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

(11) **EP 3 858 508 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
04.08.2021 Bulletin 2021/31

(51) Int Cl.:
B21D 7/08 *(2006.01)* ***B21D 11/06*** *(2006.01)*

(21) Application number: **21153556.2**

(22) Date of filing: **26.01.2021**

(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
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

(30) Priority: **03.02.2020 IT 202000002068**

(71) Applicant: **Oscam S.r.l.**
10127 Torino (IT)

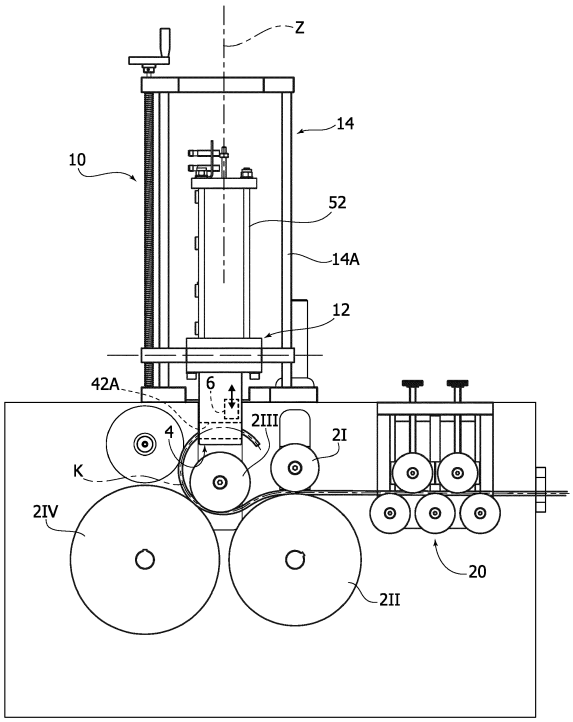
(72) Inventor: **PERUZZO, Mr. Stefano**
I-10127 Torino (IT)

(74) Representative: **Frontoni, Stefano**
Buzzi, Notaro & Antonielli d'Oulx S.p.A.
Corso Vittorio Emanuele II, 6
10123 Torino (IT)

(54) **MACHINE FOR SHAPING METAL BARS**

(57) A machine (10) for shaping metal bars according to curved profiles, in particular according to spiral or helical profiles, of the type comprising:
- a set of rotating rollers (2I-2IV), pre-arranged for forming a path of feed (K) of a metal bar along a preset curved profile;
- a positioning member (4), pre-arranged for receiving said bar and defining a predetermined pitch of said curved profile in a reference direction (Y), said member being adjustable in position; and
- a cutting member (6), pre-arranged for cutting said bar so as to separate the shaped part of said bar from a remaining portion and define a trailing end of said shaped bar, with reference to said path of feed (K) .

FIG. 1



EP 3 858 508 A1

Description

[0001] The present invention relates to a machine for shaping metal bars according to curved profiles, in particular spiral or helical ones.

[0002] In particular, the present invention refers to a shaping machine of the type comprising a set of rotating rollers pre-arranged for forming a path of feed of a metal bar along a preset curved profile. The bar can be fed from a reel or else from a store of individual bars.

[0003] In machines of the type in question, the individual bar is forced to follow the aforesaid path of feed defined between the rollers of the machine, thus undergoing bending until it assumes the profile of the path itself.

[0004] In order to obtain a helix, the bar is bent to form a first spiral at an end portion of its own. Next, the spiral formed is stretched in a direction orthogonal to its plane of generation so that it will assume a three-dimensional configuration. The bar is then made to advance further and deformed to obtain a further turn in the same way as described above. Once the desired number of turns has been obtained, the helix obtained is separated from the remaining part of the bar via a cutting operation.

[0005] The machines known in the art present various levels of automation, starting from the so-called "manual" ones that are entirely guided by the operator to the "automatic" ones that are able to manage in a completely autonomous way entire production cycles.

[0006] In this regard, it may be noted that manual machines present the drawbacks of only being able to provide a low working precision and of requiring the operator to carry out a protocol of operations that are somewhat elaborate during the processing cycle. On the other hand, automatic machines present a somewhat complex and costly structure, while the production cycle that is in any case frequently very slow.

[0007] In this context, the object of the present invention is to provide a machine for shaping metal bars that is improved, and in particular is able to guarantee a high machining precision and/or is able to operate indifferently in manual mode, semiautomatic mode, or else automatic mode.

[0008] The above object is achieved via a machine that presents the characteristics recalled in Claim 1.

[0009] The claims form an integral part of the teaching provided herein.

[0010] Further characteristics and advantages of the present invention will emerge clearly from the ensuing description and from the annexed drawings, wherein:

- Figure 1 illustrates a preferred embodiment of the machine described herein, in front view;
- Figure 2 illustrates the machine of Figure 1 in side view;
- Figures 3a and 3b illustrate the machine of Figure 1 in a different operating condition, in front view and in side view, respectively; and
- Figures 4a and 4b illustrate the machine of Figure 1 in a view from beneath, in two respective different operating conditions.

[0011] In the ensuing description, various specific details are illustrated aimed at providing an in-depth understanding of the embodiments. The embodiments may be obtained without one or more of the specific details, or with other methods, components, or materials, etc. In other cases, known structures, materials, or operations are not shown or described in detail so that various aspects of the embodiment will not be obscured.

[0012] The references used herein are provided only for convenience and hence do not define the sphere of protection or the scope of the embodiments.

[0013] With reference to the figures, the machine described herein, designated as a whole by the reference number 10, comprises, in general:

- a set of rotating rollers 21, 211, 2III, 2IV pre-arranged to form a path of feed K of a metal bar along a preset curved profile;
- a positioning member 4 provided for receiving the bar and defining a predetermined pitch of the aforesaid curved profile in a reference direction Y, said positioning member 4 being adjustable in position; and
- a cutting member 6 provided for cutting the bar so as to separate the shaped part of the bar from a remaining portion and defining a trailing end of the shaped bar, with reference to the path of feed K.

[0014] In preferred embodiments, as in the one illustrated, the machine 10 further comprises a second set 20 of rotating rollers that constitutes an assembly for straightening the metal bar, in particular for applications in which the bar is fed to the machine from a roll or a reel.

[0015] To return to the first set of rollers, the two bottom rollers 211, 2IV, which have a larger diameter than the other two rollers, have a fixed axis of rotation and are both driven in rotation via an electric motor. The two rollers 21, 2III are set in respective positions opposed to the two rollers 2II, 2IV and are, instead, both idle.

[0016] The roller 2I is positioned with its own axis substantially aligned with the axis of the roller 211 with respect to a direction Z and can be adjusted in its position in this direction to vary its distance from the roller 211, in particular to adjust the force with which it presses the bar against the opposed roller 211.

[0017] The roller 2III is positioned opposed to the roller 2IV, but with its own axis of rotation in an intermediate position between the two rollers 211, 2IV.

[0018] Also the roller 2III is adjustable in position in the direction Z. In this case, its adjustment has the purpose of defining the radius of curvature of the path of feed K established by the set of rollers. In fact, the person skilled in the sector will understand that, for positions of the roller 2III closer to the axes of rotation of the rollers 2II, 2IV, smaller radii of curvature will accordingly be obtained,

and, instead, for positions of the roller 2III further away from the aforesaid axes of rotation, larger radii of curvature will accordingly be obtained.

[0019] In operation, the metal bar is fed through the rollers of the straightening assembly 20, if present, and through the rollers 2I-2IV, assuming with its leading portion - with reference to the direction of advance of the bar - a profile corresponding to the path K as a result of the bending action carried out by the aforesaid rollers.

[0020] With reference to Figures 1 and 2, the positioning member 4 is pre-arranged for receiving the shaped part of the bar and, according to its position, for defining the pitch of the helix that will be obtained on the bar.

[0021] The positioning member 4 is adjustable in position to enable an adjustment of the pitch of the helix to be obtained. In particular, in preferred embodiments, as in the one illustrated, the positioning member 4 is mobile in the reference direction Y and, preferably, also in the direction Z. As will be illustrated in greater detail in what follows, the adjustment in the direction Y has the purpose of specifically adjusting the pitch of the helix to be obtained, whereas the adjustment in the direction Z is based upon the radius of curvature established for the path of feed K. Adjustment of the pitch can be obtained for an interval that goes from a minimum substantially equal to zero up to a maximum (see Figures 3A and 3B).

[0022] With reference to Figure 2, the person skilled in the sector will understand that, starting from the condition illustrated in this figure, where a first turn is formed on the bar, further advance of the bar along the path K and consequent formation of further turns will bring about an extension of the shaped part of the bar in the direction Y, maintaining between one turn and the next the pitch defined by the positioning member 4.

[0023] Once the helix has been completed, the cutting member 6 carries out cutting of the bar to separate the helix obtained from the remaining part of the bar.

[0024] In preferred embodiments, as in the one illustrated, the machine 10 comprises a mobile unit 12 that carries on itself the positioning member 4 and the cutting member 6. The unit 12 is mobile in the reference direction Y and, preferably, also in the direction Z, to carry out the adjustment of position of the member 4 discussed above.

[0025] In preferred embodiments, as in the one illustrated, the unit 12 is carried by a movement system 14, with linear guides oriented in the directions Y and Z. This system comprises, specifically, a pair of guides 14A, which are fixed and are oriented in the direction Z, and a mobile guide 14B, which is mobile on the two guides 14A and is oriented in the direction Y.

[0026] In preferred embodiments, as in the one illustrated, the movement system 14 further comprises an actuation device 14C of an external-screw/internal-screw type, which can be operated via a crank to control movement of the unit 12 in the direction Z.

[0027] In addition, once again in preferred embodiments, as in the one illustrated, the unit 12 is freely mobile along the guide 14B and can be fixed in position via one or more blocking members (for example, fasteners that can be fixed via screws) pre-arranged in points corresponding to the guides 14B.

[0028] Figures 4A and 4B illustrate, by way of example, an operating condition of the machine 10 for an application in which a radius of curvature of the path K and a pitch are envisaged equal to the maximum values that can be set on the machine. As shown in these figures, the mobile unit 12 is, in fact, in a position corresponding to the end of travel of the guides 14A and 14B.

[0029] It should be noted that embodiments alternative to the one illustrated above may instead envisage motor-driven means for driving movement of the unit 12 in one or both of the two directions Y and Z.

[0030] In preferred embodiments, as in the one illustrated, the positioning member 4 has a structure constituted by a hollow tubular portion 42, which is oriented with its own axis parallel to the direction Z, and a flange 44 for connection, for example via screws, of the positioning member 4 to the mobile unit 12. The tubular portion 42 and the flange 44 may be made of a single piece.

[0031] In preferred embodiments, as in the one illustrated, the portion 42 of the positioning member has two openings 421, on opposite sides, for defining an internal passage of the bar through the positioning member 4. Via the edges that delimit the openings 421 the positioning member 4 is able to withhold the bar by the corresponding portion that passes through it. During operation of the machine, the bar can be inserted through the openings 421 manually by the operator himself. It should be noted that this operation is required only the first time when an operation is started with a new path K and a new pitch.

[0032] In preferred embodiments, as in the one illustrated, the cutting member 6 is mounted within the tubular portion 42 of the positioning member 4 and is connected to the stem of a cylinder 52, which is mounted on the mobile unit 12 oriented with its own axis parallel to the direction Z. As a result of actuation of the cylinder 52, the cutting member 6 moves in the direction Z within the tubular portion 42. The stroke of the cutting member 6 controlled by the cylinder 52 is such that the member 6 will intercept the internal passage for the bar that is defined through the tubular portion 42. Consequently, activation of the cutting member 6 by the cylinder 52 brings about cutting of the bar at its portion that is located within the tubular portion 42. The cylinder 52 is preferably a hydraulic cylinder. In any case, it is possible to use also actuators of some other type for actuation of the cutting member.

[0033] The cutting operation indicated above brings about separation of the helix just formed from the remaining part of the bar.

[0034] In alternative embodiments, the cutting member 6 may be rotary instead of being linearly mobile, once again controlled by a linear actuator or else by a rotary actuator.

[0035] In preferred embodiments as in the one illustrated, the positioning member 4 and the cutting member

6 are mounted on the unit 12 so as to be able to rotate fixedly about an axis of rotation I parallel to the direction Z to be able to orient about this axis the internal passage formed by the openings 421, adapting it to the inclination assumed by the bar with respect to a reference plane orthogonal to the axes of rotation of the rollers 2I-2IV. In this connection, Figures 4A and 4B illustrate by way of example the positioning member 4 and the cutting member 6 in two different orientations about the axis of rotation I.

[0036] Preferably, the cylinder 52 is, instead, mounted fixed on the mobile unit 12, and hence the coupling between its stem and the cutting member 6 is pre-arranged to enable a relative rotation between the two.

[0037] In view of the foregoing, it will be readily understood that, in addition to the function of determining the pitch of the curved profile to be obtained, during the cutting operation the positioning member 4 also performs the function of keeping the bar stationary in position precisely to enable proper execution of the cutting operation. In addition, coupling of the cutting member 6 to the positioning member 4 causes the cut to be obtained in an advantageous point of the machine, which is set in fact downstream of the rollers 2I-2IV so as to facilitate control of the length of the helix that is being formed, and which is in any case at the same time positioned in the proximity of the aforesaid rollers so as to reduce as much as possible any rejects in the case where it is necessary to change the shaping operation whereby a variation of the pitch K is required.

[0038] On the other hand, the positioning member 4 makes it possible to provide a precise and repeatable adjustment of pitch over an extensive length.

[0039] The machine described herein is suited to an operating mode that may be indifferently manual, semiautomatic, or else automatic.

[0040] With reference to the embodiments illustrated, as has been seen, it envisages a manual adjustment of the position of the mobile unit 12. Alternatively, it is possible to provide one or more actuators designed to control displacement of the unit 12 to obtain an automatic adjustment.

[0041] On the other hand, as seen above, operation of the machine requires that the initial shaped portion of the bar is inserted within the positioning member 4; this can be done by an operator as discussed above, or else a manipulator device may be provided in combination with the machine to carry out the aforesaid operation, which is also automated.

[0042] It should once again be noted that the machine may be provided to carry out a single processing cycle or else a series of processing cycles in a completely automatic way or else on the basis of commands issued by the operator from a control station of the machine. Intermediate embodiments between the two control modes referred to above are moreover possible.

[0043] To control the length of the helix being formed, the machine 10 may be provided with a sensor designed to detect a given length of bar fed along the predetermined path K. The aforesaid sensor may, for example, be a position sensor associated to one of the rollers 2I - 2IV in order to measure the number of revolutions performed by the roller. Alternatively, this sensor may be a timer designed to define a pre-set duration of the operating cycle of the rollers 2I-2V. The machine 10 may moreover envisage a sensor designed to detect that the cutting member 6 has reached the end-of-travel position of its cutting stroke, and may be pre-arranged for using the signals coming from the above sensor to control the various processing cycles of the machine.

[0044] In general, the machine described herein further comprises a control unit configured for carrying out the processing cycles of the machine on the basis of the signals coming from the aforesaid sensors and of the possible lists of operations set.

[0045] Of course, without prejudice to the principle of the invention, the details of construction and the embodiments may vary, even significantly, with respect to what is illustrated herein purely by way of nonlimiting example, without thereby departing from the scope of the invention, as defined by the annexed claims.

Claims

1. A machine (10) for shaping metal bars according to curved profiles, in particular according spirals, helices, rings, or curved segments, of the type comprising:

   - a set of rotating rollers (2I-2IV), pre-arranged for providing a path of feed (K) of a metal bar along a preset curved profile;
   - a positioning member (4), pre-arranged for receiving said bar and defining a predetermined pitch of said curved profile in a reference direction (Y), said member being adjustable in position; and
   - a cutting member (6), pre-arranged for cutting said bar so as to separate the shaped part of said bar from a remaining portion and define a trailing end of said shaped bar, with reference to said path of feed (K) .

2. The machine according to Claim 1, wherein said set of rollers (2I-2IV) rotate about axes of rotation parallel to one another and to said reference direction (Y), and wherein said machine comprises a mobile unit (12) including said positioning member (4) and said cutting member (6), which is adjustable in position in said reference direction (Y) for defining said pre-set pitch.

3. The machine according to Claim 1, wherein said mobile unit (12) is adjustable in position also in a second direction (Z), which is orthogonal to said reference

direction (Y).

4. The machine according to Claim 2 or Claim 3, wherein said positioning member (4) defines an internal passage (42A) designed to be traversed by the bar being processed and to withhold said bar, and wherein said cutting member (6) is pre-arranged for acting on a portion of the bar that is contained in said internal passage (42A).

5. The machine according to Claim 4, wherein said positioning member (4) comprises a hollow tubular portion (42), which is oriented with an axis of its own in a direction orthogonal (Z) to said reference direction (Y), and has two openings (421) on opposite sides, defining said internal passage (42A), and
wherein said cutting member (6) is mounted mobile within said tubular portion (42).

6. The machine according to Claim 4 or Claim 5, wherein said positioning member (4) and said cutting member (6) are mounted on said mobile unit (12) so as to be able to turn fixedly about an axis of rotation (I) orthogonal to said reference direction (Y), so that it can orient said internal passage (42A) about said axis.

7. The machine according to any one of Claims 2 to 6, comprising a movement system with linear guides (14A, 14B), mounted on which is said unit (12) with the possibility of moving linearly in said reference direction (Y) and in a second direction (Z) orthogonal to said reference direction (Y).

8. The machine according to Claim 7, wherein said movement system comprises a movement device (14C) configured for driving movement of said unit (12) in said first direction (Y) and/or in said second direction (Z).

9. The machine according to Claim 7 or Claim 8, wherein said unit (12) is freely mobile in said first direction (Y) and/or in said second direction (Z), and said movement system is provided with one or more blocking members for blocking said unit (12) in position with respect to said first direction (Y) and/or said second direction (Z).

10. The machine according to any one of the preceding claims, comprising:

- a first sensor, pre-arranged for detecting a given length of bar fed along said pre-set profile, preferably a sensor pre-arranged for detecting the number of revolutions of a roller of said set of rollers (2I-2IV),
- a second sensor, pre-arranged for detecting a position of said cutting member (6), and
- a control unit, configured to control actuation of said set of rollers (2I-2IV) on the basis of signals coming from said first and second sensors.

FIG. 1

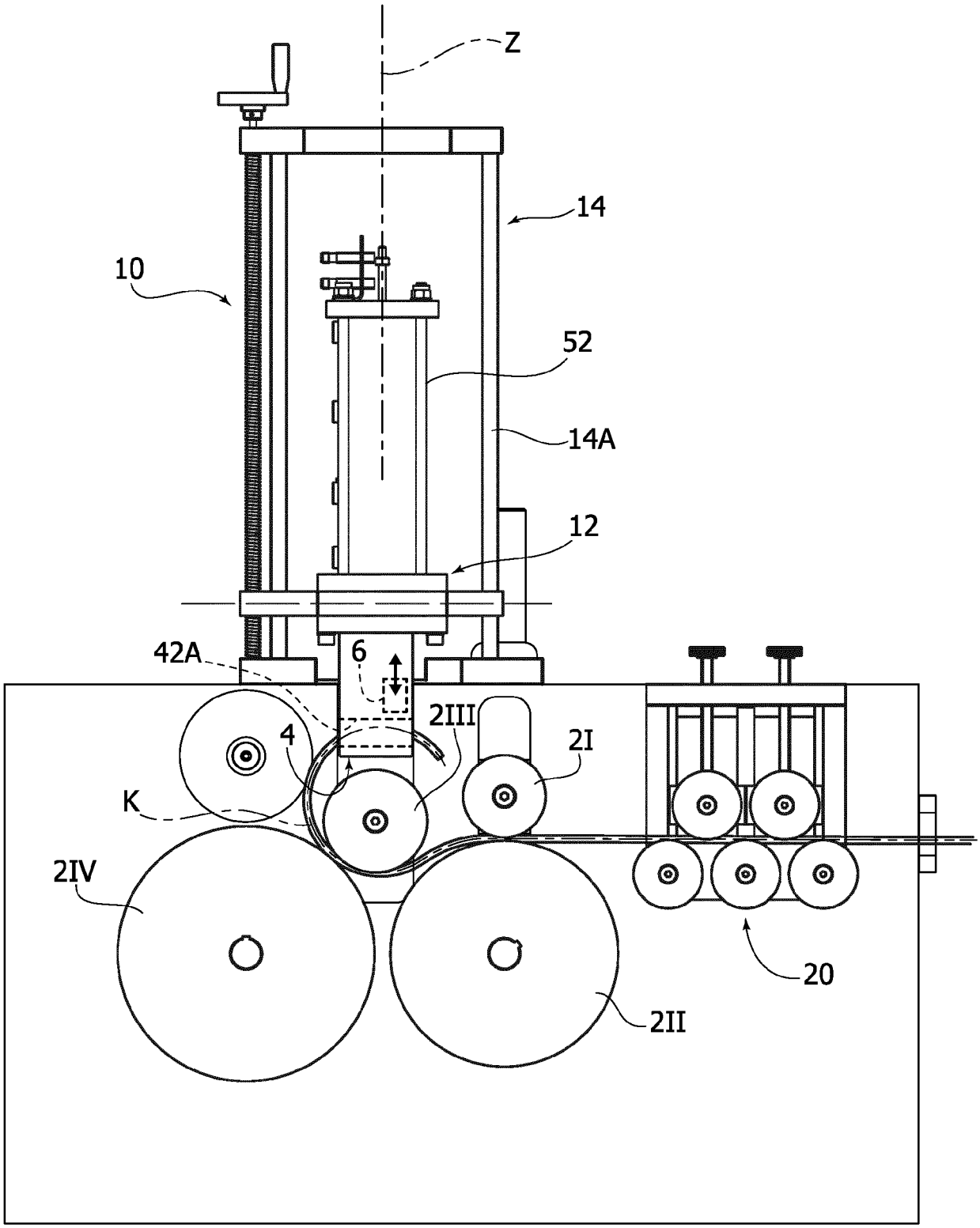


FIG. 2

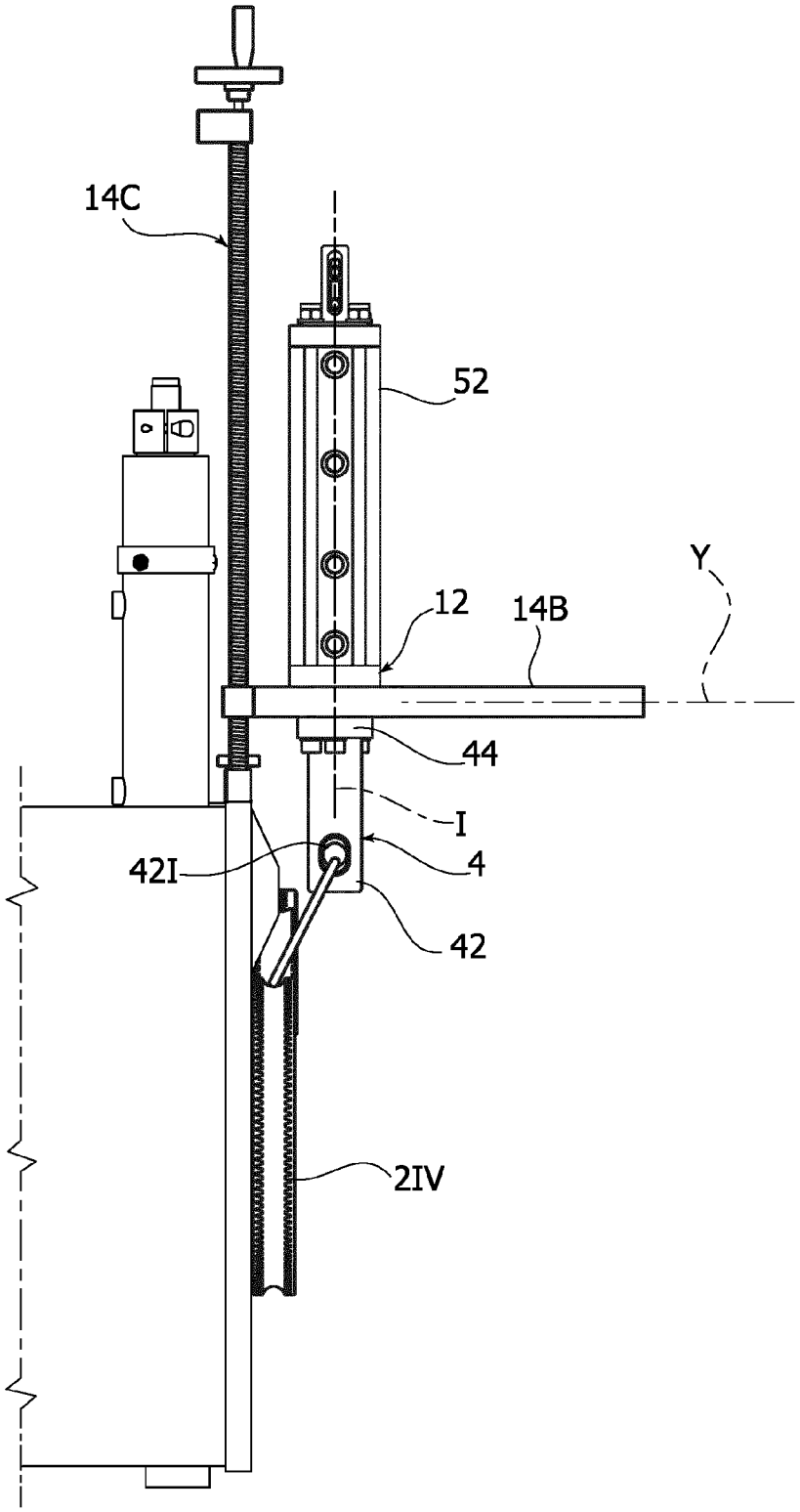


FIG. 3A

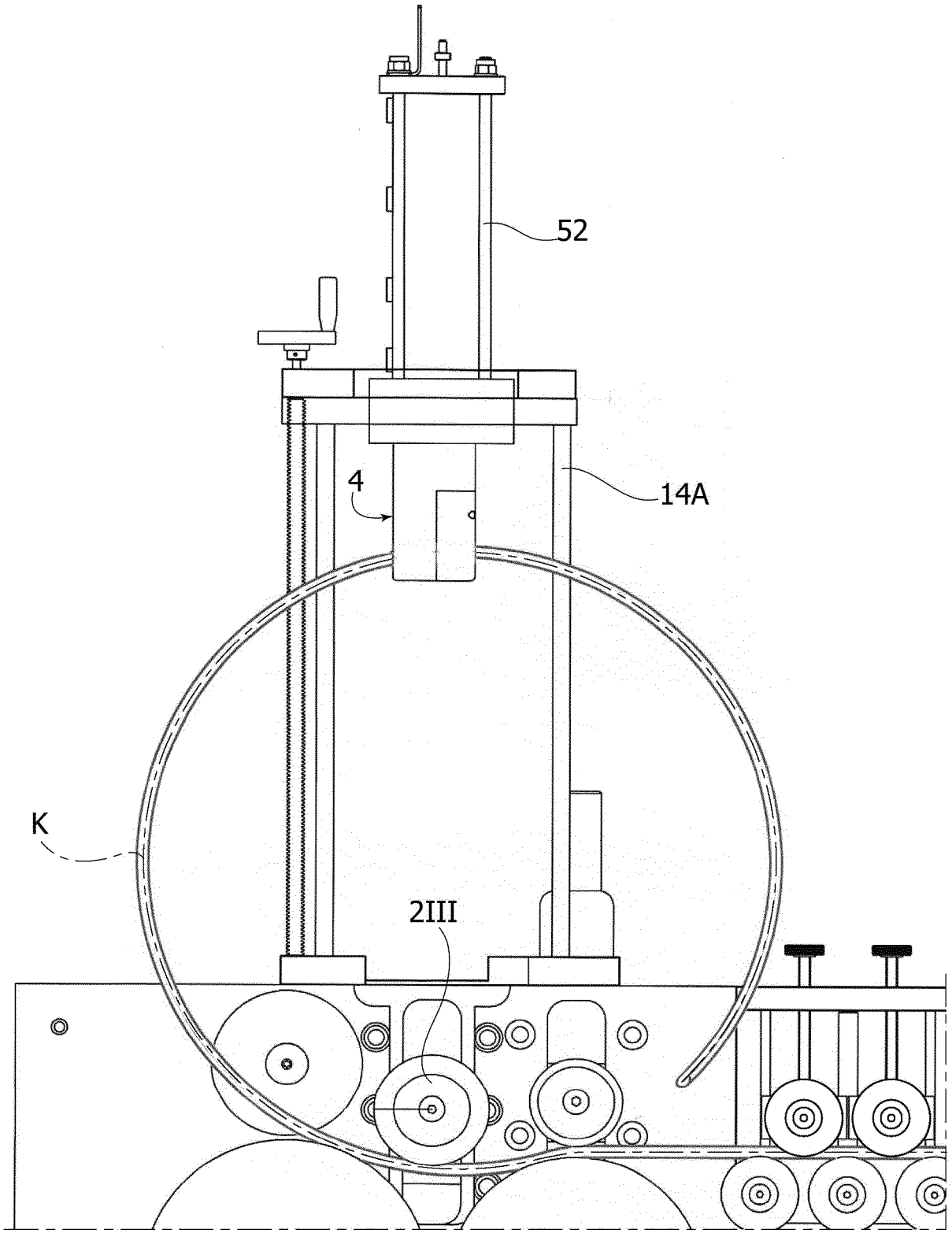


FIG. 3B

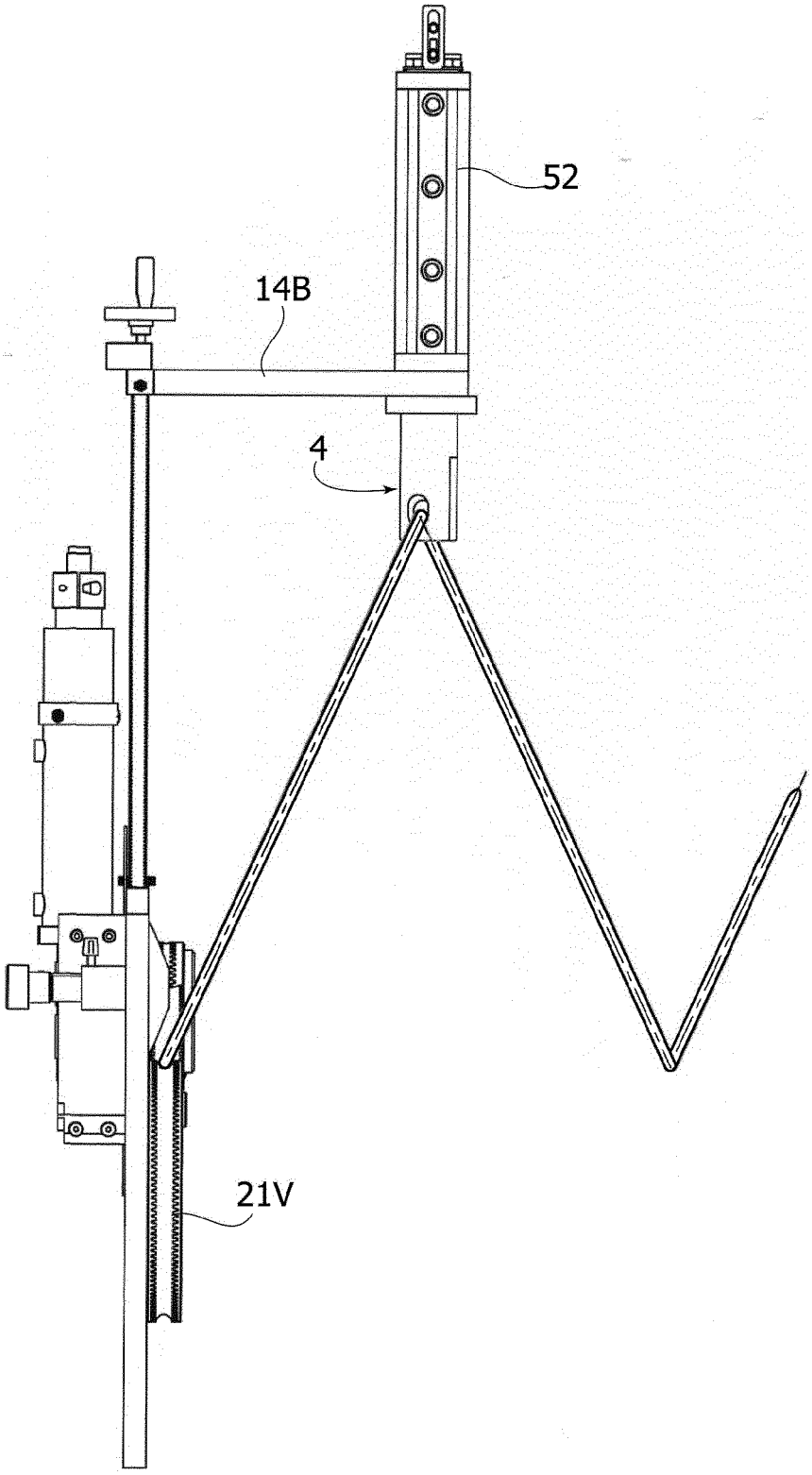


FIG. 4A

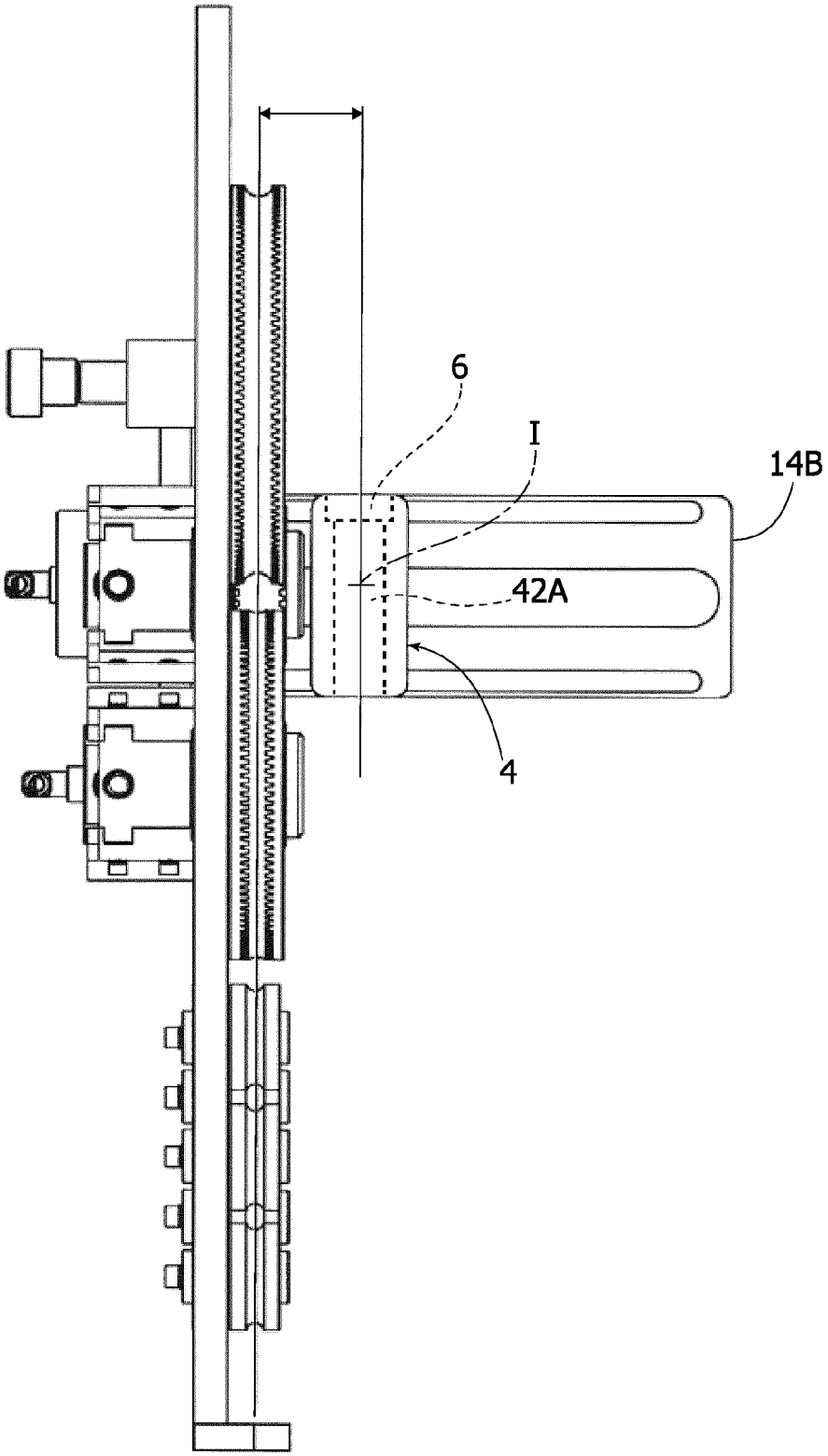
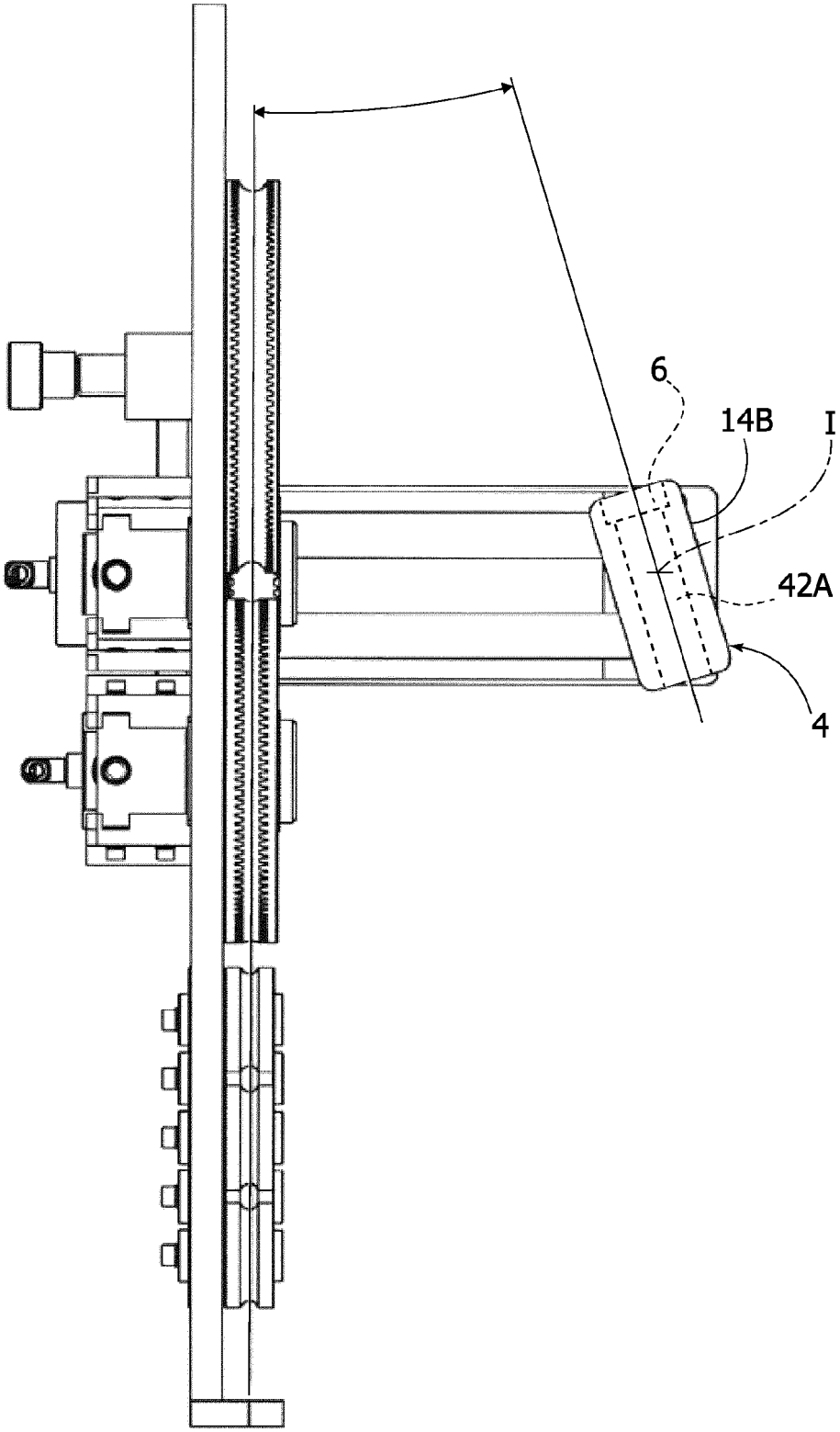


FIG. 4B



Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 21 15 3556

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X Y A	US 2013/319602 A1 (REINLEIN PETER [DE] ET AL) 5 December 2013 (2013-12-05) * claims 1, 5, 6, 13, 16-18. 30 * * paragraph [0110] * * figure 7 * -----	1-3,10 4-6 7-9	INV. B21D7/08 B21D11/06
X Y A	US 5 305 625 A (HEINZ RICHARD D [US]) 26 April 1994 (1994-04-26) * claims 1-3, 10, 14, 15, 32 * * figures 1, 3-5, 15 * -----	1-3,10 4-6 7-9	
A	CN 102 728 676 A (HUBEI DAQI HYDRAULIC CO LTD) 17 October 2012 (2012-10-17) * claim 1 * * figures 1, 2 * -----	1-10	
A	JP S62 156026 A (MITSUBISHI HEAVY IND LTD) 11 July 1987 (1987-07-11) * claim 1 * * figures 1, 2, 6 * -----	1-10	
A	EP 1 153 700 A2 (STEYR WERNER WAELZLAGER UND IN [AT]) 14 November 2001 (2001-11-14) * claims 1, 2 * * paragraph [0010] * * figures 1, 2 * -----	1-10	TECHNICAL FIELDS SEARCHED (IPC) B21D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	21 May 2021	Stanic, Franjo

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 21 15 3556

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

21-05-2021

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2013319602 A1	05-12-2013	CN 103448237 A	18-12-2013
		DE 102012219639 A1	05-12-2013
		EP 2674279 A1	18-12-2013
		US 2013319602 A1	05-12-2013
US 5305625 A	26-04-1994	NONE	
CN 102728676 A	17-10-2012	NONE	
JP S62156026 A	11-07-1987	JP H0361525 B2	20-09-1991
		JP S62156026 A	11-07-1987
EP 1153700 A2	14-11-2001	AT 501175 A1	15-07-2006
		EP 1153700 A2	14-11-2001

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82