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(71) Applicant: **S.P.I.C.E. Group S.R.L.**
16010 Ceranesi (Genova) (IT)

(72) Inventor: **Dompe, Davide**
16032 Camogli (Genova) (IT)

(74) Representative: **Forattini, Amelia**
c/o Internazionale Brevetti
Ingg. ZINI, MARANESI & C. S.r.l.
Piazza Castello 1
20121 Milano (IT)

(54) Method and apparatus for sealing a pipe that conveys gases or liquids

(57) A method for sealing a pipe that conveys gases or liquids, comprising two steps: a first step, which includes a cold plastic deformation of the material that is suitable to impart the chosen shape and reduce the diameter of the pipe to be closed, and a second step, during which the material is brought by friction to a temperature sufficient to render it plastic and amalgamable, so as to provide the actual hermetic closure point. The method is performed by means of an apparatus that includes a tool (2) that is shaped according to the material (7) and the shape to be obtained and can rotate freely about a pivot; the pivot is mounted on a rotating mechanical system that is managed by two controlled axes: a first controlled axis (4), which is suitable to move the pivot of the freely rotating tool (2) at right angles to the rotation axis of the entire system, and a second controlled axis (5), which is suitable to move longitudinally with respect to the rotation axis of the system, so that while the entire system turns the interpolation of the axes allows the freely rotating tool (2) to form different shapes at the end of the pipe.

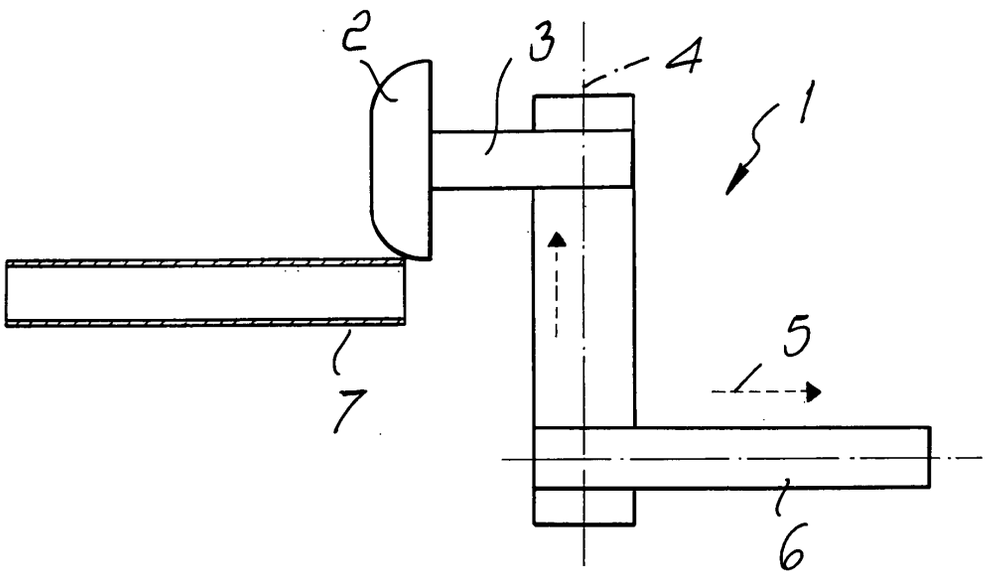

Fig. 1

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Description

[0001] The present invention relates to a method and an apparatus for sealing a pipe that conveys gases or liquids.

[0002] More particularly, the method and the apparatus according to the present invention have been studied for pipes for conveying gas in the field of household appliances.

[0003] Traditionally, pipes are sealed by electrically welding a cap made of ferrous material to the end of the pipe, which is also made of ferrous material.

[0004] Such sealing method has always had drawbacks, including always-imperfect weldings, a relatively high cost, and the possibility of welding only two parts both made of ferrous material.

[0005] The aim of the present invention is to provide a method and an apparatus for sealing a pipe that conveys gases or liquids that overcomes the drawbacks of the cited prior art.

[0006] An object of the invention is to provide a method and an apparatus that allow to use a new material that is different from the conventional ferrous material.

[0007] A further object of the invention is to provide a method and an apparatus that allow to seal a pipe without using additional components.

[0008] This aim and these and other objects that will become better apparent hereinafter are achieved by a method for sealing a pipe that conveys gases or liquids, characterized in that it comprises at least two steps: a first step, which comprises a cold plastic deformation of the material that is suitable to impart the chosen shape and reduce the diameter of the pipe to be closed, and a second step, during which the material is brought by friction to a temperature sufficient to render it plastic and amalgamable, so as to provide the actual hermetic closure point.

[0009] This aim and these and other objects that will become better apparent hereinafter are also achieved by an apparatus for sealing a pipe that conveys gases or liquids, characterized in that it comprises a tool that is shaped according to the material and the shape to be obtained and can rotate freely about a pivot; said pivot being mounted on a rotating mechanical system that is managed by two controlled axes: a first controlled axis, which moves said pivot of the freely rotating tool at right angles to the rotation axis of the entire system, and a second controlled axis, which moves longitudinally with respect to the rotation axis of the system, so that while the entire system turns the interpolation of said axes allows the freely rotating tool to form different shapes at the end of the pipe.

[0010] Further characteristics and advantages of the present invention will become better apparent from the following detailed description of preferred but not exclusive embodiments thereof, illustrated by way of non-limiting example in the accompanying drawings, wherein:

Figure 1 is a schematic view of the apparatus for sealing a pipe that conveys gases or liquids, according to the invention, shown in an initial position;
Figure 2 is a schematic view of the apparatus, according to the invention, shown in a final position.

[0011] The method according to the invention can be used to seal all metallic pipes of various shapes and sizes, both ferrous and non-ferrous ones, produced by extrusion and/or welding, sheathed, treated or raw.

[0012] The method according to the invention includes two steps sequentially: a first step, which includes a cold plastic deformation of the material, for imparting the intended shape and reducing the diameter of the pipe to be closed, and a second step in which the material is brought by friction to a temperature that is sufficient to render it plastic and amalgamable so as to provide the actual seal point.

[0013] With reference to the cited figures, the method according to the invention is preferably performed by means of an apparatus, generally designated by the reference numeral 1, which includes a tool 2, which is shaped according to the material and shape to be obtained and can rotate freely about a pivot 3. The pivot is mounted on a rotating mechanical system that is managed by two controlled axes.

[0014] A first controlled axis 4 moves the pivot 3 of the freely rotating tool at right angles to the rotation axis of the entire system, and a second controlled axis 5 moves longitudinally with respect to a rotation axis 6 of the system.

[0015] While the entire system rotates, the interpolation of these two axes allows the free tool to obtain different shapes at the end of a pipe 7.

[0016] It is thus possible to achieve completely flat closures at right angles to the axis of the pipe, which are particularly suitable for light alloys, extruded and weld-free materials, or spherical closures, as shown in the figures, with a camber whose dimensions are approximately half the diameter of the pipe being treated, which are particular suitable for ferrous pipes, welded pipes and sheathed pipes.

[0017] The freely rotating tool 2, made of a suitable material and with a surface treatment that is suitable for the type and shape of the pipe to be treated, by rotating on the entire system as soon as it makes contact with the part due to friction, starts to rotate at a rate that is linked to the rotation rate of the system, to the dimensions of the part to be machined, and to the friction coefficient.

[0018] The rotation rate of the tool, from when one begins, by virtue of the two controlled axes, to impart a compression force to the part, allows the initial step of forming for closure, minimizing the torque on the part and producing a plastic deformation.

[0019] As the cross-section of the pipe decreases, the rotation rate of the freely rotating tool also decreases accordingly. By reducing the relative speed between the

pipe and the tool, friction increases and, due to the mutual rubbing of the two metallic parts, increases the temperature.

[0020] At a certain distance from the axis of the pipe, the freely rotating tool almost stops rotating, maintaining this position for the time sufficient to bring the temperature of the pipe to an adequate level.

[0021] The tool is moved from here only on the planar surface thereof along the perpendicular axis of the part.

[0022] This last step is the one that allows to amalgamate the structure of the part and spread the material, so as to ensure tightness.

[0023] In the application of the method according to the invention to some types of material with particular uses, it may be convenient to pass the end of the machined pipe through a magnetic inductor so as to heat it to a given temperature, in order to "normalize" the molecular structure of the part, considerably reducing any abnormal tension inside the structure.

[0024] In practice it has been found that the invention achieves the intended aim and objects, providing a method for sealing a pipe that conveys gases or liquids and is made of any material, without using caps or other additional components.

[0025] Experimental tests have been conducted on round pipes having a diameter of 2 to 28 mm, with thicknesses that varied between 0.2 and 10 mm, on square pipes measuring from 2 x 2 mm to 30 x 30 mm, with thicknesses from 0.2 to 10 mm; however, the method can be used for other dimensions, thicknesses and shapes.

[0026] The method and the apparatus according to the invention are susceptible of numerous modifications and variations, within the scope of the appended claims. All the details may be replaced with technically equivalent elements.

[0027] The materials used, as well as the dimensions, may of course be any according to requirements and to the state of the art.

Claims

1. A method for sealing a pipe that conveys gases or liquids, **characterized in that** it comprises at least two steps: a first step, which comprises a cold plastic deformation of the material that is suitable to impart the chosen shape and reduce the diameter of the pipe to be closed, and a second step, during which the material is brought by friction to a temperature sufficient to render it plastic and amalgamable, so as to provide the actual hermetic closure point.

2. The method according to claim 1, **characterized in that** said first step is performed by means of a tool that rotates, in contact with the part, at a rate that is linked to the rotation rate of the system, to the dimensions of the part to be treated, and to the friction coefficient.

3. The method according to claim 2, **characterized in that** said rotation rate of the tool from when a compression force begins to be applied to the part by means of the two controlled axes allows the initial step for forming and closure, minimizing the torque on the part and performing a plastic deformation.

4. The method according to one or more of the preceding claims, **characterized in that** as the cross-section of the pipe decreases, the rotation rate of the freely rotating tool also decreases; by reducing the relative speed between the pipe and the tool, friction increases and, by virtue of the mutual rubbing of the two parts, raises the temperature.

5. The method according to one or more of the preceding claims, **characterized in that** at a certain distance from the axis of the pipe, the freely rotating tool almost stops turning, maintaining this position for the time sufficient to bring the temperature of the pipe to an adequate level.

6. The method according to one or more of the preceding claims, **characterized in that** said tool is moved only on the planar surface thereof along the perpendicular axis of the part, so as to amalgamate the structure of the part and spread the material, so as to ensure its sealing.

7. The method according to one or more of the preceding claims, **characterized in that** the end of the pipe being treated is passed through a magnetic inductor in order to heat it to a given temperature so as to "normalize" the molecular structure of the part, reducing considerably any abnormal tension within said structure.

8. An apparatus for sealing a pipe that conveys gases or liquids, **characterized in that** it comprises a tool that is shaped according to the material and the shape to be obtained and can rotate freely about a pivot; said pivot being mounted on a rotating mechanical system that is managed by two controlled axes: a first controlled axis, which moves said pivot of the freely rotating tool at right angles to the rotation axis of the entire system, and a second controlled axis, which moves longitudinally with respect to the rotation axis of the system, so that while the entire system turns the interpolation of said axes allows the freely rotating tool to form different shapes at the end of the pipe.

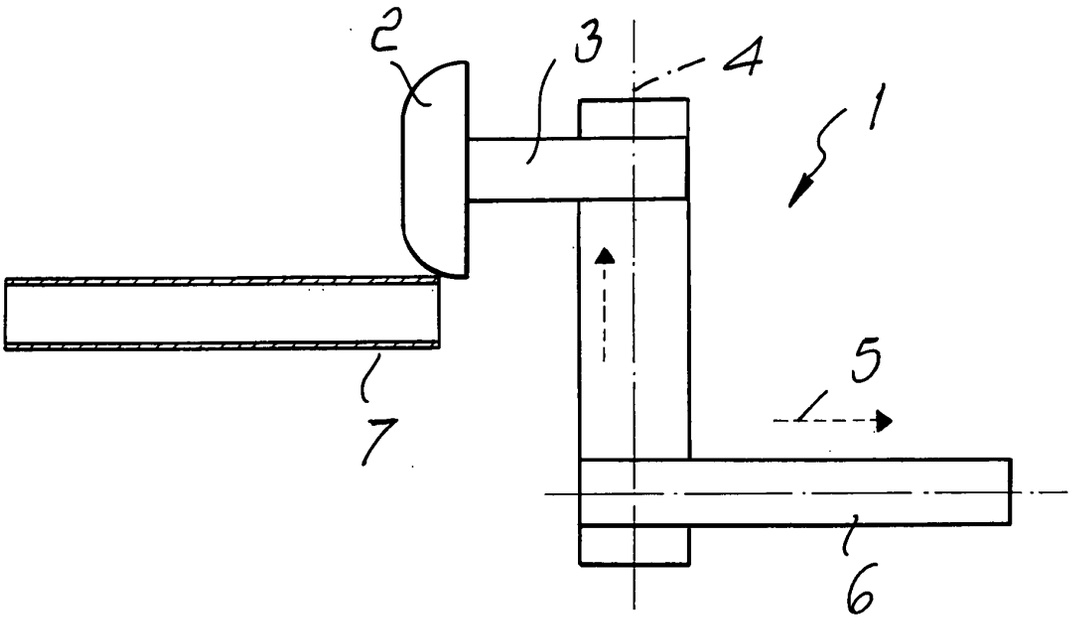

FIG. 1

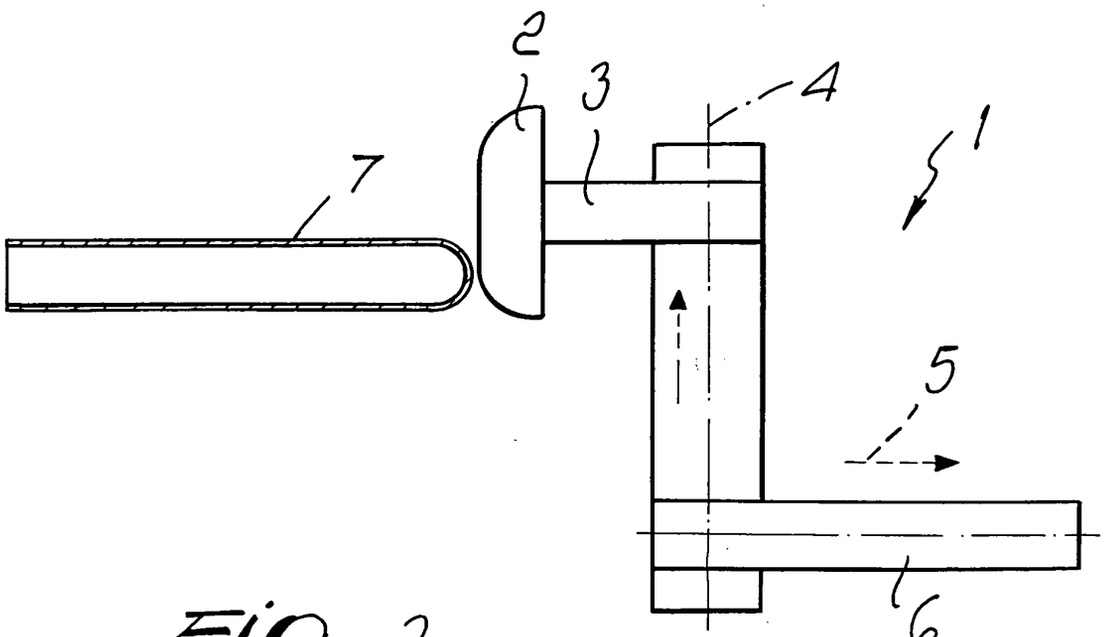

FIG. 2

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EUROPEAN SEARCH REPORT

Application Number
EP 04 01 3745

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	30 September 2004	Jaeger, H

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 04 01 3745

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