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**Drum, system and method for handling long rolled products
coming from different strands of a rolling mill**

[0001] The invention concerns a drum and a method for
5 handling rolled long products coming from different strands
of a rolling mill. The invention also concerns a system
incorporating such a drum.

[0002] The invention may be used particularly, but not
10 exclusively, in hot-rolling plants for the production of
ferrous long products such as bars, rods or the like.

[0003] In order to produce finished long metal products
such as bar, rod or the like, a long metal plant comprises,
15 among other devices, a plurality of rolling stands aligned
along a rolling line to continuously roll billets received
from a furnace or other like source.

[0004] After the last rolling stand, the product is
20 generally cut in bar segments which are subsequently cooled
at ambient temperature, for example in a cooling bed.

[0005] The long product can be discharged on the cooling
bed by an apparatus called a drum.

25 [0006] A long product production plant can be configured
to process simultaneously a plurality of strands. The
strands are obtained by dividing or slitting the product
when still hot at a given point of the plant after a given
30 number of rolling passes. The slitting is realized in order
to increase the production rate of a plant without
increasing rolling speed of the last stands. After this

slitting operation, the long metal product is divided in different strands which need to be subsequently treated.

[0007] In document EP 1 8 77 203 B1, in order to be able to process long products segments coming from different production strands, at least two drums per strand are provided. Each drum alternately receives one segment of the long product which has been previously cut. This means that two drums are allocated per strand of product. Furthermore switching means for directing the long product segments in the appropriate drum are needed. The above mentioned elements make the equipment rather complicated, increase its complexity and require a high amount of maintenance.

[0008] Document WO 02 070156 A1 discloses a device for receiving and discharging bars coming from a rolling mill. In this document, two pairs of drums are used to handle the bars coming from a single strand. This means again that two pairs of drums are allocated per strands, which implies that four drums are needed per strand of product.

[0009] A major objective of the invention is to simplify the handling of bars originating from different strands of a rolling mill before their loading on a cooling apparatus.

[0010] A companion objective of the present invention is to diminish the number of drums, driving systems, and switches needed for handling bars segment coming from a plurality of strands.

[0011] Another objective of the invention is to increase the production rate of a rolling mill plant, and to obtain a more compact plant.

[0012] SUMMARY OF THE INVENTION

[0013] The above mentioned problems are solved by a drum
5 for receiving, transporting and discharging long metal
products such as bars, rods or the like, preferably coming
from a hot rolling mill,

characterized in that said drum comprises at least one pair
of circumferential channels extending parallel to the drum
10 axis, said at least one pair of channels being arranged to
receive simultaneously two long products, respectively one
long product in each one of the channels part of the pair.

15 [0014] According to other optional features of the
invention taken alone or in combination:

[0015] - the drum comprises a plurality of pairs of
channels, each pair of channels being spaced apart relative
20 to the neighboring pairs of channels;

[0016] - each pair of channel is angularly spaced apart
relative to the neighboring pairs of channels by an angle
greater than or equal to 12 degrees and preferably comprised
25 between 12 and 45°;

[0017] - the drum comprises a plurality of pairs of
channels, each pair of channel being spaced apart relative
to the neighboring channels by a portion free of channel;

30 [0018] - said portion free of channel has an angular
width α comprised between 12 and 18 degrees;

[0019] - the drum according comprises a plurality of pairs of channels wherein each channel of each pair of channels has a first size, and wherein the drum further comprises between each of said pairs of channels a channel
5 having a second size different from the first size;

[0020] - the angular width and the depth of each channel having the second size are respectively greater than the angular width and the depth of each channel having the first
10 size;

[0021] - each channel extends along a longitudinal axis parallel to the drum axis, and wherein the angularly distance between two axis of a pair of channel is bigger
15 than or equal to 30° , and preferably comprised between 30° and 45° degrees;

[0022] - the angular distance between two channels of a pair depends on the linear distance between the two long
20 products that the pair of channels is intended to receive;

[0023] wherein the angle B between two channels of a pair is comprised between 14° and 24° , and preferably between 16° and 20° .
25

[0024] The invention also concerns a system for handling a plurality of long products preferably coming from a plurality of strands of a hot rolling mill characterized in that said system comprises:
30

- a. at least one drums as above defined,
- b. at least one cover intended to cooperate with each channel of said drum to form a chamber to momentarily confine each long product,

c. at least one guide having at least two entry sections leading to a common exit section , the entry sections being intended to receive and guide at least two long products coming from two different strands of a rolling mill toward the exit section, and wherein the exit section face the entries of the channels of said drum and is intended to align in a parallel manner said at least two long products before their introduction into the channels of said drum,

d. braking means for breaking said two parallel long products coming from said guide.

[0025] The invention also concerns a method for handling at least two long products preferably coming from two different strands of a rolling mill, characterized in that the method comprises the following steps:

- a) introducing said at least two long products in different channels of the same drum simultaneously and
- b) subsequently discharging said at least two long products on the same notch of a cooling bed.

[0026] Advantageously prior to step a) the method comprises the following step:

- guiding said at least two long products to align said two long product in a parallel manner and,
- braking said at least two long products.

[0027] An advantageously a drum according as previously defined is used.

[0028] The invention provides a drum able to handle simultaneously at least two bars in a simple manner and therefore minimize the number of drums needed to process multiple strands in a rolling mill plant.

5

[0029] The drum according to the invention is particularly advantageous in case where there is a plurality of strands coming from the rolling mill but can also be used where only one strand is produced.

10

[0030] BRIEF DESCRIPTION OF THE DRAWINGS

[0031] The teachings of the present invention can be readily understood by considering the following non-limiting detailed description in conjunction with the accompanying drawings, in which:

15

[0032] FIG. 1 shows a transversal cross-section of drums according to the invention located above a cooling bed, the drums being loaded with long products having a first diameter;

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[0033] FIG. 2 is an enlargement of a figure 1;

[0034] FIG. 3 is a view similar to figure 2 where the drums are loaded with long products having a second diameter;

25

[0035] FIG. 4 is a schematic view of a first embodiment of a system for handling a plurality of strands of long products coming from a rolling mill;

30

[0036] FIG. 5 is a schematic view of a second embodiment of a system for handling a plurality of strands of long products coming from a rolling mill; and

5 [0037] FIG. 6 is a cross-sectional transversal view of second embodiment of drums according to the invention.

[0038] To facilitate understanding, identical reference numerals have been used, where possible, to designate
10 identical elements that are common to the figures.

[0039] Further, as in a same drawing the drums are most of the time identical all reference numbers for one drum have not been reproduced twice for sake of clarity.

15

[0040] DETAILED DESCRIPTION

[0041] Figures 1 and 2 show generally a couple of drums 10 and 12 located above a cooling bed 14. Each drum 10 or 12
20 has a cylindrical shape and is driven to rotate step-wisely about its axis X. Each drum 10, 12, defines a plurality of channels C1 to Cn. Each channel C1-Cn extends along and parallel to the axis of its respective drum 10 or 12 and around the circumference of said drum.

25

[0042] As can be best seen on figures 2,3 and 6 each channel C1-Cn is designed to cyclically receive one long product P coming from a rolling mill at time.

30 [0043] Each drum also cooperates with a cover 16 extending partially around and outside said drum 10 or 12. More precisely, the cover 16 is arranged to momentarily

close each channel C1-Cn and to form with each closed channel C1 to Cn a chamber Ch wherein each long metal product P is confined before being discharged onto the cooling bed 14. Each cover 16 extends on a given angular
5 segment with vertex the center X of the drum 10 or 12.

[0044] According to the invention, in order to be able to handle long products coming from different strands obtained for example thanks to a slitting process, each drum 10 or 12
10 comprises at least two channels C1-C2, forming a pair of channels. Each channel of said pair is located close enough one relative to the other such that, each channel of the pair can receive simultaneously one long product at time. In other words, the pair of channels receives simultaneously
15 two long products. Again in other words, said pair of channels is arranged to receive simultaneously two long products, namely one long product in each one of the channels part or the pair.

20 [0045] The angle B (see figure 2 drum 12) between two channels of a pair - which can be defined as being the angle between the axis of the channels of a pair measured from the axis X of the channel- depends on the linear distance C (see figure 5) between the two long products before their
25 entrance in each pair of channel. Said angle may be for example comprised between 14 and 24°, and preferably between 16 and 20°. In one embodiment B is equal to 18°.

[0046] As can be seen on figures 2, 3 and 6 each drum 10
30 or 12 comprises a plurality of pair of channels as above defined. Each pair of channels is angularly spaced apart relative to the neighboring pair of channels by a predetermined angle α (with vertex the center X of the drum

10 or 12). This angle can be for example bigger than or equal to 30° . In the embodiment of figure 2, α can be preferably comprised between 30 and 45° . In one embodiment α is equal to 42° . Of course this angle depends on the
5 diameter of the biggest product to be handled and on the maximal rotational speed of the drum.

[0047] In the embodiment shown in figure 6, each pair of channels is angularly spaced apart relative to its
10 neighboring channels by a portion free of channel. This portion has an angle α' (with vertex the center X of the drum 10 or 12) which can be for example bigger or equal to 12° and preferably comprised between 12° and 18° . In one embodiment α' is equal to 15° . More precisely, each drum
15 defines a plurality of longitudinal recesses 18. Each recess 18 has a pair of U shaped half tube, each U shaped half tube is a channel intended to receive a long product.

[0048] The arrangement of the two channels (for example
20 C1 and C2) part of a pair close to each other also allows the discharging of two long products on the same notch of the cooling bed 14 as can be seen on figures 3 and 6.

[0049] The channels of a pair have generally the same or
25 a quite similar transversal cross section.

[0050] In the embodiment shown on figures 2 to 4, each drum comprises between each pair of channel, for example between C1-C2 and C3-C4, a channel C1' having in a
30 transversal cross section of said drum a shape different than the shape of the channels, for example C1-C4, part of a

pair. In other words, in this embodiment, each drum has two different types of channels with two different sizes.

[0051] The channels with the first size, called small
5 channels (for example C1-C4), are designed to receive long products with for example a diameter up to 16mm and the second size of channel, called big channels (for example C1'), are designed to receive long products with for example a diameter greater than 16mm up to for example 42mm. The
10 angular width β and the depth "d" of each big channel are respectively greater than the angular width and the depth of each small channel.

[0052] In addition to the fact that a drum according to
15 the invention can process a plurality of strands at the same time, the different sizes of channels also allow to widen the range of long products which can be handled by a drum according to the invention in comparison to a known drum. In other words, thanks to this embodiment, the same drum can
20 process different kinds of long products having a wide range of diameters.

[0053] Furthermore, the fact that the sizes of the channels are adapted to the side of the product guarantees
25 the stability of the product during its traveling within the channel.

[0054] In addition, when traditional drums are used, the long products introduced within the channel cause wear. In
30 case the wear occurs in a channel designed for a long product having an important diameter, for example greater than 32mm, the wear changes the channel shape. This can lead

to stoppage of subsequent long product having a smaller diameter using the same channel. This problem is avoided with the drum according to the invention because dedicated channels for small diameter long products and for bigger diameter long products are provided. In this way, all kinds of products are always well guided, even when a wear occurs in one of the channels.

[0055] Furthermore, under certain circumstances the use of a drum according to this embodiment may allow to avoid the use of aprons normally needed upstream the cooling bed in the prior art solutions.

[0056] Figure 4 is a schematic view showing a system for handling a plurality of strands of long products preferably coming from a rolling mill according to the invention. In a first embodiment, this system comprises at least one drum 10 or 12. Upstream each drum 10 or 12 a guide 20 or 20' is provided. Each guide 20 or 20' has a "V" shape and comprises two spaced apart branches or entering portions 20a, 20b converging toward an ending branch or ending portion 20c. During operation of the rolling mill, each spaced apart branch receives segments P1 or P2 of long product coming from two different strands of the rolling mill. Each branch 20a, 20b guides a long product segment toward the guide ending portion 20c where the two long product segments P1 and P2 are aligned in a parallel manner. Subsequently, each long product segment P1 and P2 is introduced simultaneously into a pair of channels of the drum by a breaking pinch roll 22 or 22'.

[0057] As above shown, the drum 10 or 12 according to the invention is arranged for and capable of cooperating with a system delivering simultaneously two parallel long products coming from two different strands of a rolling mill.

5

[0058] In the embodiment shown in figure 4, each breaking pinch roll 22, 22' is a single groove pinch roll and is driven by one motor (not shown).

10

[0059] In the embodiment shown in figure 5, a single double groove breaking pinch roll 24 or 24' is used to introduce both strands within the pair of channels 10 or 12, said pinch roll 24 or 24' being driven by a sole motor (not shown). This embodiment may be used in cases where the available space is limited at this location of the plant.

15

[0060] As can be seen in figures 2, 3 and 6, after introduction of a pair of small diameter long products, or of one big diameter long product, each drum is rotated stepwisely and delivers a pair of long products at time on the cooling bed or one big diameter long product at time on the cooling bed.

20

[0061] Even if not shown, it will be understood that the system according to invention comprises control means driving the rotation of the drum such that a pair of channel are facing the charging means 20, 22 and 22' and also synchronizing the pinch rolls breaking and the motions of the cooling bed to move forward the discharged long products.

30

[0062] When two long products coming from two different strands of a rolling mill arrive in the handling system

(driven by upstream pinch rolls not shown on the figures) according to the invention, they are in a first step guided by the two entry sections 20a and 20b of the guide 20 or 20'.

5

[0063] In a second step, the two long products are aligned in a parallel manner by the exit section 20c of the guide 20 or 20'.

10

[0064] In a third step, the two long products are braked by the pinch rolls 22,22' and are introduced into a pair of channels of the drum 10 or 12 facing the pinch rolls.

15

[0065] In a fourth step, the drum 10 or 12 is driven to rotate by one step such that two long product, which were previously confined in two chambers Ch closed by the cover 16 are discharged by gravity on the same notch of the cooling bed 14.

20

CLAIMS

1. Drum (10,12) for receiving, transporting and discharging long metal products (P) such as bars, rods or the like, preferably coming from a hot rolling mill,
characterized in that said drum comprises at least one pair of circumferential channels (C1-C2) extending parallel to the drum axis (X), said at least one pair of channels being arranged to receive simultaneously two long products (P1,P2), respectively one long product in each one of the channels part of the pair.
2. Drum according to claim 1 comprising a plurality of pairs of channels (C1-C2, C3-C4), each pair of channels being spaced apart relative to the neighboring pairs of channels.
3. Drum according to claim 2 wherein each pair of channels (C1-C2, C3-C4) is angularly spaced apart relative to the neighboring pairs of channels by an angle (α , α') greater than or equal to 12 degrees and preferably comprised between 12 and 45°.
4. Drum according to claims 1 to 3 comprising a plurality of pairs of channels (C1-C2, C3-C4), each pair of channel being spaced apart relative to the neighboring channels by a portion free of channel.

5. Drum according to the previous claim wherein said portion free of channel has an angular width α comprised between 12 and 18 degrees.
6. Drum according to claims 1 to 3 comprising a plurality of pairs of channels (C1-C2, C3-C4) wherein each channel of each pair of channels has a first size, and wherein the drum further comprises between each of said pairs of channels a channel (C1') having a second size different from the first size.
7. Drum according to the previous claim wherein the angular width (β) and the depth (d) of each channel having the second size are respectively greater than the angular width and the depth of each channel having the first size.
8. Drum according to anyone of the previous claims wherein each channel extends along a longitudinal axis parallel to the drum axis (X), and wherein the angularly distance between two axis of a pair of channel is bigger than or equal to 30°, and preferably comprised between 30° and 45° degrees.
9. Drum according to anyone of the previous claims wherein the angular distance (B) between two channels of a pair depends on the linear distance (C) between the two long products that the pair of channels is intended to receive.
10. Drum according to anyone of the previous claims wherein the angle B between two channels of a pair

is comprised between 14 and 24°, and preferably between 16 and 20°.

11. System for handling a plurality of long products preferably coming from a plurality of strands of a hot rolling mill characterized in that said system comprises:

- a. at least one drums (10,12) according to anyone of the previous claims,
- b. at least one cover (16) intended to cooperate with each channel (C1-Cn) of said drum to form a chamber (Ch) to momentarily confine each long product,
- c. at least one guide (20, 20') having at least two entry sections (20a,20b) leading to a common exit section (20c), the entry sections being intended to receive and guide at least two long products (P1,P2) coming from two different strands of a rolling mill toward the exit section, and wherein the exit section (20c) face the entries of the channels of said drum and is intended to align in a parallel manner said at least two long products before their introduction into the channels of said drum,
- d. braking means for breaking said two parallel long products coming from said guide.

12. Method for handling at least two long products (P1,P2) preferably coming from two different strands of a rolling mill, characterized in that the method comprises the following steps:

- a) introducing said at least two long products in different channels of the same drum (10,12) simultaneously and
- b) subsequently discharging said at least two long products on the same notch of a cooling bed (14).

13. Method according to claim 12 comprising prior to step a):

- guiding said at least two long products to align said two long product in a parallel manner and,
- braking said at least two long products.

14. Method according the previous claims wherein a drum according to claims 1-9 is used.

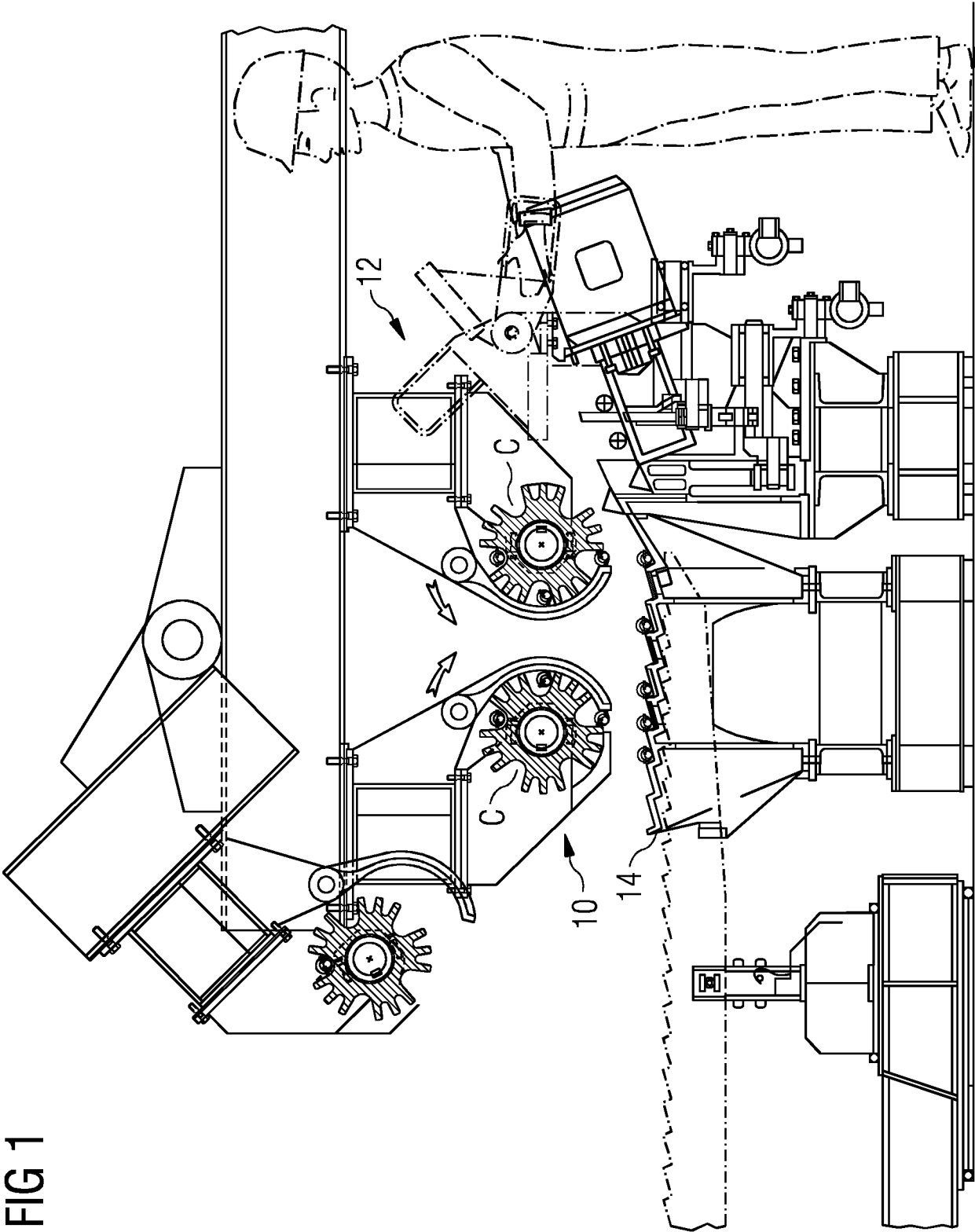


FIG 1

FIG 2

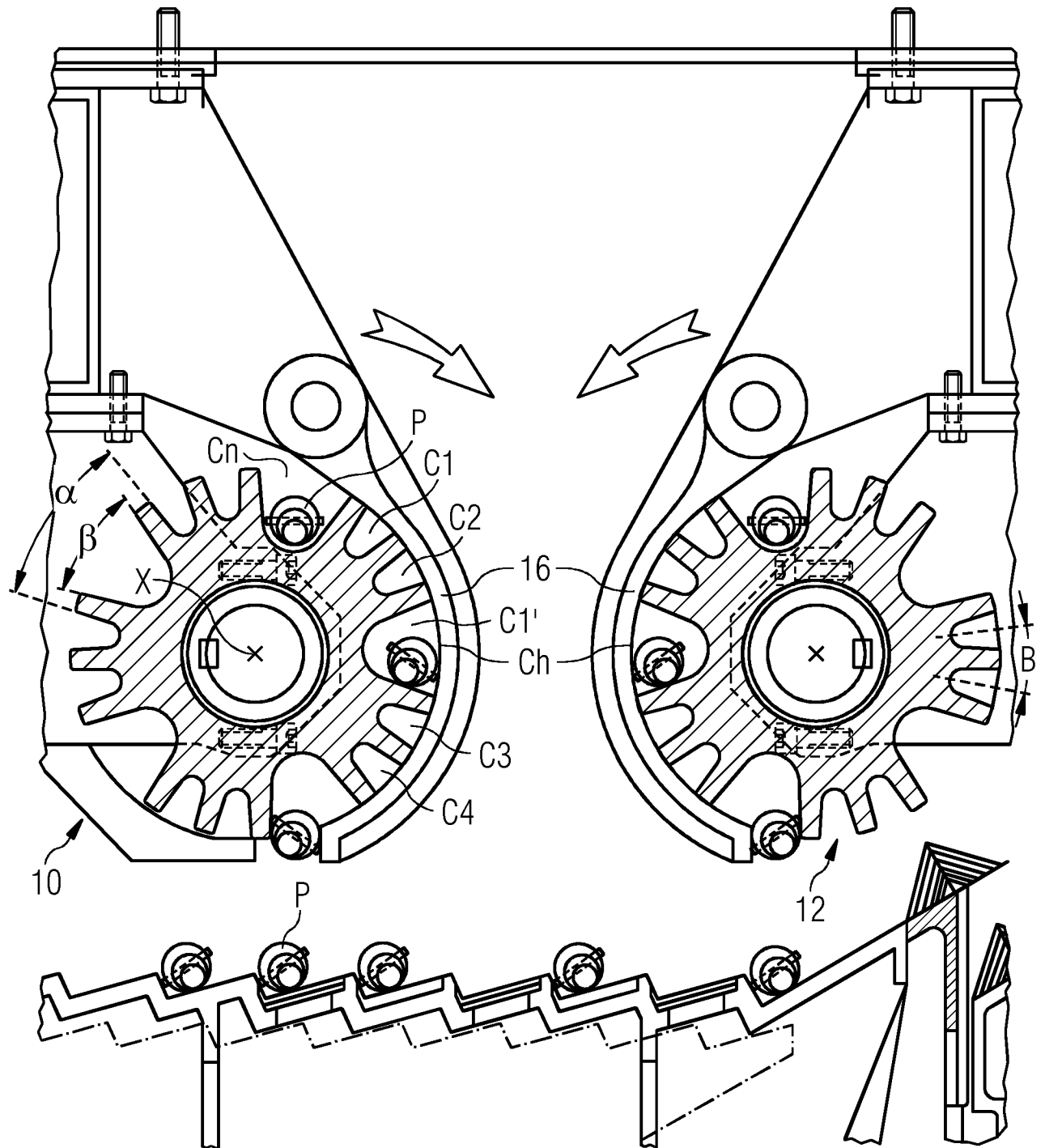
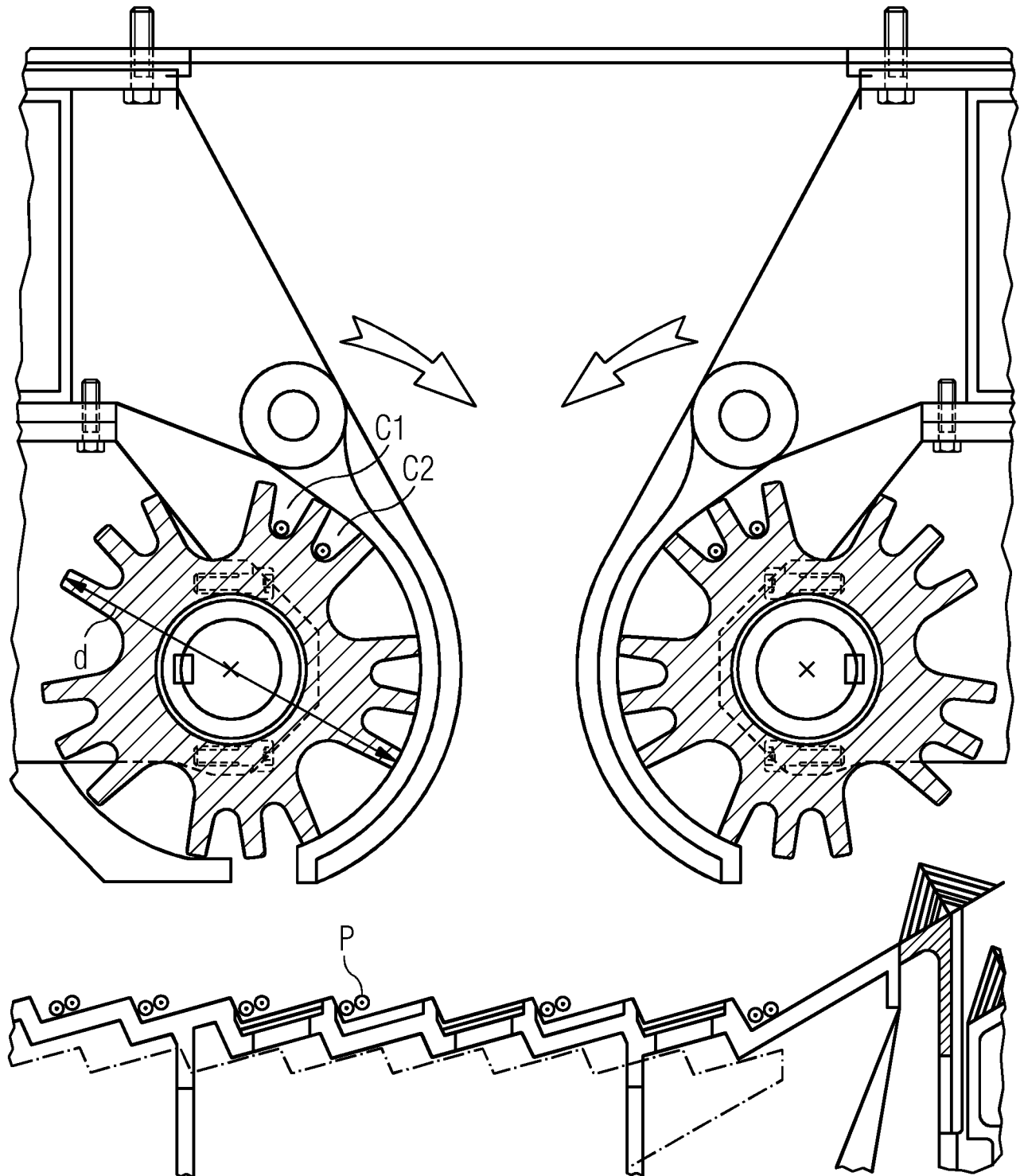


FIG 3



4/6

FIG 4

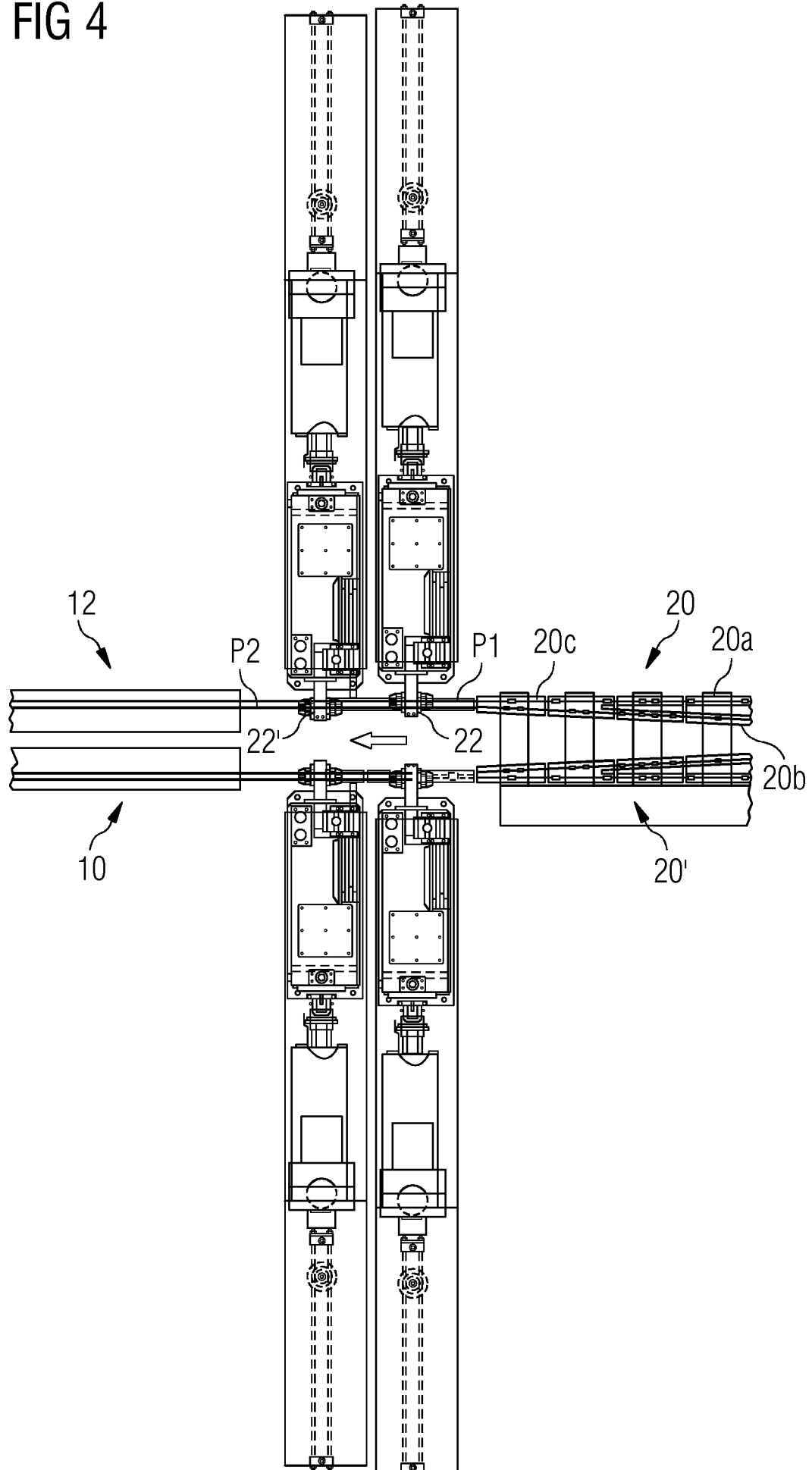
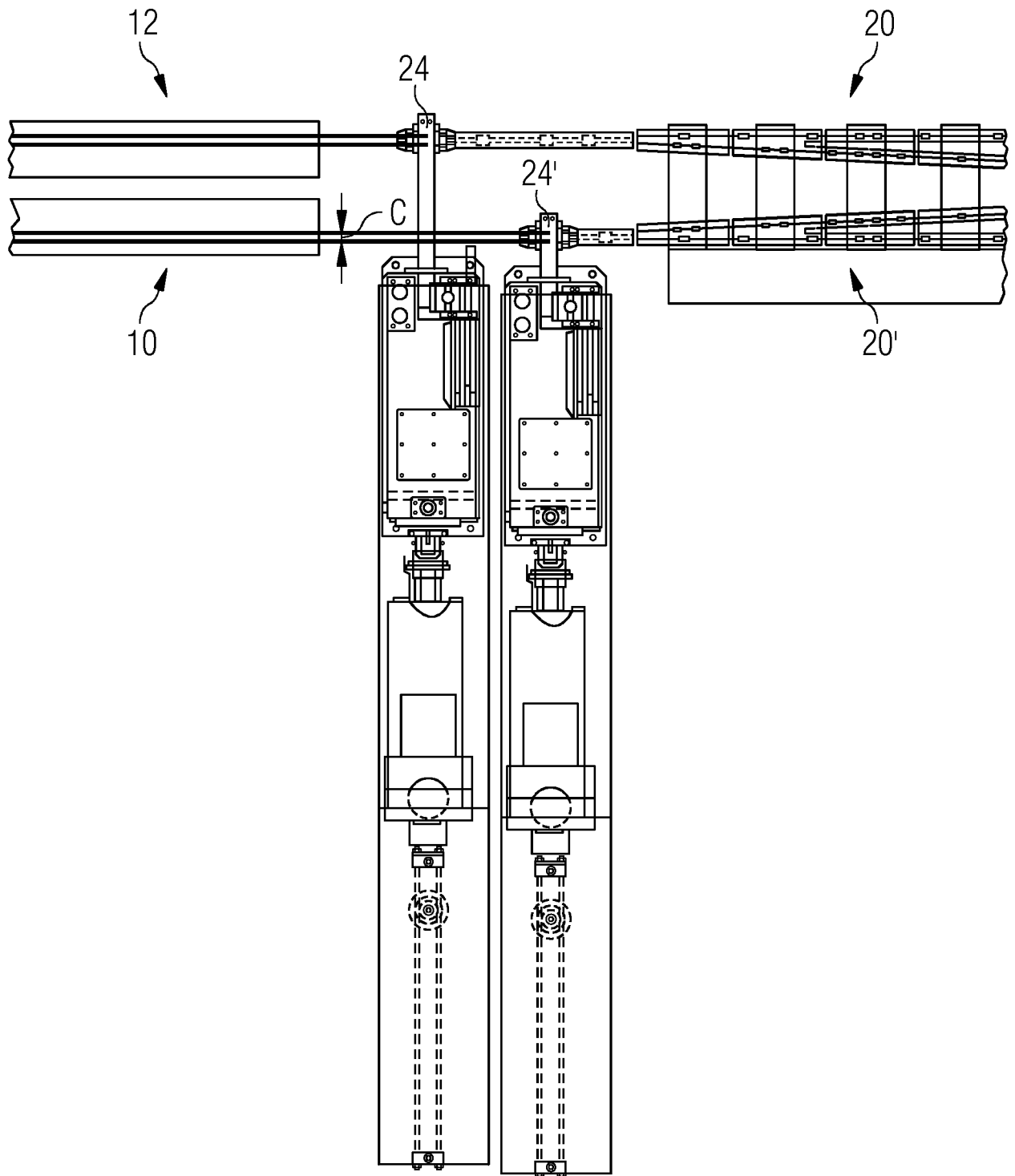


FIG 5



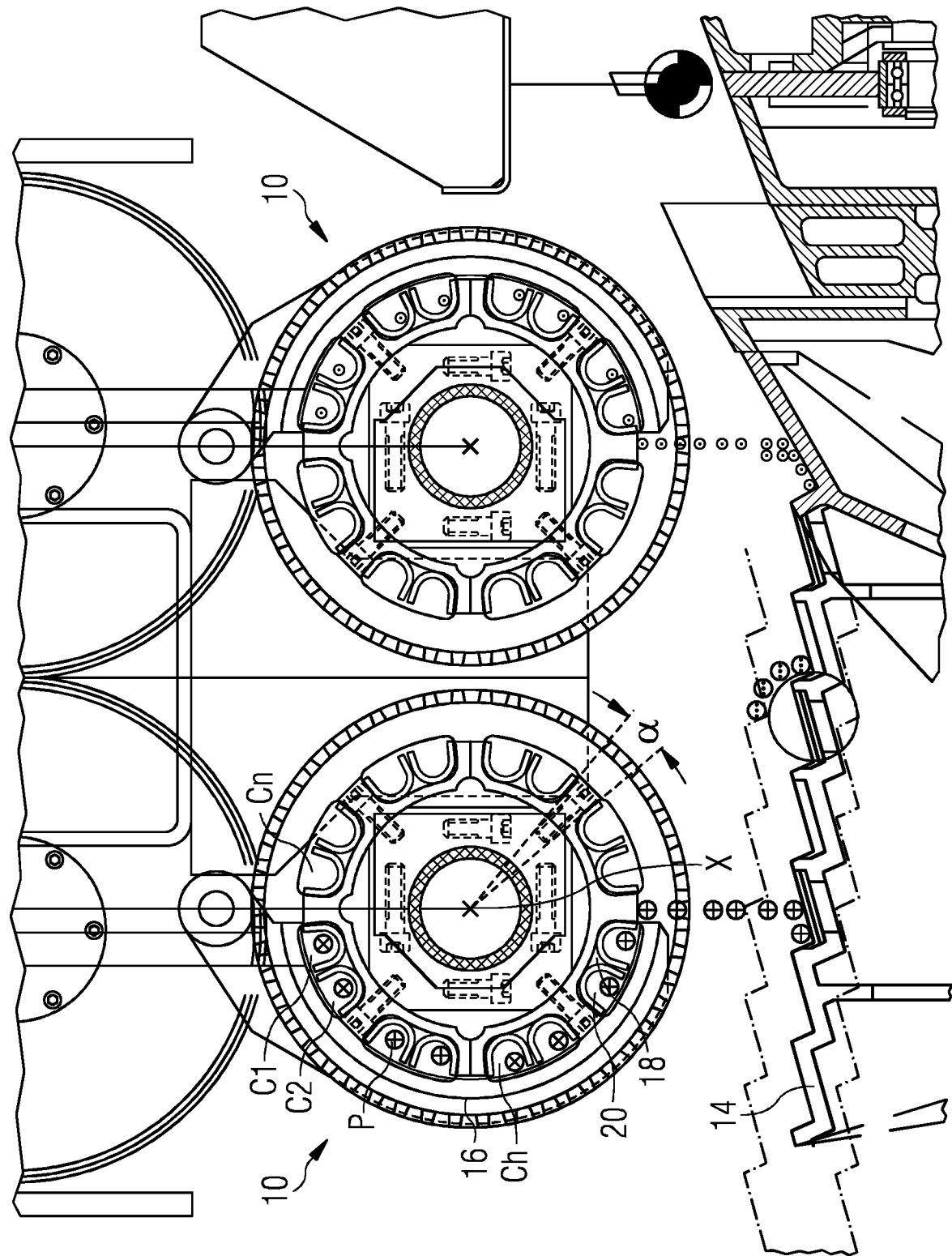


FIG 6

INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2014/063487

A. CLASSIFICATION OF SUBJECT MATTER

INV. B21B43/00 B21C47/34
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

B21B B21C B65G B21F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	IT 1 225 986 B (SIMAC SPA [IT]) 10 December 1990 (1990-12-10)	1-4,8-14
Y	claims 1-4; figures 1-7 -----	5-7
X	WO 98/31483 A1 (SIMAC SPA [IT]; OFFOIA CH RENZO [IT]) 23 July 1998 (1998-07-23)	1,12
Y	page 5; figure 1 -----	5
X	EP 0 553 930 A1 (POMINI TECHINT SPA [IT] POMINI SPA [IT])	1,12
Y	4 August 1993 (1993-08-04) paragraph [0008]; claims 1-8; figures 1-3 -----	6,7



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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Date of the actual completion of the international search

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2014/063487

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
IT 1225986	B	10-12-1990	NONE

WO 9831483	A1	23-07-1998	AU 5574398 A 07-08-1998
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			US 5301794 A 12-04-1994
