



(11) **EP 1 909 991 B1**

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
30.09.2009 Bulletin 2009/40

(21) Application number: **06765239.6**

(22) Date of filing: **04.08.2006**

(51) Int Cl.:
B21H 1/12 (2006.01) B21H 1/06 (2006.01)

(86) International application number:
PCT/GB2006/002937

(87) International publication number:
WO 2007/017655 (15.02.2007 Gazette 2007/07)

(54) **RING ROLLING FROM METAL BLANKS**

RINGWALZEN AUS METALLROHLINGEN

LAMINAGE DE COURONNES A PARTIR D EBAUCHES METALLIQUES

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LT LU LV MC NL PL PT RO SE SI SK TR

(30) Priority: **05.08.2005 GB 0516221**

(43) Date of publication of application:
16.04.2008 Bulletin 2008/16

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Description

[0001] This invention relates to a method of rolling a ring from a metal blank according to the preamble of claim 1. An example of such a method is disclosed by GB 1 329 251 A.

[0002] The blanks are typically of standard steels such as wrought steels, but could comprise other metals or alloys. They can be rolled to form rings having many uses, particularly bearing components. The invention may also be applied to powder metal blanks.

[0003] In rolling processes of the kind described above, the metal blank is mounted on a mandrel located between two forming rolls either side of the mandrel axis. Growth control rolls are disposed above and below the mandrel axis to engage the blank as it turns between the forming rolls. Four growth roll controls are used; one directly above another between the mandrel axis and each forming roll. This process has produced good results with very good quality roundness in the final product. However, the process does generate lobes. The present invention seeks to further reduce the generation of lobes, and thereby further improve the roundness of the ring rolled product.

[0004] This is achieved by the features of claim 1. Preferred embodiments are described in the dependent claims. According to the invention, the growth control rolls are arranged above, below and on either side of the mandrel axis to generate a less symmetric pattern of forces acting on the ring blank with more of the horizontal forces being resolved between the upper or the lower growth control rolls and the forming rolls. The preferred arrangement has the pair of upper growth control rolls with their axes parallel to but closer than those of the lower rolls. However, for some applications of the invention the lower pair of growth control rolls can be closer together than the upper pair.

[0005] In the method of the invention the upper and lower growth control rolls will normally be arranged with their axes equidistant on either side of the vertical plane containing the mandrel axis. In one variant of the invention, the two upper growth controls can be replaced by a single growth control with its axis disposed directly over the mandrel axis. In this variant, the upper growth control does of course apply only vertical forces to the ring blank with all the horizontal forces being resolved between the lower growth control rolls and the forming rolls. The disposition of the growth control rolls is preferably selected to minimise the length of unsupported blank between peripherally adjacent rolls (forming rolls and growth control rolls).

[0006] In the methods of the invention, the mandrel axis and the forming rolls are in the same horizontal plane. However, in some applications of the invention there can be some benefit in locating the mandrel axis below the axes of the forming rolls so that there is a vertical component of the forces between the forming rolls and the ring blank.

[0007] The invention will now be described by way of example and with reference to the accompanying schematic drawings in which:

5 Figure 1 shows a cross-section through ring rolling apparatus adapted to practice the method of the invention; and

10 Figure 2 shows an alternative apparatus to that of Figure 1 in which the upper growth controls, are replaced by a single roll.

[0008] As shown in Figure 1 a metal blank (2) is mounted on a mandrel (4) disposed between two forming rolls (6). The axis (8) of the mandrel (4) is located below the horizontal plane containing the axes (10) of the forming rolls, the line between the axis (8) and each forming roll axis (10) subtending an angle β with the horizontal. Angle β is normally no more than 10° , and typically will be no more than 5° . Effective performance has been achieved with angle β at around 1° .

[0009] Two lower growth control rolls (12) are disposed beneath the mandrel (4) to engage the metal blank (2) from below. The rolls (12) are arranged symmetrically on either side of the vertical plane containing the mandrel axis (8); equally spaced from that vertical plane. The rolls (12) are mounted on a framework (14) enabling their spacing to be adjusted. It will be appreciated that the diameter of the lower growth control rolls may need to vary depending upon the spacing between them, to avoid interference with either each other or the forming rolls. The critical factor is of course the line of engagement with the blank on the mandrel, and the angle θ subtended between the line of engagement and the mandrel axis and the horizontal. This angle θ is typically in the range of 50° to 70° , and normally at least 60° .

[0010] Two upper growth control rolls (16) are mounted in a framework (18) over the mandrel axis for engaging the blank (2) from above. These rolls (16) are located closer to each other than are the lower growth control (12) but once again their spacing can be altered by movement of their axes in the framework (18). The rolls (16) are also arranged symmetrically on either side of the vertical plane containing the mandrel axis, and the angle θ' subtended by the line of engagement of the roll (16) and the blank (2) and the mandrel axis relative to the horizontal will of course be greater than the angle θ defined in the location of the lower growth controls. The angle θ' is typically in the range of 50° to 80° , normally in the range 65° to 70° .

[0011] As noted above different sized growth control rolls can be used depending upon the geometry of the desired roll arrangement and of course the size of the ring to be rolled on the forming rolls. Because of the forces involved, the diameter of the growth control rolls should be as much as the geometry allows. The location of the growth control rolls relative to the blank is normally selected such that the spacing between the lines of engage-

ment of the upper rolls (16) is substantially equal to the spacing between each upper roll and the line of engagement of the adjacent forming roll (6). The lower growth control rolls (12) are located in a similarly symmetric arrangement.

[0012] Figure 2 shows a modification of the arrangement in Figure 1 in which the upper growth control rolls (16) are replaced by a single roll (20). In other respects the arrangement of forming and growth control rolls is the same as in Figure 1.

Claims

1. A method of rolling a ring from a metal blank (2), comprising mounting the blank on a mandrel (4) between two forming rolls (6) located on opposite sides of the mandrel axis (8), with a pair of lower growth control rolls (12) located below and with their axes parallel to and on opposite sides of the mandrel axis (8), and a pair of upper growth control rolls (16) arranged above and with their axes parallel and on opposite sides of the mandrel axis, and rolling the ring between the forming rolls (6) with the growth control rolls engaging the ring **characterized in that** the spacing between the pair of upper growth control rolls (16) is different from the spacing between the pair of lower growth control rolls (12).
2. A method according to Claim 1 wherein the spacing between the pair of upper growth control rolls (16) is less than the spacing between the pair of lower growth control rolls (12).
3. A method according to Claim 1 or Claim 2, wherein the lower growth control rolls (12) are located relative to the mandrel axis (8) with their axes disposed at an angle in the range 50° to 70° below the horizontal plane containing the mandrel axis.
4. A method according to Claim 3, when said angle is at least 60°.
5. A method according to any preceding Claim, wherein the upper growth control rolls (16) are located relative to the mandrel axis (8) with their axes disposed at an angle in the range 50° to 80° above the horizontal plane containing the mandrel axis.
6. A method according to Claim 5, wherein said angle is in the range 65° to 70°.
7. A modification of a method according to any of Claims 1 to 4, wherein the blank engages with only a single upper growth control roll (20) with its axis disposed directly over the mandrel axis (8).
8. A method according to any preceding Claim, wherein

the mandrel axis (8) and the axis (10) of the forming rolls (6) are in the same horizontal plane.

9. A method according to any of Claims 1 to 7, wherein the mandrel axis (8) is disposed below a horizontal plane containing the forming roll axes (10).
10. A method according to Claim 8, wherein the mandrel axis (8) is disposed at an angle no greater than 10° below the horizontal plane containing the forming roll axis (10).
11. A method according to Claim 9, wherein the angle is no greater than 5°.

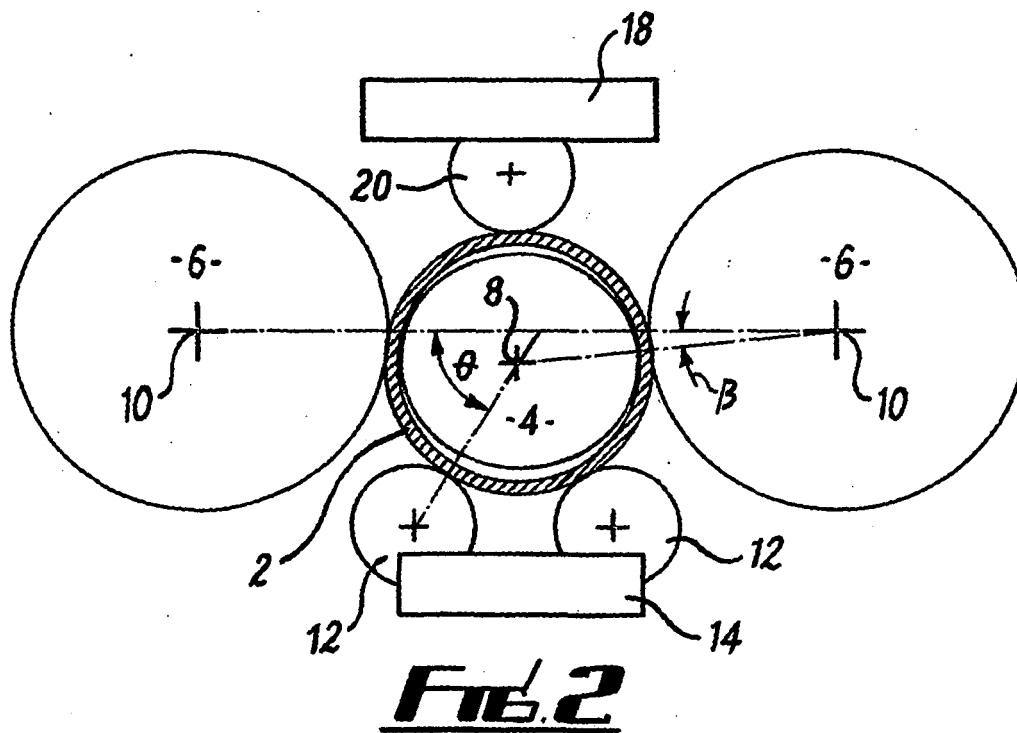
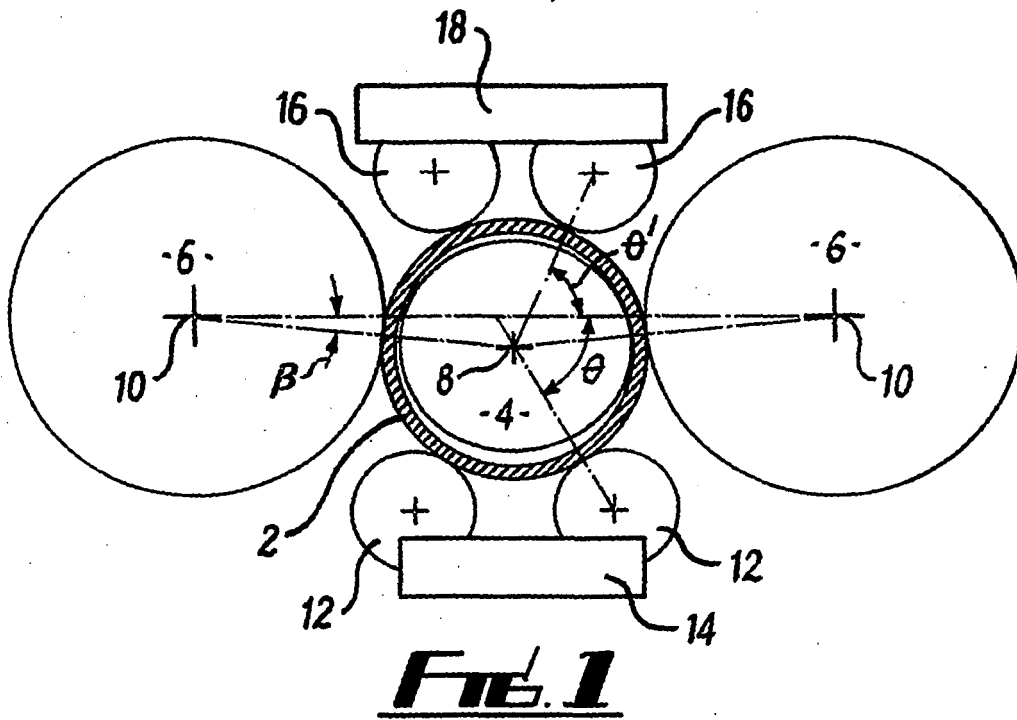
Patentansprüche

1. Verfahren zum Walzen eines Rings aus einem Metallrohling (2), das umfasst, den Rohling auf einem Dom (4) zwischen zwei Formwalzen (6), die auf gegenüberliegenden Seiten der Dornachse (8) angeordnet sind, anzubringen, mit einem Paar von unteren Zunahmesteuerungswalzen (12), die unterhalb und mit ihren Achsen parallel zu und auf gegenüberliegenden Seiten der Dornachse (8) angeordnet sind, und einem Paar von oberen Zunahmesteuerungswalzen (16), die oberhalb und mit ihren Achsen parallel zu und auf gegenüberliegenden Seiten der Dornachse angeordnet sind, und den Ring zwischen den Formwalzen (6) zu walzen, wobei die Zunahmesteuerungswalzen den Ring in Eingriff nehmen, **dadurch gekennzeichnet, dass** sich der Abstand zwischen dem Paar von oberen Zunahmesteuerungswalzen (16) von dem Abstand zwischen dem Paar von unteren Zunahmesteuerungswalzen (12) unterscheidet.
2. Verfahren nach Anspruch 1, wobei der Abstand zwischen dem Paar von oberen Zunahmesteuerungswalzen (16) geringer ist als der Abstand zwischen dem Paar von unteren Zunahmesteuerungswalzen (12).
3. Verfahren nach Anspruch 1 oder Anspruch 2, wobei die unteren Zunahmesteuerungswalzen (12) im Verhältnis zu der Dornachse (8) so positioniert sind, dass ihre Achsen in einem Winkel in dem Bereich von 50° bis 70° unterhalb der horizontalen Ebene, welche die Dornachse enthält, angeordnet sind.
4. Verfahren nach Anspruch 3, wenn der Winkel wenigstens 60° beträgt.
5. Verfahren nach einem der vorhergehenden Ansprüche, wobei die oberen Zunahmesteuerungswalzen (16) im Verhältnis zu der Dornachse (8) so positioniert sind, dass ihre Achsen in einem Winkel in dem

- Bereich von 50° bis 80° oberhalb der horizontalen Ebene, welche die Dornachse enthält, angeordnet sind.
6. Verfahren nach Anspruch 5, wobei der Winkel in dem Bereich von 65° bis 70° liegt.
7. Modifikation eines Verfahrens nach einem der Ansprüche 1 bis 4, wobei der Rohling mit nur einer oberen Zunahmesteuerungswalze (20) ineinandergreift, wobei deren Achse unmittelbar über der Dornachse (8) angeordnet ist.
8. Verfahren nach einem der vorhergehenden Ansprüche, wobei sich die Dornachse (8) und die Achse (10) der Formwalzen (6) in der gleichen horizontalen Ebene befinden.
9. Verfahren nach einem der Ansprüche 1 bis 7, wobei die Dornachse (8) unterhalb einer horizontalen Ebene, welche die Formwalzenachsen (10) enthält, angeordnet ist.
10. Verfahren nach Anspruch 8, wobei die Dornachse (8) in einem Winkel, der nicht größer als 10° ist, unterhalb der horizontalen Ebene, welche die Formwalzenachsen (10) enthält, angeordnet ist.
11. Verfahren nach Anspruch 9, wobei der Winkel nicht größer als 5° ist.
- trôle de la croissance (12).
3. Procédé selon les revendications 1 ou 2, dans lequel les rouleaux inférieurs de contrôle de la croissance (12) sont agencés par rapport à l'axe du mandrin (8) de sorte que leurs axes sont agencés à un angle compris dans l'intervalle allant de 50° à 70° au-dessous du plan horizontal contenant l'axe du mandrin.
4. Procédé selon la revendication 3, dans lequel ledit angle correspond au moins à 60°.
5. Procédé selon l'une quelconque des revendications précédentes, dans lequel les rouleaux supérieurs de contrôle de la croissance (16) sont agencés par rapport à l'axe du mandrin (8) de sorte que leurs axes sont agencés à un angle compris dans l'intervalle allant de 50° à 80° au-dessus du plan horizontal contenant l'axe du mandrin.
6. Procédé selon la revendication 5, dans lequel ledit angle est compris dans l'intervalle allant de 65° à 70°.
7. Modification d'un procédé selon l'une quelconque des revendications 1 à 4, dans lequel l'ébauche s'engage uniquement dans un seul rouleau supérieur de contrôle de la croissance (20), son axe étant agencé directement au-dessus de l'axe du mandrin (8).
8. Procédé selon l'une quelconque des revendications précédentes, dans lequel l'axe du mandrin (8) et l'axe (10) des rouleaux de formage (6) sont agencés dans le même plan horizontal.
9. Procédé selon l'une quelconque des revendications 1 à 7, dans lequel l'axe du mandrin (8) est agencé au-dessous d'un plan horizontal contenant les axes des rouleaux de formage (10).
10. Procédé selon la revendication 8, dans lequel l'axe du mandrin (8) est agencé à un angle non supérieur à 10° au-dessous du plan horizontal contenant l'axe du rouleau de formage (10).
11. Procédé selon la revendication 9, dans lequel l'angle n'est pas supérieur à 5°.

Revendications

1. Procédé de laminage d'une bague à partir d'une ébauche métallique (2), comprenant les étapes de montage de l'ébauche sur un mandrin (4) entre deux rouleaux de formage (6) agencés sur des côtés opposés de l'axe du mandrin (8), avec une paire de rouleaux inférieurs de contrôle de la croissance (12), agencés au-dessous de l'axe du mandrin (8), sur des côtés opposés de celui-ci, leurs axes y étant parallèles, et une paire de rouleaux supérieurs de contrôle de la croissance (116) agencés au-dessus de l'axe du mandrin, sur des côtés opposés de celui-ci, leurs axes y étant parallèles, et de laminage de la bague entre les rouleaux de formage (16), les rouleaux de contrôle de la croissance s'engageant dans la bague, **caractérisé en ce que** l'espacement entre la paire de rouleaux supérieurs du contrôle de la croissance (16) est différent de l'espacement entre la paire de rouleaux inférieurs du contrôle de la croissance (12).
2. Procédé selon la revendication 1, dans lequel l'espacement entre la paire de rouleaux supérieurs du contrôle de la croissance (16) est inférieur à l'espacement entre la paire de rouleaux inférieurs de con-



REFERENCES CITED IN THE DESCRIPTION

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