(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 045 116**
B1

(12) # EUROPEAN PATENT SPECIFICATION

(45) Date of publication of patent specification: **02.05.84**

(51) Int. Cl.³: **B 21 D 45/06**

(21) Application number: **81200865.4**

(22) Date of filing: **30.07.81**

(54) **Method of releasing a wall-ironed sleeve from a wall-ironing mandril and wall-ironing mandril for carrying out the same.**

(30) Priority: **30.07.80 NL 8004357**

(43) Date of publication of application:
03.02.82 Bulletin 82/5

(45) Publication of the grant of the patent:
02.05.84 Bulletin 84/18

(84) Designated Contracting States:
AT BE CH DE FR GB IT LI LU NL SE

(56) References cited:
US - A - 3 402 591
US - A - 3 406 554
US - A - 3 524 338
US - A - 3 771 344

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EP 0 045 116 B1

Courier Press, Leamington Spa, England.

Method of releasing a wall-ironed sleeve from a wall-ironing mandril and wall-ironing mandril for carrying out the same

The invention relates to a method of releasing a wall-ironed sleeve having an enlarged wall thickness at the end remote from the bottom from a wall-ironing mandril whereby pressurized fluid is led to the operative surface of the mandril causing the sleeve to be released from the mandril. Such a method is known from U.S. Patent specification 3,524,338. According to the technique taught by said U.S. Patent a pressurized fluid is introduced at the front face of the wall-ironing mandril. For a good understanding of the disadvantageous effects of such a method it is pointed out that attempts have to be made to overcome the clamping force by which the sleeve is shrunk on the wall-ironing mandril. This clamping force is generated by cooling down after heating during the wall-ironing process.

By the introduction of pressurized fluid at the front face of the mandril the bottom of the wall-ironed sleeve is very heavily loaded so that it may readily be plastically deformed or damaged. This load serves to produce a tractive force exceeding the frictional force to be overcome, produced by the sleeve being clamped to the mandril as described above. This mode of operation involves that exclusively sleeves of a material having a relatively low Young's modulus can be used. The known method of the aforesaid U.S. Patent cannot possibly be used for construction materials having higher Young's moduli, for example, sheet iron, steel or the like.

A further disadvantage of the prior art is that the introduction of fluid at the front face of the wall-ironing mandril brings about the risk of bottom deformation as well as the risk of the sleeve being, so to say, shot away, which may give rise to unsatisfactory process control and to disturbances in automatic processes.

The invention has for its object to obviate the disadvantages of the prior art and provides a method of the kind set forth in which the fluid is allowed to enter at the transitional region between the normal wall thickness and the enlarged wall thickness. It is pointed out that the axial position of the admission of the fluid corresponds to a region where no wall-ironing operation takes place, since otherwise fluid inlet apertures might become clogged, the fluid being now admitted as near as possible the zone where the operation concerned is carried out in order to maximize the effect.

The fluid pressure preferably amounts to at least 10 bars. Experiments with tinned iron sleeves having a wall thickness of about 0.1 mm have shown that, for example, at a fluid pressure of about 25 bars the sleeve can be released substantially without friction.

The invention furthermore relates to a wall-ironing mandril suitable for carrying into effect the method according to the invention, said mandril having a cylindrical, relatively broad part at its free end, a cylindrical, relatively narrow part coaxial to the former and a substantially conical part interconnecting said two cylindrical parts and at least one fluid inlet conduit opening out at the operative surface, said wall-ironing mandril being characterized in accordance with the invention in that the at least one fluid inlet conduit opens out in the region of the transitional part between the cylindrical, relatively narrow part and the conical part.

Preferably, a plurality of fluid inlet apertures are arranged along the circumference.

In order to reliably prevent the sleeve from being explosively released, there is preferably provided at least one pressure equalizing duct opening out at the front face. This excludes at the same time any risk of the atmospheric pressure between the front face of the mandril and the bottom of the sleeve deforming the sleeve bottom and the neighbouring wall parts.

A very simple embodiment is obtained in which the pressure equalizing duct is in open communication with the atmosphere.

By the method and the wall-ironing mandril according to the invention sleeves having wall thicknesses of even less than 0.1 mm can be stripped off the wall-ironing mandril without deformation of the material.

According to the invention an appreciable saving of material can be obtained by reducing length differences between the initially manufactured and the finally trimmed sleeves. Moreover, disturbances of the process are minimized, which is conductive to the productivity, whilst in addition the various tools have a considerably longer lifetime, which means saving of costs.

The invention will be described more fully with reference to a drawing. This drawing shows in

Figure 1 a schematic cross-sectional view of a device for carrying out the method embodying the invention,

Figure 2 a cross-sectional view of a wall-ironing mandril embodying the invention, and

Figure 3 a detail indicated by III in Figure 2.

The device schematically shown in Figure 1 comprises a wall-ironing mandril 1 embodying the invention, a first wall-ironing ring 2, a second wall-ironing ring 3, a third wall-ironing ring 4 as well as a frame 5 interconnecting the three wall-ironing rings. The wall-ironing mandril is axially driven by means of a plunger 7 actuated by means not shown and being rigidly connected by known coupling means with the wall-ironing mandril 1. In the situation shown the device is in that stage of the wall-ironing process in which a formed sleeve 6 has to be released from the wall-ironing mandril 1.

In this embodiment of the invention the wall-ironing mandril has a plurality of circumferen-

tially disposed fluid inlet apertures 8 located in the area of a transitional part shown in the drawing, particularly Figures 2 and 3, between the relatively narrow part 9 of the wall-ironing mandril 1 and the conical part 11 connecting the narrow part 9 with the relatively broad part 10 with a view to the releasing operation.

The fluid inlet apertures 8 communicate in the manner illustrated in Figure 1 through a flexible pressure duct 12 with a source 13 of pressurized fluid.

This pressurized fluid source is energized synchronously with the displacement of the plunger 7 or continuously in a manner such that the releasing operation takes place after the accomplishment of the wall-ironing operation proper.

With respect to the specific positions of the apertures 8 in the embodiment concerned it is noted that if the apertures are nearer the open end of the sleeve the effectiveness is lower, whereas if the apertures are nearer the bottom, material will be pressed into the apertures during the wall-ironing operation, which would render the release more difficult, whilst during release scraps of material might settle on the outer side of the mandril.

At its front face the wall-ironing mandril 1 has a fluid inlet aperture 14 which communicates in the manner shown in Figure 1 through a second pressure duct 15 with a second source 16 of pressurized fluid, for example, compressed air. This source is also energized synchronously with the displacement of the plunger 7 or else permanently.

Various variants of the embodiment shown are possible. For example, the axial positions of the apertures 8 may be chosen within wide limits on either side.

Claims

1. A method of releasing a wall-ironed sleeve (6) having an enlarged wall thickness at the end remote from the sleeve bottom from a wall-ironing mandril (1) whereby pressurized fluid is led to the operative surface of the mandril causing the sleeve to be released from the mandril characterized in that the fluid is admitted at a transitional region (at 11) between the normal wall thickness (at 10) and the enlarged wall thickness (at 9).

2. A method as claimed in claim 1 characterized in that the fluid pressure amounts to at least 10 bars.

3. A wall-ironing mandril for carrying out the method claimed in either of the preceding claims, said mandril (1) having a cylindrical, relatively broad part (10) at its free end, a cylindrical, relatively narrow part (9) coaxial with the former a substantially conical part (11) interconnecting said two cylindrical parts and at least one fluid inlet conduit opening out at the operative surface characterized in that the at least one fluid inlet conduit (8) opens out in the region of a transitional part (11) between the cylindrical relatively narrow part (9) and the conical part (11).

4. A wall-ironing mandril as claimed in claim 3 characterized by a plurality of circumferentially disposed fluid inlet apertures (8).

5. A wall-ironing mandril as claimed in claim 3 or 4 characterized by at least one pressure equalizing duct (14) opening out at the front face.

6. A wall-ironing mandril as claimed in claim 5 characterized in that the pressure equalizing duct (14) is in open communication with the atmosphere.

Patentansprüche

1. Verfahren zum Abstreifen tiefgezogener Hohlkörper, die an ihren vom Boden des Hohlkörpers wegweisenden Enden eine etwas größere Wandstärke aufweisen, von dem Tiefziehdorn (1), wozu ein unter Druck stehendes Fluid auf die eigentliche Ziehfläche des Ziehdornes gegeben wird, um den Hohlkörper vom Ziehdorn zu lösen, dadurch gekennzeichnet, daß das Fluid bei einem Bereich des Überganges (bei 11') von der normalen (bei 10) zur größeren (bei 9) Wandstärke zugeführt wird.

2. Verfahren nach Anspruch 1, dadurch gekennzeichnet, daß der Fluid-Druck mindestens 10 bar beträgt.

3. Tiefziehdorn zum Durchführen des Verfahrens nach einem der vorherigen Ansprüche, welcher Tiefziehdorn (1) ein verhältnismäßig dickes zylindrisches Teil (10) an seinem freien Ende, ein mit diesem Teil koaxiales verhältnismäßig dünneres zylindrisches Teil (9) und ein die beiden zylindrischen Teil (9, 10) verbindendes, im wesentlichen konisches Teil (11) hat sowie wenigstens an seiner eigentlichen Ziehfläche die Mündung einer Fluid-Zuführleitung aufweist, dadurch gekennzeichnet, daß wenigstens eine Fluid-Zuführleitung (8) in den Bereich eines Übergangsteiles (11') zwischen dem verhältnismäßig dünneren Teil (9) und dem konischen Teil (11) mündet.

4. Tiefziehdorn nach Anspruch 3, dadurch gekennzeichnet, daß am Umfang des Tiefziehdornes verteilt mehrere Zuführ-Öffnungen (8) für Fluid angeordnet sind.

5. Tiefziehdorn nach Anspruch 3 oder 4, dadurch gekennzeichnet, daß mindestens eine Druck-Ausgleichleitung (14) in der Stirnfläche mündet.

6. Tiefziehdorn nach Anspruch 5, dadurch gekennzeichnet, daß die Druck-Ausgleichleitung (14) in offener Verbindung mit der Atmosphäre steht.

Revendications

1. Procédé pour dégager d'un mandrin (1) de formage par étirage un manchon (6) formé par étirage ayant une epaisseur de paroi plus large à son extrémité éloignée du fond du manchon, du

fluide sous pression étant acheminé vers la surface opérationnelle du mandrin pour ainsi dégager le manchon du mandrin, caractérisé en ce que le fluide est admis dans une région de transition (en 11) entre l'épaisseur de paroi normale (en 10) et l'épaisseur de paroi plus large (en 9).

2. Procédé selon la revendication 1, caractérisé en ce que la pression du fluide s'élève à au moins 10 bars.

3. Mandrin de formage par étirage pour la mise en oeuvre du procédé selon l'une des revendications précédentes, ledit mandrin (1) comportant une partie cylindrique relativement large (10) à son extrémité libre, une partie cylindrique relativement étroite (9) coaxiale avec la première, une partie sensiblement conique (11) reliant entre elles les deux parties cylindriques, et au moins un conduit d'admission de fluide s'ouvrant sur la surface opérationnelle caractérisé en ce que le conduit d'admission de fluide (8) s'ouvre dans la région d'une partie de transition (11) entre la partie cylindrique relativement étroite (9) et la partie conique (11).

4. Mandrin selon la revendication 3, caractérisé par une pluralité d'ouvertures d'admission de fluide (8) disposées circonférentiellement.

5. Mandrin selon l'une des revendications 3 et 4, caractérisé par au moins un conduit d'équilibrage des pressions (14) s'ouvrant sur la face avant.

6. Mandrin selon la revendication 5, caractérisé en ce que le conduit d'équilibrage des pressions (14) est en communication libre avec l'atmosphère.

FIG. 1

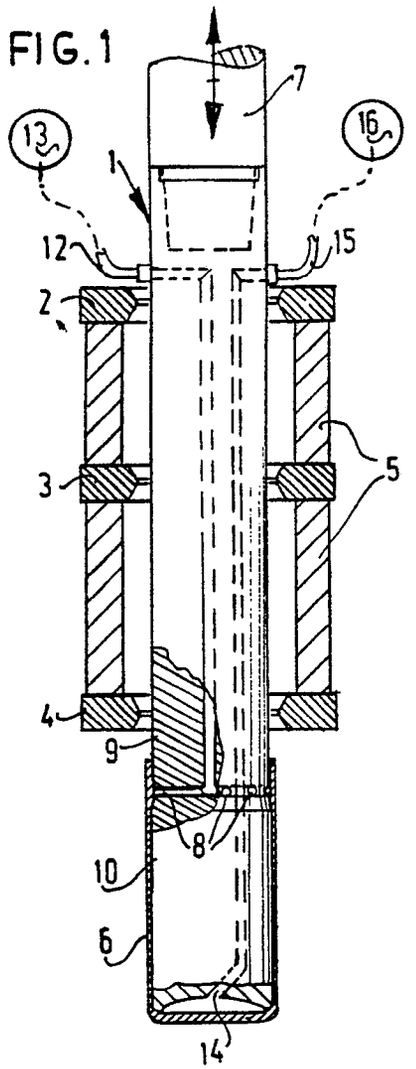
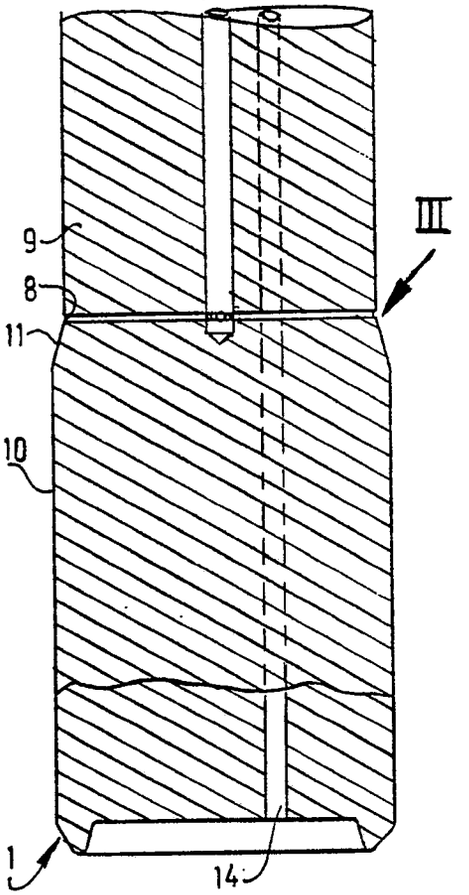


FIG. 2



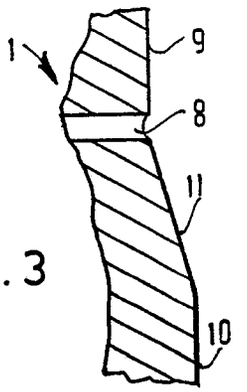


FIG. 3