

(19)



(11)

EP 3 243 577 B1

(12)

EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention
of the grant of the patent:
19.02.2020 Bulletin 2020/08

(51) Int Cl.:
B21C 37/08 (2006.01) B21D 5/12 (2006.01)

(21) Application number: **17169403.7**

(22) Date of filing: **04.05.2017**

(54) A FORMING UNIT FOR A PROFILING MACHINE LINE

UMFORMEINHEIT FÜR EINE PROFILIERUNGSANLAGE

UNITÉ DE FORMAGE POUR UNE LIGNE DE MACHINES À PROFILER

(84) Designated Contracting States:
**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB
GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO
PL PT RO RS SE SI SK SM TR**

(30) Priority: **10.05.2016 IT UA20163295**

(43) Date of publication of application:
15.11.2017 Bulletin 2017/46

(73) Proprietor: **FIVES OTO S.P.A.
42022 Boretto, Reggio Emilia (IT)**

(72) Inventors:
• **ALBERINI, Gianluca
42016 Guastalla, Reggio Emilia (IT)**

• **MICALI, Luciano
42016 Guastalla, Reggio Emilia (IT)**
• **BARBOLINI, Fabio
41010 Limidi di Soliera, Modena (IT)**

(74) Representative: **Casadei, Giovanni
Bugnion S.p.A.
Via Vellani Marchi, 20
41124 Modena (IT)**

(56) References cited:
**EP-A2- 0 924 004 DE-A1- 2 608 410
GB-A- 438 790 JP-A- 2016 022 534
US-A- 2 012 795**

EP 3 243 577 B1

Note: Within nine months of the publication of the mention of the grant of the European patent in the European Patent Bulletin, any person may give notice to the European Patent Office of opposition to that patent, in accordance with the Implementing Regulations. Notice of opposition shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European Patent Convention).

Description

[0001] The present invention relates to a forming unit and a profiling machine line for realising profiled elements.

[0002] A profiling machine line substantially enables production of longitudinally welded tubes, which are obtained by progressively bending a steel strip about a longitudinal axis, up to bringing the longitudinal edges of the strip into reciprocal contact. The longitudinal edges are welded together to obtain a tube. The tube is cut into sections of a pre-established length, according to known processes. The whole production is performed in a continuous line.

[0003] A profiling machine line substantially comprises a series of forming units, arranged in succession, each of which comprises at least two profiling rollers. These forming units are predisposed for progressively bending the steel strip about a longitudinal axis thereof until they confer thereon a tubular conformation. The bending of the sheet is done by passing the strip itself between the rollers of the various forming units which, by contact, progressively deform it. The strip slides continuously through the forming units, being progressively deformed.

[0004] A profiling machine line generally comprises at least an initial forming section along which the strip from which the tubes will be obtained is progressively deformed from a flat conformation to one having a U-shaped bend. This deformation is obtained by pairs of rollers, associated to each forming unit, formed by a roller having a concave outer surface and a roller having a convex outer surface. The radii of curvature of the two rollers are substantially equal. The rollers typically have a horizontal rotation axis.

[0005] The radii of curvature of the rollers progressively diminish from the start to the end of the forming section, so as to progressively reduce also the radius of curvature of the strip. The rollers of the final zone of the forming section thus have a significant difference between the diameter of the central part thereof and the diameter of the ends thereof. In particular the ends of the concave rollers and the central portion of the convex rollers have rather large diameters, and overall take on a large and unwieldy conformation, as well as being expensive.

[0006] A forming unit which only in part solves the technical problem above is disclosed in document DE 2608410. Such forming unit is provided with three lower rollers which define a concave curve on which the profile is laid. The profile is pushed downwards by means of a single roller, such that the profiling of the lateral zones of the profile is not guided with sufficient precision.

[0007] The object of the present invention is to provide a forming unit for a profiling machine line which allows the drawbacks summarized above to be obviated.

[0008] An advantage of the forming unit according to the present invention is that it enables a considerable reduction in the diameter of the rollers, thus further enabling a reduction in weight and dimensions thereof.

[0009] A further advantage of the forming unit according to the present invention is that it can be integrated in already-existing lines.

5 **[0010]** A further aim of the present invention is to provide a profiling machine line that is particularly advantageous with respect to currently-available lines.

10 **[0011]** Further characteristics and advantages of the present invention will become more apparent in the following detailed description of an embodiment of the present invention, illustrated by way of non-limiting example in the attached figures, in which:

- - figure 1 is a schematic view of a profiling machine line according to the present invention;
- 15 - - figure 1a schematically illustrates the bending of a profiled element (P) starting from the flat configuration of the initial strip;
- - figure 2 illustrates a front view of a forming unit (10) according to the present invention;
- 20 - - figure 3 shows the forming group of figure 2 in a different operating configuration;
- - figure 4 shows a front view of a guide means (5) according to the present invention.

25 **[0012]** The profiling machine line, illustrated generally in figure 1, guides the starting strip in advancement along a generally horizontal advancement direction (Y). As a skilled person in the sector knows, the starting strip is progressively bent in an upwards curve about a longitudinal axis thereof, assuming a tubular conformation in which the two longitudinal edges (E1, E2) are placed alongside one another and welded. In the following description the starting strip is for convenience indicated as a "profiled element" starting from when deformation
30 thereof begins, by curving upwards about its own longitudinal axis. In the final profiled element (P), the longitudinal edges (E1, E2) of the starting strip are, being welded together, in the upper part of the profiled element (P).

35 **[0013]** The progressive curving of the strip about its own longitudinal axis preferably occurs in an upwards direction, i.e. by lifting the longitudinal edges (E1, E2) and placing them alongside one another in the upper part of the profiled element (P), as schematically illustrated in figure 1a. This allows simplification of the welding operations and subsequent removal of the weld bead, which can take place, still on the processing line, substantially above the profiled element (P) itself. This does not exclude the possibility that the progressive curving of the strip about its own longitudinal axis can take place in a downwards direction, i.e. by lowering the longitudinal
40 edges (E1, E2) and placing them alongside one another in the lower part of the profiled element (P).

45 **[0014]** The profiling machine line comprises a plurality of working units (10, 2a, 2b, 2c, 3a, 3b, 3c, ...) each of which is provided with two or more rollers profiled and arranged so as to produce, on the profiled element (P), a certain curvature about the longitudinal axis thereof. The operating principle of the various working units and the way
50

in which they produce the overall curvature of the profiled element (P) are widely known to a person skilled in the sector.

[0015] The profiling machine line has a forming section (1), comprising a plurality of forming units (10) aligned along a first longitudinal direction (Y1). The forming units (10), by means of two or more profiled rollers, produce the initial deformation of the strip, taking it from the flat conformation to a curved conformation, substantially a U-shape, with the concavity thereof facing upwards.

[0016] The forming section (1) is followed by a finishing section (2) which comprises a plurality of finishing units (2a,2b,2c,...) aligned along a second longitudinal direction (Y2), substantially coplanar to the longitudinal direction (Y1). The finishing units, by means of a plurality of profiled rollers, continue with the deformation of the strip, processing it into a substantially tubular conformation with the lateral edges parallel and close to one another.

[0017] The finishing section is in turn followed by a guide section (3) that comprises a plurality of guide units (3a,3b,3c,...), aligned to one another.

[0018] The guide units guide the strip, now closed in a tubular configuration, to welding means (4), predisposed to perform a welding of the longitudinal edges of the strip. The guide units (3a,3b,3c,...) comprise a plurality of profiled rollers.

[0019] Generally, the starting strip advances along the advancement direction (Y) changing its conformation from substantially flat to tubular, due to the effect of the action exerted along the various sections (1, 2, 3) by the working units (10,2a,2b,2c,3a,3b,3c...).

[0020] At least a forming unit (10), illustrated in figures 2 and 3, comprises a plurality of profiled lower rollers (11,12,13) having outer surfaces which envelop, on at least a transversal section plane (S), a lower curve (P1). In particular, the outer surfaces of the lower rollers (11,12,13) envelop a continuous lower curve (P1), i.e. they envelop a lower curve (P1) without any interruptions.

[0021] As illustrated in figure 2, the transversal section plane is the plane on which the rotation axes of the lower rollers (11,12,13) lie. The lower curve (P1) preferably has concavities facing upwards. As is immediately comprehensible, the predisposing of a plurality of lower rollers (11,12,13) enables obtaining the lower curve (P1), by reducing the maximum diameter required for obtaining the desired curve. In fact, in the forming units at present available which use a single lower roller, the lower curve (P1) can be obtained only by configuring a roller provided with a maximum diameter in the end zone that is decidedly larger. In the forming unit according to the present invention, the lower rollers (11,12,13) can be realised with more modest dimensions.

[0022] The lower rollers (11,12,13) comprise a central roller (11) that exhibits a concave outer surface. In other terms, excluding the rotation pins which do not enter into contact with the strip to be deformed, the central roller (11) has a minimum external diameter at a central zone and a maximum external diameter in the end zones. The

central roller (11) can be motorised.

[0023] The lower rollers comprise one or more lateral rollers (12,13) each of which is provided with a concave outer surface. In the illustrated embodiment, the concave outer surface of the lateral rollers (12,13), on the transversal section plane, is connected to the outer surface of the central roller (11), so as substantially to define a continuous lower curve (P1).

[0024] The lateral rollers (12, 13) have rotation axes that are inclined with respect to the rotation axis of the central roller (11). In the illustrated embodiment the rotation axes of the lateral rollers (12, 13) diverge in a distancing direction from the central roller (11).

[0025] At least a forming unit (10) comprises a plurality of upper rollers (21,22,23,24,25) shaped with outer surfaces that envelop, on the transversal section plane, an upper curve (P2). The upper curve (P2) is preferably parallel to the lower curve (P1), i.e. the upper rollers (21,22,23,24,25) are tangential to a curve coinciding with the lower curve (P1). As illustrated in figure 2, the transversal section plane is the plane on which the rotation axes of the upper rollers (21,22,23,24,25) lie. The upper curve (P2) preferably has concavities facing upwards. As is immediately comprehensible, the predisposing of a plurality of upper rollers (21,22,23,24,25) enables obtaining the upper curve (P2), reducing the maximum diameter required for obtaining the desired curve. In fact, in the forming units at present available which use a single upper roller, the upper curve (P2) can be obtained only by configuring a roller provided with a maximum diameter in the central zone that is decidedly larger. In the forming unit according to the present invention, the upper rollers (21,22,23,24,25) can be realised with more modest dimensions.

[0026] The upper rollers comprise a central roller (21) that exhibits a convex outer surface. In other terms, the central roller (21) has a barrel-shaped conformation, with a maximum diameter in a central zone. The upper rollers further comprise one or more lateral rollers (22,23,24,25) which exhibit a convex outer surface. The outer surfaces of the upper rollers (21,22,23,24,25) are substantially tangential to the upper curve (P2) on the transversal section plane.

[0027] In the illustrated embodiment, the forming unit (10) comprises a plurality of lower rollers (11,12,13) and a plurality of upper rollers (21,22,23,24,25).

[0028] The rotation axes of the rollers lie on a same transversal section plane.

[0029] The upper curve and the lower curve (P2,P1) both lie on the transversal section plane. The upper curve and the lower curve (P2,P1) are substantially parallel to one another.

[0030] The strip to be processed and bent about the longitudinal axis thereof passes in contact with the lower rollers and the upper rollers, substantially assuming a curvature parallel to the upper curve and the lower curve (P2, P1).

[0031] Preferably, though not necessarily, the upper

rollers (21,22,23,24,25) are associated with an upper support (20), which is movable along a vertical direction. This enables adjusting the distance between the upper rollers and the lower rollers, for example in relation to the thickness of the strip to be processed. This further enables adjusting the pressure that the rollers exert on the strip under process.

[0032] The upper support (20) has overall a curved conformation, with a concavity facing upwards. The support (20) is further provided with seatings for rotatably housing the upper rollers (21,22,23,24,25).

[0033] The upper support (20) can be associated to a cross-member (26) which is vertically slidable along a support structure (9). Means known to a person skilled in the sector can be predisposed to command the displacement of the upper support (20). In the illustrated version the support structure comprises two uprights (91, 92).

[0034] The lower rollers (11, 12, 13) can be associated to the uprights (91, 92).

[0035] The central roller (11) is associated to the uprights at the ends thereof, by means of a shaft or by rotation pins. The lateral rollers (12, 13) are each associated to a respective upright.

[0036] The lower rollers (11, 12, 13) can be associated to a lower support (14).

[0037] The lower support (14) comprises two portions (14) to each of which is rotatably associated an end of the rotation shaft of the central roller (11).

[0038] Each support portion (14) further rotatably supports one of the lateral rollers (12, 13). In particular each support portion (14) bears a pair of shelf members (14a) to which the ends of the rotation shaft of the respective lateral roller are associated.

[0039] The two opposite portions of the lower support (14) are each associated to one of the uprights (91, 92), preferably vertically slidably, for enabling the adjustment of the position of the lower rollers (11, 12, 13). Means known to a person skilled in the sector can be predisposed to command the vertical displacement of the lower support (14).

[0040] The profiling machine line can advantageously be provided with at least a working unit (10, 2a, 2b, 2c, 3a, 3b, 3c...) a position of which is vertically adjustable independently with respect to the other working units. By adjusting the vertical position of at least a working unit it is possible to set a predetermined curvature for the profiled element (P). For example, by lowering the position of a working unit with respect to the following working units, a curvature can be set for the profiled element (P) which is concave facing upwards followed by a curvature that is concave facing downwards.

[0041] In the downwards-facing concavity section the upper zones of the profiled element (P) are stretched, in particular the zones of the longitudinal edges (E1, E2) which assume a stretched conformation that is substantially free of undulations, or having very modest undulations.

[0042] In a possible embodiment the profiling machine line is provided with an intermediate section, comprising one or more working units, which is rotatable about a horizontal axis (X) with respect to a first preceding section, in turn comprising one or more working units. Rotation means, not illustrated, can be predisposed to produce this rotation. The line further comprises a third section, comprising one or more working units, which is subsequent with respect to the intermediate section and the position of which on a vertical plane is adjustable. This enables inclining the profiled element (P) upwards, thanks to the possibility of rotating the intermediate section about the horizontal axis (X) and returning the profiled element (P) consecutively to the intermediate section and along the third section, in a substantially horizontal inclination that is in any case smaller than the inclination assumed in the intermediate section of the line. In this way, in passing from the intermediate section to the third section of the line, the profiled element (P) is subjected to a bending operation, a concavity of which is facing upwards. The whole zone of the edges (E1, E2) of the profiled element (P) which are to be welded to one another is therefore stretched to assume a stretched conformation that is substantially free of undulations, or has very modest undulations. This significantly facilitates the welding of the longitudinal edges and the realisation of a weld bead that is structurally solid. The intermediate section might be provided with a base to which one or more working units are fixed. The base might be hinged about the horizontal axis (X) to a preceding working unit.

[0043] For example, the finishing section (2) can be rotatable about a horizontal axis (X) relative to the forming section (1). This enables adjusting the inclination of the second longitudinal direction (Y2) relative to the first longitudinal direction (Y1).

[0044] As already specified, the finishing section (2) can be inclined upwards (by a few degrees). As it enters the guide section (3) consecutive to the finishing section (2), the profiled element (P), which has by now taken on a tubular configuration, undergoes a bending a concavity of which is facing downwards. The whole zone of the edges (E1, E2) of the profiled element which are to be welded to one another is therefore stretched to assume a stretched conformation that is substantially free of undulations, or has very modest undulations. This significantly facilitates the welding of the longitudinal edges and the realisation of a weld bead that is structurally solid.

[0045] In a possible embodiment, at least one of the finishing units (2a, 2b, 2c...) is rotatable about a horizontal axis (X) relative to the forming section (1).

[0046] In the illustrated embodiment, the finishing section (2) comprises a base (B2), to which the finishing units (2a, 2b, 2c, ...) are constrained, which base (B2) is hinged, relative to the horizontal axis (X), to an end portion of the forming section (1). For example the base (B2) can be hinged to a base portion of the nearest forming unit (10). Alternatively, the forming section (1) can in turn be provided with a base (B1) to which the forming units

(10) are associated. With reference to the advancement direction of the profiled element (P), a front end of the second base (B2) can be hinged to a rear end of the first base (B1). Actuator means known to the expert in the sector can be used for determining the rotation of the finishing section (2) about the horizontal axis (X).

[0047] The profiling machine line can advantageously be provided with guide units (3a, 3b, 3c, ...) that are vertically mobile independently of one another. In other terms, the vertical position of each guide unit can be adjusted independently with respect to the vertical position of the other guide units. This enables giving the transiting profiled element (P) a predetermined curvature on a vertical longitudinal plane thereof. For example, in the same way as already described with respect to the finishing group (2), it is possible to give the profiled element (P) a curvature the concavity of which is facing downwards. The whole zone of the edges of the profiled element (P) which are to be welded to one another is therefore stretched to assume a stretched conformation that is substantially free of undulations, or has very modest undulations. This significantly facilitates the welding of the longitudinal edges and the realisation of a weld bead that is structurally solid. The guide units (3a,3b,3c,...), vertically mobile independently of one another, can be present, in the presence or absence of the finishing section (2), rotatable about the horizontal axis (X) with respect to the forming section (1). For example, in the presence of an upwards-inclined finishing section (2), the vertical position of the guide units (3a,3b,3c,...) can be adjusted so as to bend the profiled element (P) downwards to overall define a continuous curvature with the concavity facing downwards. This produces a consistent stretching of the edges of the profiled element (P) which assume a stretched and straight configuration.

[0048] The profiling machine line can be provided with guide means (5), interposed for example between the forming section (1) and the finishing section (2), which are so structured as to push the edges (E1, E2) of the profiled element (P) under process one towards the other.

[0049] The guide means (5), illustrated schematically in figure 4, preferably comprise a pair of shoes (51,52), fixed opposite one another, and positioned so as to enter into contact with two opposite zones of the article (P). For example, the shoes (51, 52) are positioned so as to enter into contact with zones close to the edges (E1, E2) of the profiled element (P) under process.

[0050] In a possible embodiment the shoes (51, 52) are associated to a foot or support structure and are located at a predetermined height, preferably adjustable. The shoes (51,52) prevalently extend along a longitudinal direction parallel to the advancement direction (Y). On a section plane that is vertical and perpendicular to the advancement direction (Y), the shoes (51, 52) are preferably inclined so as to converge towards one another.

[0051] The shoes (51, 52) can be positioned for example in a section of the intermediate line between two work-

ing units, passing through which the edges (E1, E2) of the profiled element (P) begin to be inclined, turning towards one another. This facilitates the passage from the preceding working unit to the working unit positioned following the shoes (51, 52).

[0052] For example the shoes (51, 52) can be positioned between the forming section and the finishing section. The shoes (51, 52) are preferably associated to respective supports (51a, 52a) that are horizontally and vertically mobile, as schematically illustrated in figure 4.

Claims

1. A forming unit for a profiling line, comprising: a plurality of lower rollers (11,12,13) shaped with outer surfaces that envelop, on at least one transversal section plane (S) on which the rotation axes of the lower rollers (11,12,13) lie, a lower curve (P1); a plurality of upper rollers (21,22,23,24,25) shaped with outer surfaces that envelop, on the transversal section plane, an upper curve (P2) substantially parallel to the lower curve (P1);
wherein the lower rollers (11,12,13) include a central roller (11), that exhibits a concave outer surface, and one more lateral rollers (12,13) each of which is provided with a concave outer surface that, on the transversal section plane, is matched to the outer surface of the central roller (11);
characterized in that:

the upper rollers comprise a central roller (21), that exhibits a convex outer surface, and one or more lateral rollers (22,23,24,25) which exhibit a convex outer surface;
the outer surfaces of the upper rollers (21,22,23,24,25) are substantially tangential to the upper curve (P2) on the transversal section plane.
2. A forming unit according to claim 1, in which the lower rollers (11,12,13) exhibit axes of rotation lying on the transversal section plane.
3. A forming unit according to claim 1, wherein at least one of the upper rollers (21,22,23,24,25) exhibits its axis of rotation lying on the transversal section plane.
4. A forming unit according to claim 1, wherein the upper rollers (21,22,23,24,25) are associated with a support (20), which is movable along a vertical direction.
5. A forming unit according to claim 1, in which the central roller (11) is motorized.
6. A profiling machine line for the realization of profiled elements, comprising a plurality of working units (10,

2a, 2b, 2c, 3a, 3b, 3c, ...) each of which is provided with two or more rollers which are shaped and arranged such as to form on the profiled elements (P) a certain curvature about its longitudinal axis, **characterized in that** it comprises at least a forming unit (10) according to one of the preceding claims, **and in that** at least one working unit (10, 2a, 2b, 2c, 3a, 3b, 3c ...) has a position ef-which is vertically adjustable independently of the other working units.

7. A profiling machine line for the realization of profiled elements according to claim 6, comprising an intermediate section, which is rotatable about a horizontal axis (X) with respect to a first previous section, and a third section following the intermediate section, the position of which is adjustable on a vertical plane.

8. A profiling machine line for the realization of sections, comprising:

a forming section (1), comprising a plurality of forming units (10) according to any preceding claim, aligned along a first longitudinal direction (Y1);

a finishing section (2), consecutive to the forming section (1), comprising a plurality of finishing units (2a, 2b, 2c, ...) aligned along a second longitudinal direction (Y2);

a guide section (3), consecutive to the finishing section (2), comprising a plurality of guide units (3a, 3b, 3c, ...), mutually aligned, and welding means (4), prepared for performing a parallel welding to the longitudinal direction (Y);

wherein the finishing section (2) is rotatable about a horizontal axis (X) relative to the forming section (1), so as to adjust the inclination of the second longitudinal direction (Y2) with respect to the first longitudinal direction (Y1).

9. A profiling machine line according to claim 8, in which the finishing section (2) comprises a base (B), to which the finishing units (2a, 2b, 2c, ...) are constrained, which base (B) is hinged, relative to the horizontal axis (X), to an end portion of the forming section (1).

10. A profiling machine line according to claim 8, in which the guide units (3a, 3b, 3c, ...) are vertically movable independently of each other.

11. A profiling machine line according to claim 8, comprising guide means (5), which is so structured as to push the edges (E1, E2) of the profile (P), one towards the other.

12. A profiling machine line according to claim 11, wherein the guide means (5) comprises a pair of opposing shoes (51,52), being so positioned as to

come into contact with two zones of the article (P).

Patentansprüche

1. Umformeinheit für eine Profilierungsanlage, umfassend: eine Vielzahl an unteren Walzen (11, 12, 13), die mit Außenflächen geformt sind, die auf mindestens einer Querschnittsebene (S), auf der die Drehachsen der unteren Walzen (11, 12, 13) liegen, eine untere Kurve (P1) einschließen; eine Vielzahl an oberen Walzen (21, 22, 23, 24, 25), die mit Außenflächen geformt sind, die auf der Querschnittsebene eine obere Kurve (P2) im Wesentlichen parallel zur unteren Kurve (P1) einschließen; wobei die unteren Walzen (11, 12, 13) eine zentrale Walze (11) enthalten, die eine konkave Außenfläche aufweist, und eine oder mehrere seitliche Walzen (12, 13), von denen jede mit einer konkaven Außenfläche versehen ist, die auf der Querschnittsebene, an die Außenfläche der zentralen Walze (11) angepasst ist;

dadurch gekennzeichnet, dass:

die oberen Walzen eine zentrale Walze (21) umfassen, die eine konvexe Außenfläche aufweist, und eine oder mehrere seitliche Walzen (22, 23, 24, 25), die eine konvexe Außenfläche aufweisen;

die Außenflächen der oberen Walzen (21, 22, 23, 24, 25) im Wesentlichen tangential zu der oberen Kurve (P2) auf der Querschnittsebene sind.

2. Umformeinheit nach Anspruch 1, wobei die unteren Walzen (11, 12, 13) Drehachsen aufweisen, die auf der Querschnittsebene liegen.
3. Umformeinheit nach Anspruch 1, wobei mindestens eine der oberen Walzen (21, 22, 23, 24, 25) deren Drehachse aufweist, die auf der Querschnittsebene liegt.
4. Umformeinheit nach Anspruch 1, wobei die oberen Walzen (21, 22, 23, 24, 25) mit einem Träger (20) assoziiert sind, der entlang einer vertikalen Richtung bewegbar ist.
5. Umformeinheit nach Anspruch 1, wobei die zentrale Walze (11) motorisiert ist.
6. Profilierungsanlage zur Realisierung von profilierten Elementen umfassend eine Vielzahl an Arbeitseinheiten (10, 2a, 2b, 2c, 3a, 3b, 3c, ...), von denen jede mit zwei oder mehreren Walzen versehen ist, die geformt und derart angeordnet sind, dass sie auf den profilierten Elementen (P) eine gewisse Krümmung um ihre Längsachse bilden, **dadurch gekennzeichnet,**

net, dass sie mindestens eine Umformeinheit (10) nach einem der vorhergehenden Ansprüche umfasst und dass mindestens eine Arbeitseinheit (10, 2a, 2b, 2c, 3a, 3b, 3c ...) eine Position aufweist, die unabhängig von den anderen Arbeitseinheiten vertikal einstellbar ist.

7. Profilierungsanlage zur Realisierung von profilierten Elementen nach Anspruch 6, umfassend einen Zwischenabschnitt, der gegenüber einem ersten vorherigen Abschnitt um eine horizontale Achse (X) drehbar ist, und einen dritten Abschnitt, der dem Zwischenabschnitt folgt, dessen Position auf einer vertikalen Ebene einstellbar ist.

8. Profilierungsanlage zur Realisierung von Abschnitten, umfassend:

einen Umformabschnitt (1), umfassend eine Vielzahl an Umformeinheiten (10) nach einem der vorhergehenden Ansprüche, die entlang einer ersten Längsrichtung (Y1) ausgerichtet sind; einen an den Umformabschnitt (1) anschließenden Endbearbeitungsabschnitt (2), umfassend eine Vielzahl an Endbearbeitungseinheiten (2a, 2b, 2c, ...), die entlang einer zweiten Längsrichtung (Y2) ausgerichtet sind;

einen an den Endbearbeitungsabschnitt (2) anschließenden Führungsabschnitt (3), umfassend eine Vielzahl an zueinander ausgerichteten Führungseinheiten (3a, 3b, 3c, ...) und Schweißmittel (4), die zum Durchführen eines Schweißens parallel zur Längsrichtung (Y) vorbereitet sind;

wobei der Endbearbeitungsabschnitt (2) relativ zum Umformabschnitt (1) um eine horizontale Achse (X) drehbar ist, um die Neigung der zweiten Längsrichtung (Y2) in Bezug auf die erste Längsrichtung (Y1) einzustellen.

9. Profilierungsanlage nach Anspruch 8, wobei der Endbearbeitungsabschnitt (2) eine Basis (B) umfasst, an der die Endbearbeitungseinheiten (2a, 2b, 2c, ...) festgespannt sind, wobei die Basis (B) relativ zu der horizontalen Achse (X) an einem Endabschnitt des Umformabschnitts (1) angelenkt ist.

10. Profilierungsanlage nach Anspruch 8, wobei die Führungseinheiten (3a, 3b, 3c, ...) unabhängig voneinander vertikal bewegbar sind.

11. Profilierungsanlage nach Anspruch 8, umfassend Führungsmittel (5), die so aufgebaut sind, dass sie die Kanten (E1, E2) des Profils (P) gegeneinander drücken.

12. Profilierungsanlage nach Anspruch 11, wobei die Führungsmittel (5) ein Paar gegenüberliegender

Schuhe (51, 52) umfassen, die so positioniert sind, dass sie mit zwei Zonen des Gegenstands (P) in Kontakt kommen.

Revendications

1. Unité de formage pour une ligne de profilage, comprenant : une pluralité de rouleaux inférieurs (11, 12, 13) façonnés avec des surfaces extérieures qui enveloppent, sur au moins un plan (S) à section transversale sur lequel reposent les axes de rotation des rouleaux inférieurs (11, 12, 13), une courbe inférieure (P1) ; une pluralité de rouleaux supérieurs (21, 22, 23, 24, 25) façonnés avec des surfaces extérieures qui enveloppent, sur le plan à section transversale, une courbe supérieure (P2) substantiellement parallèle à la courbe inférieure (P1) ; dans laquelle les rouleaux inférieurs (11, 12, 13) incluent un rouleau central (11) présentant une surface extérieure concave, et un ou plusieurs rouleaux latéraux (12, 13) chacun étant pourvu d'une surface extérieure concave qui, sur le plan à section transversale, correspond à la surface extérieure du rouleau central (11) ;

caractérisée en ce que :

les rouleaux supérieurs comprennent un rouleau central (21) présentant une surface extérieure convexe et un ou plusieurs rouleaux latéraux (22, 23, 24, 25) présentant une surface extérieure convexe ;
les surfaces extérieures des rouleaux supérieurs (21, 22, 23, 24, 25) sont substantiellement tangentes à la courbe supérieure (P2) sur le plan à section transversale.

2. Unité de formage selon la revendication 1, dans laquelle les rouleaux inférieurs (11, 12, 13) présentent des axes de rotation reposant sur le plan à section transversale.

3. Unité de formage selon la revendication 1, dans laquelle au moins un des rouleaux supérieurs (21, 22, 23, 24, 25) présentent son axe de rotation reposant sur le plan à section transversale.

4. Unité de formage selon la revendication 1, dans laquelle les rouleaux supérieurs (21, 22, 23, 24, 25) sont associés à un support (20) étant mobile le long d'une direction verticale.

5. Unité de formage selon la revendication 1, dans laquelle le rouleau central (11) est motorisé.

6. Ligne de machines à profiler pour la réalisation d'éléments profilés, comprenant une pluralité d'unités de production (10, 2a, 2b, 2c, 3a, 3b, 3c, ...), chacune

étant pourvue de deux ou plusieurs rouleaux étant façonnés et disposés de manière à former sur les éléments profilés (P) une certaine courbure autour de son axe longitudinal, **caractérisée en ce qu'elle** comprend au moins une unité de formage (10) selon l'une des revendications précédentes, et **en ce qu'**au moins une unité de production (10, 2a, 2b, 2c, 3a, 3b, 3c ...) a une position étant verticalement réglable indépendamment des autres unités de production.

7. Ligne de machines à profiler pour la réalisation d'éléments profilés selon la revendication 6, comprenant une section intermédiaire pouvant tourner autour d'un axe horizontal (X) par rapport à une première section précédente, et une troisième section suivant la section intermédiaire, dont la position est réglable sur un plan vertical.

8. Ligne de machines à profiler pour la réalisation de sections, comprenant :

une section de formage (1), comprenant une pluralité d'unités de formage (10) selon l'une quelconque des revendications précédentes, alignées le long d'une première direction longitudinale (Y1) ;
 une section de finition (2), faisant suite à la section de formage (1), comprenant une pluralité d'unités de finition (2a, 2b, 2c, ...) alignées le long d'une seconde direction longitudinale (Y2) ;
 une section de guidage (3), faisant suite à la section de finition (2), comprenant une pluralité d'unités de guidage (3a, 3b, 3c, ...) mutuellement alignées, et des moyens de soudage (4) préparés pour effectuer un soudage parallèle à la direction longitudinale (Y) ;
 dans laquelle la section de finition (2) peut tourner autour d'un axe horizontal (X) par rapport à la section de formage (1), de manière à régler l'inclinaison de la seconde direction longitudinale (Y2) par rapport à la première direction longitudinale (Y1).

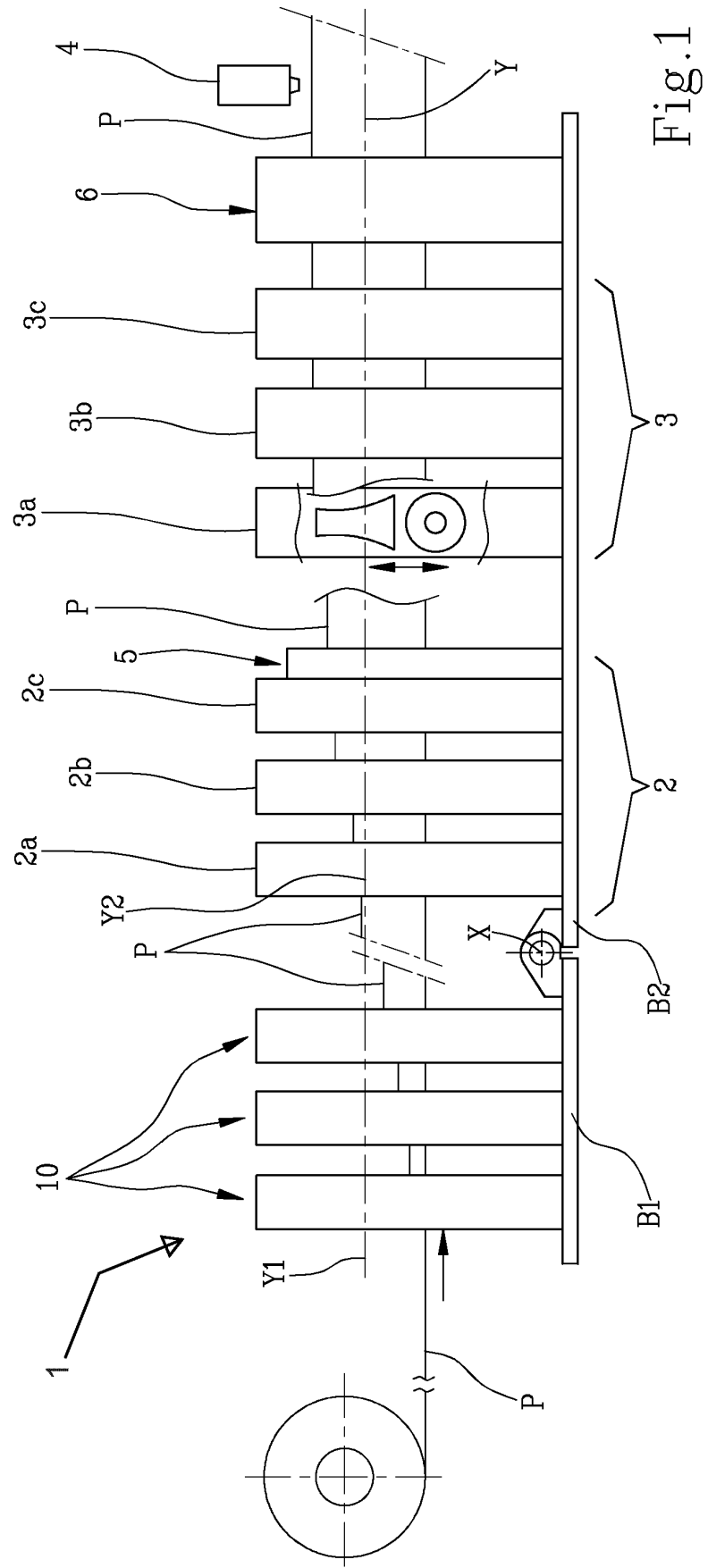
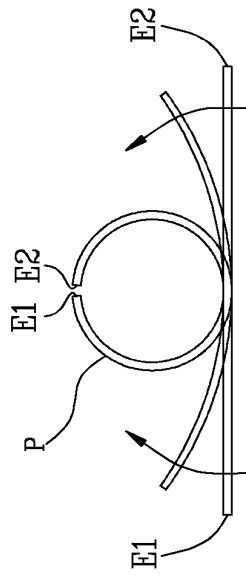
9. Ligne de machines à profiler selon la revendication 8, dans laquelle la section de finition (2) comprend une base (B) à laquelle sont solidaires les unités de finition (2a, 2b, 2c, ...), ladite base (B) est montée articulée, par rapport à l'axe horizontal (X), à une portion terminale de la section de formage (1).

10. Ligne de machines à profiler selon la revendication 8, dans laquelle les unités de guidage (3a, 3b, 3c, ...) sont mobiles verticalement indépendamment les unes des autres.

11. Ligne de machines à profiler selon la revendication 8, comprenant des moyens de guidage (5) étant

structurés de manière à pouvoir pousser les bords (E1, E2) du profilé (P), l'un vers l'autre.

12. Ligne de machines à profiler selon la revendication 11, dans laquelle les moyens de guidage (5) comprennent une paire de patins (51, 52) opposés, étant positionnés de manière à venir en contact avec deux zones de l'article (P).



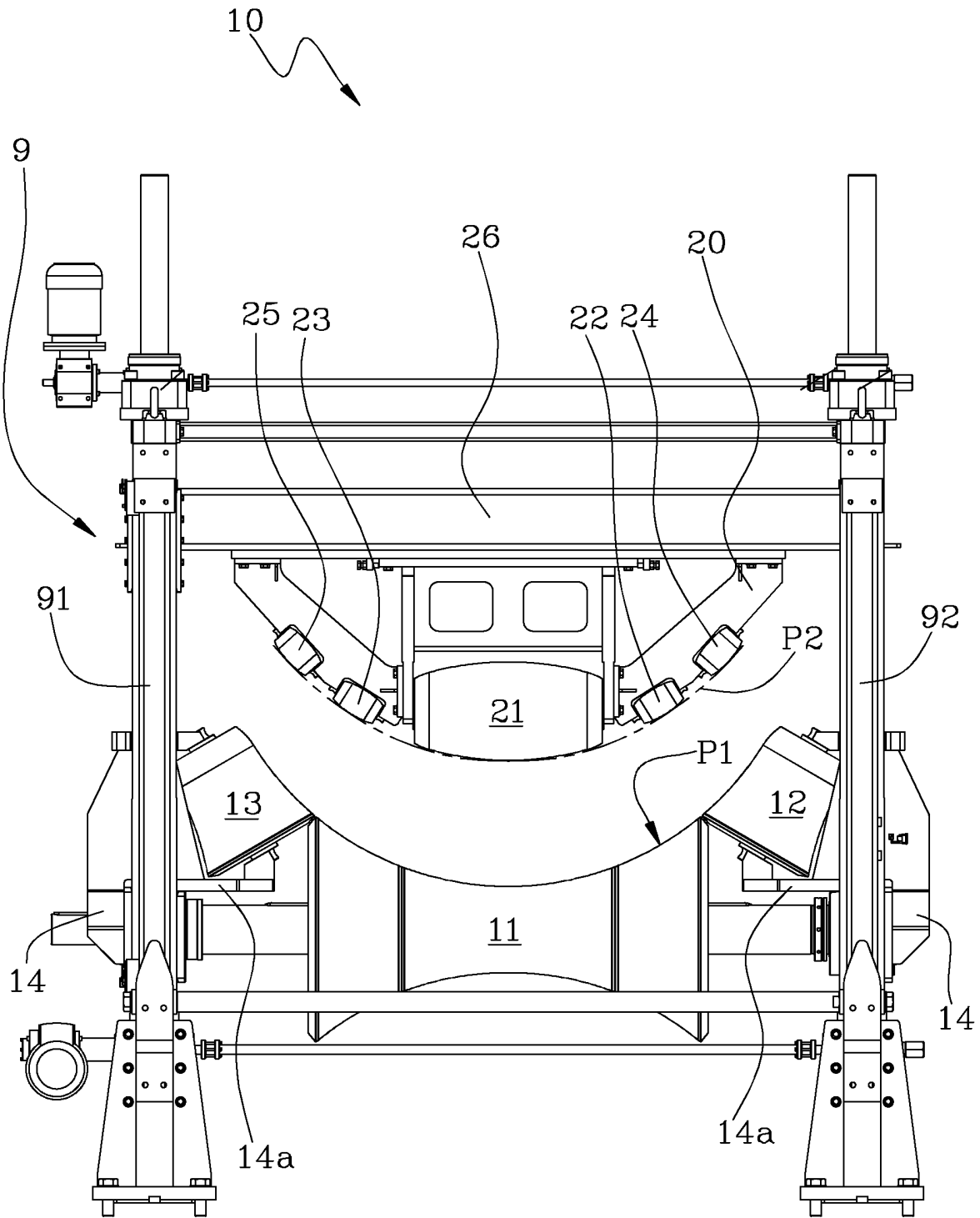


Fig.2

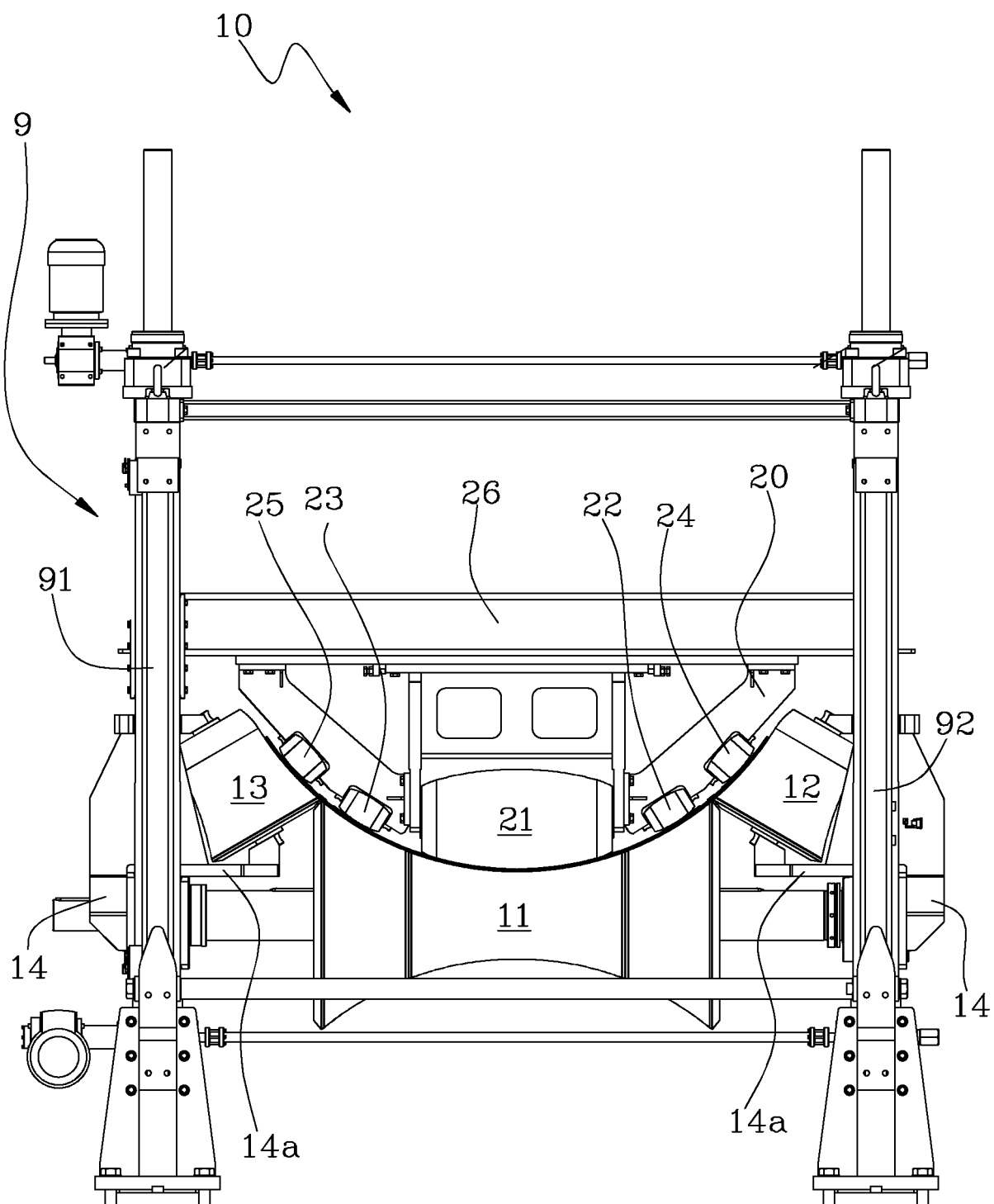


Fig.3

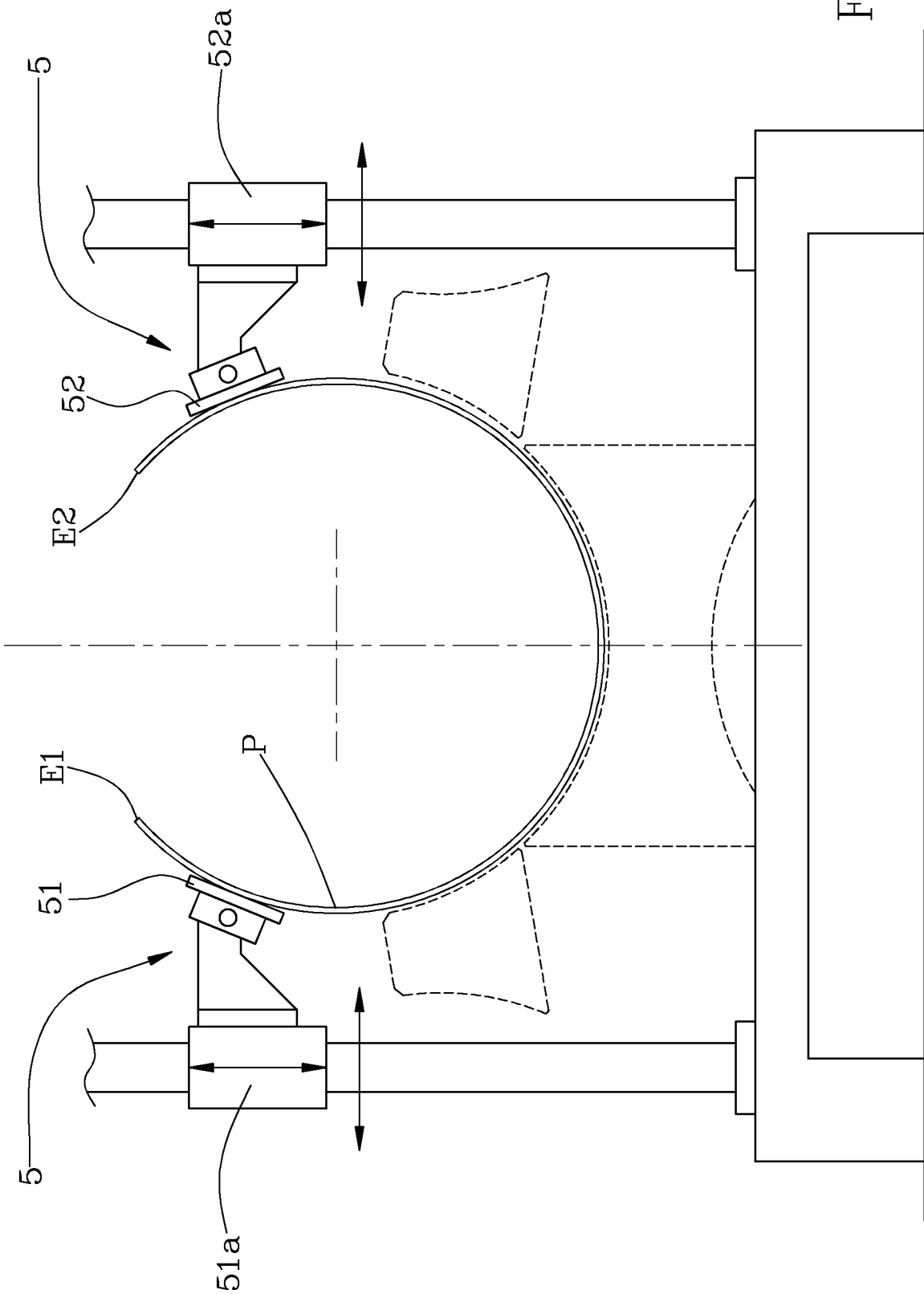


Fig. 4

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- DE 2608410 [0006]