

## A process for the continuous production of a longitudinal seam-welded metal tube

### Description

The present invention relates to a process for the continuous production of a longitudinal seam-welded metal tube.

The continuous production of longitudinal seam-welded metal tubes - either plain or corrugated - has long been known.

A process is known from the Uniwema Machines and Accessories specialist catalogue of kabelmetal electro GmbH by means of which metal tubes with a diameter of 2 to 400 mm and a wall thickness of 0.05 to 4.0 mm can be produced in almost infinite lengths.

In this process, a metal strip situated on a spool is pulled off, is cleaned if necessary, and is formed into a slit tube in a plurality of forming stages on a forming table, and the longitudinal slit in the slit tube is welded in a welding station. After the welding device, the metal tube is grasped by what is termed a collet chuck take-off device which conveys the metal strip and the metal tube at a uniform velocity. For this purpose, collet chucks which are mounted on two endless roller chains surround the tube. Clamping jaws which are accurately matched to the tube diameter are inserted in the collet chucks.

The welded tube is then usually wound on a cable spool.

This known process is beset by the problem that tubes with an outside diameter of less than 2 mm cannot be produced, for reasons associated with the deformation of the metal strip to form the slit tube and also for reasons associated with the welding of the longitudinal edges. So as to be able to produce tubes of smaller diameter, the tubes have to be drawn down in one or more steps. In the course of this procedure the tubes are drawn through a die, the inside diameter of which is less than the outside diameter of the tube to be drawn. If the wall thickness of the tube is to be reduced in addition during the drawing operation, a mandrel,

the outside diameter of which is larger than the inside diameter of the die, has to be inserted in the tube.

In order to reduce the friction between the tube wall and the forming tools, namely the die and the mandrel, a lubricant has to be supplied. The tube can be lubricated from the outside almost without problems. However, it is difficult to introduce the requisite amount of lubricant into the interior of the tube when long lengths of tube are drawn.

Embodiments of the present invention seek to provide a process by which metal tubes of considerable length can be produced, and by which both the outside diameter and the wall thickness of said tubes can be reduced without problems in a subsequent operation.

In accordance with an aspect of the present invention, there is provided a process for the continuous production of a longitudinal seam-welded metal tube, wherein a metal strip is pulled off from a strip supply, is gradually formed into a tube comprising an open longitudinal slit and the longitudinal slit is closed by soldering or welding, characterised in that a lubricant is introduced into the still open slit tube.

A lubricating oil may be introduced in the process. The lubricant may be introduced drop-wise. The lubricant may be introduced into the metal tube after the weld point by means of a lance.

The longitudinal slit may be closed by laser welding. The welded tube may be wound to form an annular coil or may be wound on a spool, wherein the lubricant may be introduced into the still open slit tube in an amount such that after winding the tube the entire internal surface of the metal tube is covered with lubricant.

In a next operation both the outside diameter and the wall thickness of the metal tube may be reduced by means of a drawing process using a mandrel in the interior of the tube as well as a drawing die.

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The essential advantage of the invention is manifested in that it is possible in a simple manner to coat the internal surface with an accurately metered amount of a lubricant, whereby the subsequent drawing operation can be performed without problems, i.e. without damaging the internal surface of the tube and thus without the risk of the tube breaking after the die.

The invention is explained in greater detail with reference to a schematic illustration of an example of an embodiment in figure 1.

A metal strip 2, made of austenitic steel, for example, is pulled off from a supply spool 1 and is fed to a set of forming rolls 3 in which the metal strip 2 is gradually formed into a tube 4 comprising a longitudinal slit. The longitudinal slit is closed by a welding device 5, preferably a laser welding device. After the welding device 5, the welded tube 6 is grasped by a collet chuck take-off device 7 which draws the metal strip 2, the slit tube 4 and the welded tube 6 through the production installation. The collet chuck take-off device is known from German Patent (Auslegeschrift) 11 64 355.

The welded tube 6 is subsequently wound on a cable drum 8.

The process described is limited to tubes with an outside diameter of 2 mm at most.

There is a need for metal tubes with an outside diameter of 0.2 mm and a wall thickness of 0.02 mm. Metal tubes such as these are used in the production of injection needles.

So as to be able to produce metal tubes with these dimensions, the longitudinal seam-welded tubes which are produced by the process described above have to be reduced to the desired dimensions in a plurality of steps.

In order to make the longitudinal seam-welded tubes suitable for the subsequent drawing operation, provision is made according to the invention for the metal tube 6 to be provided with a film of lubricant on its internal surface.

For this purpose, a lubricant is introduced from a supply container 10, by means of a lance 9, into the slit tube 4 or metal tube 6.

The end of the lance 9 is particularly advantageously disposed after the welding device, so that the lubricating properties of the lubricant are not impaired by the heat of welding.

The lubricant can be introduced discontinuously by the lance 9 into the still open tube 4 or into the welded tube 6. During the subsequent winding operation on to the cable drum 8 or spool, the lubricant is distributed over the entire internal surface of the tube 6.

Alternatively, the lubricant can be applied by spraying a thin film on to the internal surface of the tube 6 after the welding device 5. By means of the process according to the invention, longitudinal seam-welded tubes of considerable length, i.e. up to 20,000 m or more, can be produced, from which tubes with a considerably smaller outside diameter and a considerably lesser wall thickness can be produced by a subsequent drawing operation.

## Claims

1. A process for the continuous production of a longitudinal seam-welded metal tube, wherein a metal strip is pulled off from a strip supply, is gradually formed into a tube comprising an open longitudinal slit and the longitudinal slit is closed by soldering or welding, **characterised in that** a lubricant is introduced into the still open slit tube.
2. A process according to claim 1, **characterised in that** a lubricating oil is introduced.
3. A process according to claim 1 or 2, **characterised in that** the lubricant is introduced drop-wise.
4. A process according to claim 1 or 2, **characterised in that** the lubricant is introduced into the metal tube after the weld point by means of a lance.
5. A process according to any one of claims 1 to 4, **characterised in that** the longitudinal slit is closed by laser welding.
6. A process according to any one of claims 1 to 5, wherein the welded tube is wound to form an annular coil or is wound on a spool, **characterised in that** the lubricant is introduced into the still open slit tube in an amount such that after winding the tube the entire internal surface of the metal tube is covered with lubricant.
7. A process according to any one of claims 1 to 6, **characterised in that** in a next operation both the outside diameter and the wall thickness of the metal tube are reduced by means of a drawing process using a mandrel in the interior of the tube as well as a drawing die.

**A PROCESS FOR THE CONTINUOUS PRODUCTION OF  
A LONGITUDINAL SEAM-WELDED METAL TUBE**

**ABSTRACT**

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In a process for the continuous production of a longitudinal seam-welded metal tube, wherein a metal strip is pulled off from a strip supply, is gradually formed into a tube comprising an open longitudinal slit and the longitudinal slit is closed by soldering or welding, a lubricant is introduced into the still open slit tube.

Fig. 1