed. This will leave a metal tube 18, of the character shown in Figs. 4 and 5, having a lining 19 of a metal other than that of the tube.

For example, the ingot and, consequently, the tube may be formed of iron, the lining of lead and the core of a low-melting-point alloy, such as Wood's alloy. Obviously, the thickness of the lining and both the external and the internal diameter of the finished tube may be varied at will by correspondingly varying the thickness of the ingot wall, the thickness of the lining sleeve and the thickness of the core, when forming the composite ingot from which the tube is made.

When practising my invention according to the application disclosed, I may employ various combinations of ingot metal, core metal and lining metal and may use any suitable form of heating. For example, copper may be used as a core when forming tubes of certain alloy steels, and the heating may be done electrically by passing a heavy current through the composite rod formed by elongating the ingot and its core. Furthermore, when practising my invention, the metals employed may be protected from oxidization by employment of an inert or non-oxidizing atmosphere, without, in any way, departing from my invention.

As various modifications of my invention are obvious to one skilled in the art, it will be appreciated that no limitations are to be imposed upon it other than those indicated in the appended claims.

I claim as my invention:

1. The method of forming a lined seamless tube which comprises providing a metallic ingot with a longitudinal bore, filling the bore with a core comprising a sleeve of the metal to constitute the lining of the tube and an inclosed body of a metal having a relatively low melting point, forging the ingot and inclosed core to elongate them and reduce their diameter and melting and removing the relatively low-melting-point metal.

2. The method of forming a lined seamless tube which comprises providing a metallic ingot with a longitudinal bore, filling the bore with a core comprising a sleeve of different metal than that constituting the ingot and an inclosed body of a metal having a lower melting point than either the ingot or the sleeve, forging the ingot and inclosed core to elongate them and to reduce their diameter and melting and removing the low melting point metal.

In testimony whereof, I have hereunto subscribed my name this 31st day of Dec. 1918.

PORTER H. BRACE.