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F. R. BONTE

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MANUFACTURE OF TUBES

Filed July 20, 1929

Fig. 1.

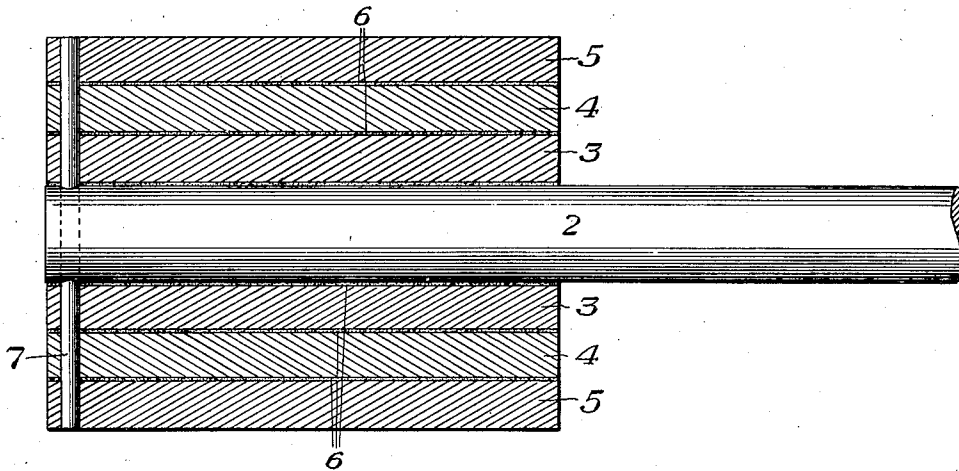


Fig. 2.

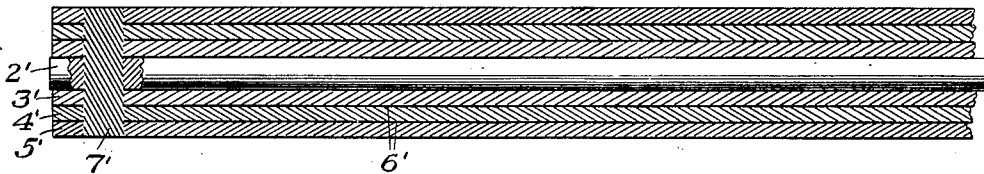
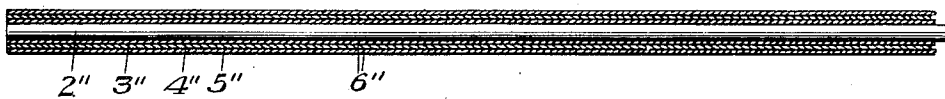


Fig. 3.



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MANUFACTURE OF TUBES

Application filed July 20, 1929. Serial No. 379,720.

This invention relates to the manufacture of tubes, and particularly to seamless tubes of light gauge.

The requirements of the aviation industry particularly, demand a large quantity of seamless steel tubing of very light gauge and of various cross-sectional shapes. The wall thickness of the tubing required by the aviation industry particularly is such that the tubing cannot be economically produced with the present methods of seamless tube manufacture.

The present invention relates to a process for producing tubes which is particularly applicable to the production of thin gauge tubing and by means of which the manufacture of thin gauge tubing can be carried out economically and in large quantity with existing types of machinery, and it constitutes an improvement on the invention shown in my Patent No. 1,527,780, dated February 24, 1925.

The invention may be readily illustrated in connection with the accompanying drawing in which

Figure 1 represents an assembly of nested tubular members on a central core;

Figure 2 represents the nest of tubular members after it has been rolled; and

Figure 3 illustrates the assembly after still further rolling.

In carrying out the invention, a plurality of tubular steel billets are formed of varying diameters, these billets being arranged in sets, so that one nest will be received within another. This is illustrated in Figure 1 wherein 2 designates a solid core on which is a hollow billet 3. Enclosing the hollow billet 3 is another billet 4, and this in turn is enclosed by another billet 5. Two or more of the billets may comprise a nest, more than two preferably being used. The wall thickness of the billets may be uniform, as shown in Figure 1, or may be non-uniform according to whether it is desired to produce tubes having uniform gauge thickness or having varying gauge thickness. There is a slight clearance between the billets, and a slight clearance between the inside of the billet 3 and the core 2.

The billets may be manufactured according to any well-known or preferred process, and

after being formed are preferably pickled and then lamed, as disclosed in my said Patent 1,527,780. In nesting the billets and in inserting the core 2, a filler of a compound adapted to prevent the welding of the billets to each other and of the inner billet to the core is provided in the spaces between the respective elements of the assembly. This lubricating material must be one that will resist high temperatures and which will not scratch the surface of the metal in the process of forming the tubes. I have found that dry graphite provides the best lubricant for this purpose. In Figure 1 the layers of graphite are indicated at 6.

After the billets have been nested and assembled about the core 2, they may be connected together by means of a pin 7 passing through them and through the core, although the use of this pin is not essential. After the assembly has been completed, it is placed in a furnace and heated almost to a welding temperature. It is then passed through reducing rolls. I have found that in passing the unit through the reducing rolls and tubes will all be elongated to substantially the same extent. This is illustrated in Figure 2 wherein 2' designates the core and 3', 4' and 5' are the partially completed tubes formed by the billets 3, 4 and 5, respectively. It will also be noted that the core 2 is elongated to the same extent as the billets. If in the process of rolling the diameter of the outer billet is reduced one-half, the tubes will be elongated practically twice the original length. By further rolling of the assembly, the tubes can be reduced to the desired diameter and the desired wall thickness. In Figure 3 I have shown the assembly further reduced and providing a nested series of thin wall seamless tubes 3'', 4'' and 5'' still supported on the core 2''. The graphite which is interposed between the various elements of the assembly prevents the metal from sticking and welding and provides a lubricant which facilitates the separation of the tubes. After the assembly has been rolled to the desired extent, the tubes are separated by removing one from the other. I have found that the separation is facilitated and

that improved tubes are formed by making the core 2 longer than the billets. By making the core 2 longer than the billets, the projecting end of the core forms a guide about
 5 which the tubes are supported as they are elongated. Since the bar or core elongates to substantially the same extent as the billets, one end of the core at least will always project beyond the ends of the tubes, and this
 10 core can be grasped or clamped in effecting the separation of the tubes.

By connecting the billets together at one end by the use of the pin 7, the elongation is confined in one direction. This makes the
 15 unit more convenient to handle during the process of rolling and insures the tubes extending along the projecting end of the core instead of elongating in the other direction.

In carrying out the process, tubes of thin gauge can be produced in different diameters on a commercially practical basis. If the billets are all of the same thickness, the resulting tubes will be of the same gauge but of different diameters. If some of the billets
 20 are thicker than others, the tubes of different diameters will not be of uniform gauge. This feature lends flexibility to the invention, in that it allows for the production of different gauge tubes in the diameters at which
 25 tubes of a particular gauge are required.

While I have indicated the billets and cores as being circular, the invention is not confined to the manufacture of round tubing, and the core and billets may be of any preferred cross-sectional shape. After the
 30 tubes have been rolled, and they are separated, they are preferably drawn through a drawing die over a mandrel by means of which a smooth finish can be attained and the cross sectional shape of the tube modified if it is desired to change the cross sectional shape.

As a modification of the invention, it may be practiced on welded steel tubing, particularly electrically welded steel tubing, and
 35 eliminate certain defects which at the present time prevent the use of welded steel tubing in the aeroplane industry. In the welding of steel tubing, the portion of the metal along the seam is heated to a temperature considerably above the temperature of the body
 40 of the tubing. This localized heating causes a grain growth along the seam in the region of the weld, which weakens the tubing.

By practicing the present invention on welded tubes, the welded tubes are heated and then are rolled and the combined action of the heating and the rolling corrects the grain structure along the seam of the tube and
 45 makes the metal of the tube substantially uniform and homogeneous throughout.

It will be understood that I have described preferred ways of carrying out my invention, but that various changes and modifications
 50 may be made therein within the contempla-

tion of my invention and under the scope of the following claims.

I claim:

1. In the method of forming seamless tubes, which comprises nesting a plurality of
 70 billets about a core with the ends of the billets at one end of the assembly in the same vertical plane, securing the other ends of the billets to each other and to the mandrel, heating the assembly, and simultaneously elongating
 75 all of the billets to substantially the same extent in a progressive manner from the secured ends.

2. The method of simultaneously forming a plurality of seamless tubes of different diameters and of equal wall thickness, which comprises nesting a plurality of hollow billets about a core, with the ends of the billets at one end of the assembly in the same
 80 vertical plane, securing the other ends of the billets to each other and to the mandrel heating the billets and core, and then rolling the assembly from the secured ends toward the other ends to elongate the billets and the core, and thereafter separating the resulting
 85 tubes.

3. The method of manufacturing a plurality of seamless tubes, which comprises nesting a plurality of hollow billets about a core of greater length than the billets with the ends
 90 of the billets at one end of the assembly in the same vertical plane, securing the other ends of the billets to each other and to the end of the mandrel, heating the assembly from the end of the mandrel to which the billets are secured toward the other ends of the billets, and rolling the assembly to elongate the respective billets and the core to substantially the same extent, thereby producing
 95 a plurality of concentric tubes, and thereafter separating the tubes.

4. The method of manufacturing a plurality of seamless tubes of different diameters, which comprises nesting a plurality of concentric billets about a central core, introducing a lubricating loose non-metallic material between the concentric billets and between the innermost billet and the core for preventing the billets from welding together and preventing the innermost billet from
 100 welding to the core, securing the billets and the core together at one end of the assembly, heating the assembly, and then rolling the assembly and thereby reducing the billets to form a plurality of concentric tubes. 120

5. The method of manufacturing a plurality of seamless tubes of different diameters, which comprises nesting a plurality of concentric billets about a central core, introducing a lubricating loose flaky non-metallic
 105 material between the concentric billets and between the innermost billet and the core for preventing the billets from welding together and preventing the innermost billet from welding to the core, securing the billets and

the core together against relative longitudinal movement at one end of the assembly by a connector passing therethrough, heating the assembly, and then rolling the assembly and thereby reducing the billets to form a plurality of concentric tubes, the core being longer than the billets and being elongated to substantially the same extent as the billets.

6. The method of simultaneously producing a plurality of seamless tubes of different diameters, which comprises nesting a plurality of hollow billets of equal length about a core which extends entirely through the innermost billet and projects beyond one end thereof, passing a pin through the other end of the billets and the core for holding the billets and the core against elongation in one direction, heating the assembly, and thereafter rolling the assembly until the concentric billets are reduced to a series of concentric tubes and the core is reduced to a rod, and thereafter separating the tubes and removing the rod.

7. In the process of manufacture of steel tubing, the steps which comprise nesting a plurality of tubular elements about a core, heating the assembly, and then rolling the assembly while hot to elongate the tubular elements and produce a concentric series of tubes and while holding the leading ends of the tubes of the assembly against relative longitudinal movement in either direction.

In testimony whereof I have hereunto set my hand.

FREDERICK R. BONTE.