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(73) Octrooihouder(s):
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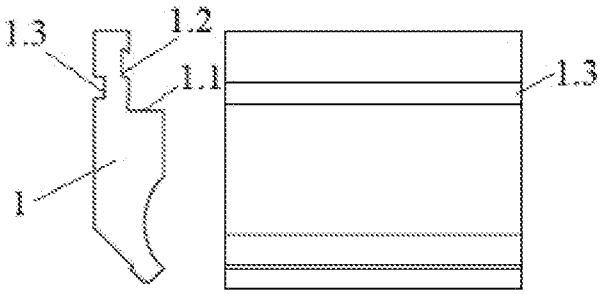
(72) Uitvinder(s):
Edvárd László Koncz te Csongrád (HU)
János Pekárik te Hódmezovásárhely (HU)
István Major te Csongrád (HU)
Viktor Somodi te Csongrád (HU)

(74) Gemachtigde:
drs. W.H.P. Derks te Amsterdam

(54) **Bending tool for connection to a tool exchange device mounted on a robot.**

(57) The present invention discloses a bending tool for connection to a tool exchange device mounted on a robot, with a shoulder, a tool holder groove, and a toolclamping groove on the tool body, and characterised by that the bending tool has i) an oval bore going through the tool body below the shoulder, ii) the tool holder groove side of the tool body has an oval seat extending into the oval through-bore, at the end of which — the end going into the tool body — is a flange extending vertically beyond the oval through-bore, iii) the clamping groove side of the tool body has a conical seat with cylindrical end sections extending into the oval through-bore, the centre line of which intersects the flange above the upper edge of the oval through-bore. Dimensions of the oval through-bore, the conical seat, and the oval seat match the connected structural elements of the tool exchange device.



Bending tool for connection to a tool exchange device mounted on a robot.

[0001] The subject of the utility model is a bending tool for connection to a tool exchange device mounted on a robot, allowing the tool exchange device mounted on the robot to quickly and easily grip and move various types of bending tools, using the connection points retrofitted in the tools.

[0002] An essential step in the sheet metal working process is selecting the appropriate design for the upper and lower bending tools and inserting and clamping them in the tool holder, which should be done by a robot in high performance production systems. Currently, the devices developed for exchanging the bending tools in robotic bending machines are not designed to be compatible with all commercially available types of bending tools and their various clamping systems. Two thirds of the bending machines worldwide are marketed using a US (European Standard) tooling system, which is not compatible with any robotic solution, and the situation is similar for other types of bending tools as well. A considerable number of users are thus excluded from automation.

[0003] US patent specification no. US 7,632,224 B2, known from the state of the art, describes an exchangeable tool consisting of a tool body equipped with a receiving end, where the receiving end is used to secure the tool in a receiving device. Coupling elements are arranged in the tool body in such a way as to provide non-rotating connections for the manipulator that inserts the tool into and removes the tool from the receiving device.

[0004] Patent document US 6,656,099 B1 describes a plate bending machine furnished with a bending tool and a tool exchange device equipped with a hook including a spline and a clench. The bending tool is equipped with a locking device supplemented with a clamping element. The bending machine constitutes a single unit with the upper and lower tool holders that are responsible for moving the bending tools. The tool exchange device transfers the bending tools into the tool clamp.

[0005] Different designs of commercially available bending tools can be found, inter alia, at URLs https://gordiuszalfa.hu/termek/rolleri-elhajlito-szerszamok/ and https://www.toolsystems24.de/en/, where it can be seen that the tool bodies are not designed

[0006] with a gripping solution allowing for attachment to a robotic gripping device. One such known solution is illustrated in Figure 1, where the tool body of the bending tool 1 is furnished with a shoulder 1.1 supporting the tool holder, a tool holder groove 1.2 and a clamping groove 1.3: these structural parts are necessary to secure the bending tool 1 in a tool holder.

[0007] A drawback of the tools as described and used in practice is that they do not provide the operator with a workable solution for modifying the raw bending tool in order to allow the tool to be safely gripped and moved by a tool exchange device mounted on a robotic arm.

[0008] Having identified this deficiency, we set ourselves the task of retrofitting a gripping point on a bending tool of known state-of-the-art design, allowing the tool to be gripped and moved safely by a known tool exchange device mounted on a robotic arm.
A further task of our utility model is the development of a bending tool on which the gripping point can subsequently be manufactured in a cost-effective way, while keeping the tool easy to use and maintain.

[0009] During the tests carried out during the design process for the utility model, we recognized that a bending tool can only be gripped firmly by a robot and moved accurately via robotic control if the bending tool has an aperture for gripping, wherein the gripping structural element of the tool exchange device can be impacted against a support surface on the tool, and another structural element of the bending tool can be clamped onto the support surface providing the impact.

[0010] For our experiments, we used a robotic arm mounted tool exchange device, with a clamp stem that can be moved linearly back and forth by means of compressed air for clamping and releasing the bending tool.

[0011] With the set task in mind, the object of our utility model is a bending tool that can be safely attached to a tool exchange device mounted on the robotic arm of a robot. The commercially available "raw" bending tool has a shoulder, a tool holder groove and a clamping groove on the tool body for mounting it in the tool holder. In order to allow attaching the tool to the tool exchange device, a gripping point is formed on the bending tool with an oval bore going through the tool body under the tool shoulder. The tool holder groove side of the tool

body has an oval seat extending into the oval through-bore. At one end of the oval seat—the end going into the tool body—is a flange extending vertically beyond the oval through-bore. On the clamping groove side of the tool body, there is a conical seat with cylindrical end sections extending into the oval through-bore, the centre line of which intersects the flange above the upper edge of the oval through-bore.

[0012] The tool exchange device has a cylindrical clamp stem with a conical end, and a grip stem for picking up and clamping the bending tool. An oval support head for the holding the bending tool is attached to the end of the grip stem. This support head hits the flange of the bending tool's oval seat when the bending tool is gripped by the robot. Compressed air can be used to move the clamp stem linearly backwards and forwards, allowing it to extrude from or retract into the device. When the support head hits the flange of the oval seat on the bending tool and the conical end of the advancing clamp stem is pressed into the conical seat on the bending tool, the bending tool is securely clamped to the tool exchange device. With regard to the robotically moved tool exchange device, the conical seat, the oval seat and the oval through-bore made at the gripping point on the tool body of the bending tool are prepared with dimensions and arrangements matching the connected structural elements of the tool exchange device.

[0013] The objectives of the invention can be achieved by the bending tool described in Claim 1, and its beneficial methods of implementation are described in the sub-claims.

[0014] Our invention is described in detail with reference to the accompanying drawings, where:

- Figure 1 shows the design of a known bending tool,
- Figure 2 shows the design of the gripping point on the bending tool,
- Figure 3 shows the connection between the robotic arm mounted tool exchange device and the bending tool before clamping,
- Figure 4 shows a bending tool clamped on the robotic arm mounted tool exchange device.

[0015] Figure 1 illustrates the design of a known bending tool 1 furnished with a shoulder 1.1, a tool holder groove 1.2 and a clamping groove 1.3, where the aforementioned structural parts are used to store the bending tool 1 in a tool holder, and to accommodate it in the tool holder

of a bending machine. As shown in the figure, the bending tool 1 is not equipped with a gripping point that would allow it to be safely gripped by a tool exchange device.

[0016] Figure 2 shows several views of the layout of the gripping point on the tool body. Below the shoulder 1.1 of a given bending tool 1 of width L, essentially in the central part of the tool body, is an oval through-bore 1.7 of width a_1 and height a_2, with centre line x_2. The width a_1 and height a_2 shall be such that the tool exchange device's 2 grip stem 2.2 equipped with the support head 2.3 (see Figures 3 and 4) can be inserted through the oval bore 1.7 without obstruction, and with a gap of at least 1 mm.

[0017] On the tool holder groove 1.2 side of the bending tool's 1 tool body, there is an oval seat 1.8 penetrating into the oval through-bore 1.7. The oval seat 1.8 is designed to accommodate the support head 2.3 mounted on the grip stem 2.2 of the tool exchange device 2, and is shaped to fit the support head 2.3. At the end of the oval seat 1.8 extending into the tool body, there is a flange 1.9 which is used to hold the support head 2.3, which is gripped by the end of the grip stem 2.2 of the tool exchange device 2 and inserted into the oval seat 1.8. The depth l_2 of the oval seat 1.8 is the same as the length of the support head 2.3. The rear height l_3 of the gripping point of the bending tool 1 shall be such that the height of the flange 1.9 extending vertically beyond the oval through-bore 1.7 should be at least 8 mm.

[0018] On the clamping groove 1.3 side of the tool body, there is a conical seat 1.4 with centre line x_1, cone angle λ, diameter D, and cylindrical end sections 1.5 and 1.6, partially penetrating into the oval through-bore 1.7. The centre line x_1 of the conical seat 1.4 is parallel to the centre line x_2 of the oval through-bore 1.7, but their arrangement is eccentric. The conical seat 1.4 is designed to accommodate the end of the cylindrical clamp stem 2.1 of the tool exchange device 2 (see Figures 3 and 4) and fits snugly against it, therefore its cone angle λ is the same as the cone angle of the end of the clamp stem 2.1, but its diameter D should be at least 1 mm larger than the diameter of the end of the clamp stem 2.1. The frontal height l_1 of the bending tool's 1 gripping point shall be determined so that the centre line x_1 of the conical seat 1.4 should intersect the flange 1.9 at least 3 mm above the top edge of the oval through-bore 1.7, thereby ensuring that the clamp stem 2.1, when pressed into the conical seat 1.4, presses the support head 2.3 mounted on the grip stem 2.2 against the flange 1.9.

Figure 3 shows the tool exchange device 2 and the bending tool 1, before they are connected. The bending tool 1 is hooked into a tool holder 3 and secured by a tool clamp 4. The clamp stem with the conical end 2.1 is pulled into the tool exchange device 2, while the grip stem 2.2 extends from the tool exchange device 2 and its end is inserted into the bending tool 1. A support head 2.3 is affixed to the end of the grip stem 2.2 with a recessed head bolt 2.4, which is positioned in abutment with the flange 1.9 of the bending tool's 1 oval seat 1.8 (see Figure 2).

Figure 4 shows the tool exchange device 2 and the bending tool 1 in the final clamping position of the tool. The compressed air supplied into the tool exchange device 2 ejects the clamp stem 2.1 from the tool and presses it into the conical seat 1.4 of the bending tool 1 in a form-locking manner (see Figure 2), whereby the bending tool 1 is firmly clamped on the tool exchange device 2 with a double-sided impact.

[0019] When changing tools on the bending machine, the tool exchange device 2 must be connected to the robotic arm in order to move the bending tool 1 with the robot. The grip stem with the support head 2.3 on the tool exchange device 2 shall be inserted into the oval through-bore 1.7 of the bending tool 1, which is designed to guide the grip stem 2.2. The support head 2.3 is then inserted into the oval seat 1.8 of the bending tool 1, and is butted against the flange 1.9 providing a support surface. Then, using the pneumatic equipment of the tool exchange device 2, the clamp stem with the conical end 2.1 must be pressed into the conical seat 1.4 of the bending tool 1 in a form-locking manner, and the bending tool 1 must be pressed onto the support head 2.3 butted against the flange 1.9. The tool exchange device 2 will then firmly hold the bending tool 1.

[0020] Next, by controlling the tool exchange device 2 with the robot, the bending tool 1 can be lifted out of the tool holder 3 and transferred to the tool clamp of the bending machine, by having the robot position the tool holder groove 1.2 of the bending tool 1 in the tool clamp. After gripping the bending tool 1 in the tool clamp, the clamp stem 2.1 of the tool exchange device 2 must be pulled back by means of compressed air and, moving the support head 2.3 outwards from the oval seat 1.8 of the bending tool 1, the grip stem 2.2 must be pulled out of the bending tool 1.

[0021] The advantage of our utility model is that it offers a gripping point on a commercially available "raw" bending tool, allowing the tool to be safely gripped and moved on a robotic arm-mounted tool exchange device equipped with a fixed grip stem and a linearly movable clamp stem. The gripping point on the bending tool can be subsequently manufactured in a cost-effective way, and the tool is easy to use and maintain.

[0022] In the following paragraphs, clauses are provided.

[0023] Clause 1. A bending tool for connection to a tool exchange device mounted on a robot, with a shoulder (1.1), a tool holder groove (1.2) and a toolclamping groove (1.3) on the tool body, and characterised by the following:
- having an oval bore (1.7) going through the tool body below the shoulder (1.1),
- the tool holder groove (1.2) side of the tool body having an oval seat (1.8) extending into the oval through-bore (1.7), at the end of which—the end going into the tool body—is a flange (1.9) extending vertically beyond the oval through-bore (1.7),
- The clamping groove (1.3) side of the tool body having a conical seat (1.4) with cylindrical end sections (1.5, 1.6) extending into the oval through-bore (1.7), the centre line (x1) of which intersects the flange (1.9) above the upper edge of the oval through-bore (1.7),
- the oval through-bore (1.7), the conical seat (1.4) and the oval seat (1.8) having dimensions and shapes matching the connected structural elements of the tool exchange device.

[0024] Clause 2. A bending tool according to clause 1, characterized in that the height of the flange (1.9) is at least 8 mm.

[0025] Clause 3. A bending tool according to either clause 1 or clause 2, characterised in that the centre line (x1) of the conical seat (1.4) intersects the flange (1.9) at least 3 mm above the upper edge of the oval through-bore (1.7).

Conclusies

1. Buiggereedschap dat aansluitbaar is op een gereedschapswisselaar, gemonteerd op een robot, met een schouder (1.1), een gereedschapshouder-groef (1.2) en een gereedschapsklem-groef (1.3) op de gereedschapsromp, met het kenmerk, dat

- een ovaal boorgat (1.7) is voorzien dat onder de schouder (1.1) door de gereedschapsromp loopt;
- de gereedschapshouder-groef (1.2) zijde van de gereedschapsromp een ovale zitting (1.8) heeft, die verbonden is met het ovale boorgat (1.7), waarbij aan een uiteinde daarvan - het uiteinde dat in het gereedschapsromp steekt - een flens (1.9) is gevormd is die verticaal voorbij het ovale boorgat (1.7) steekt;
- de gereedschapsklem-groef (1.3) zijde van het gereedschapsromp een conische zitting (1.4) heeft, waarbij de conische zitting cilindrische eindstukken (1.5, 1.6) heeft, die in het ovale boorgat (1.7) uitlopen, waarbij een hartlijn (x1) daarvan de flens (1.9) snijdt boven een bovenrand van het ovale boorgat (1.7); en
- het ovale boorgat (1.7), de conische zitting (1.4) en de ovale zitting (1.8) afmetingen en vormen hebben, die afgestemd zijn op afmetingen en vormen van aan te sluiten structurele elementen van de gereedschapswisselaar.

2. Buiggereedschap volgens conclusie 1, gekenmerkt doordat de hoogte van de flens (1.9) ten minste 8 mm is.

3. Buiggereedschap volgens conclusie 1 of 2, gekenmerkt doordat de hartlijn (x1) van de conische zitting (1.4) de flens (1.9) snijdt ten minste 3 mm boven de bovenrand van het ovale boorgat (1.7).

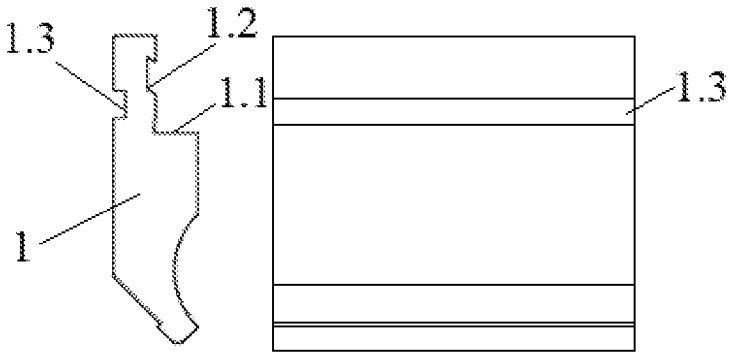


Figure 1

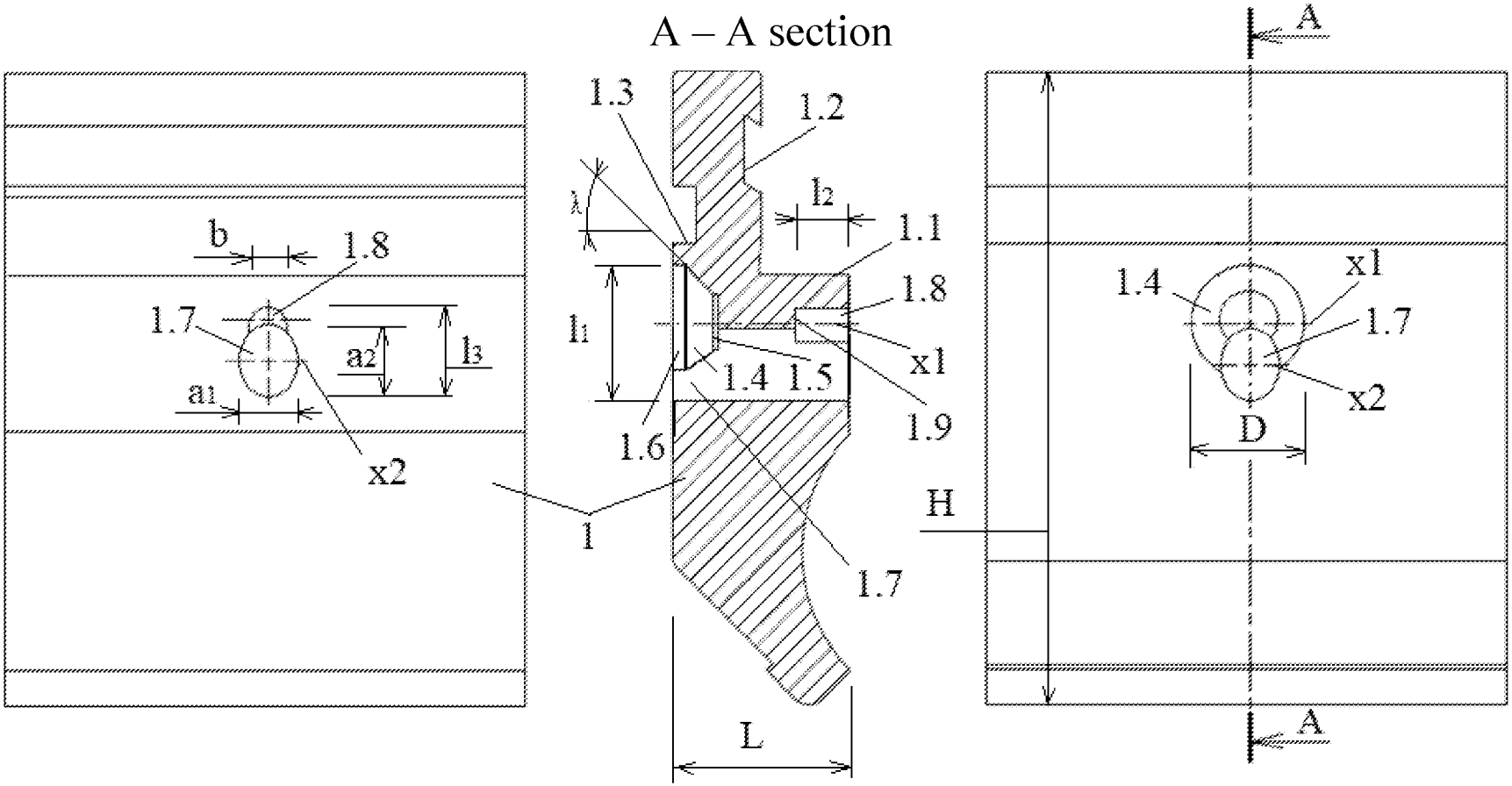

A – A section
b
1.8
1.7
a2
l3
a1
x2
1.3
1.2
λ
l2
1.1
l1
1.8
x1
1.4
1.5
1.9
1.6
1
1.7
L
H
A
A
1.4
x1
1.7
x2
D

Figure 2

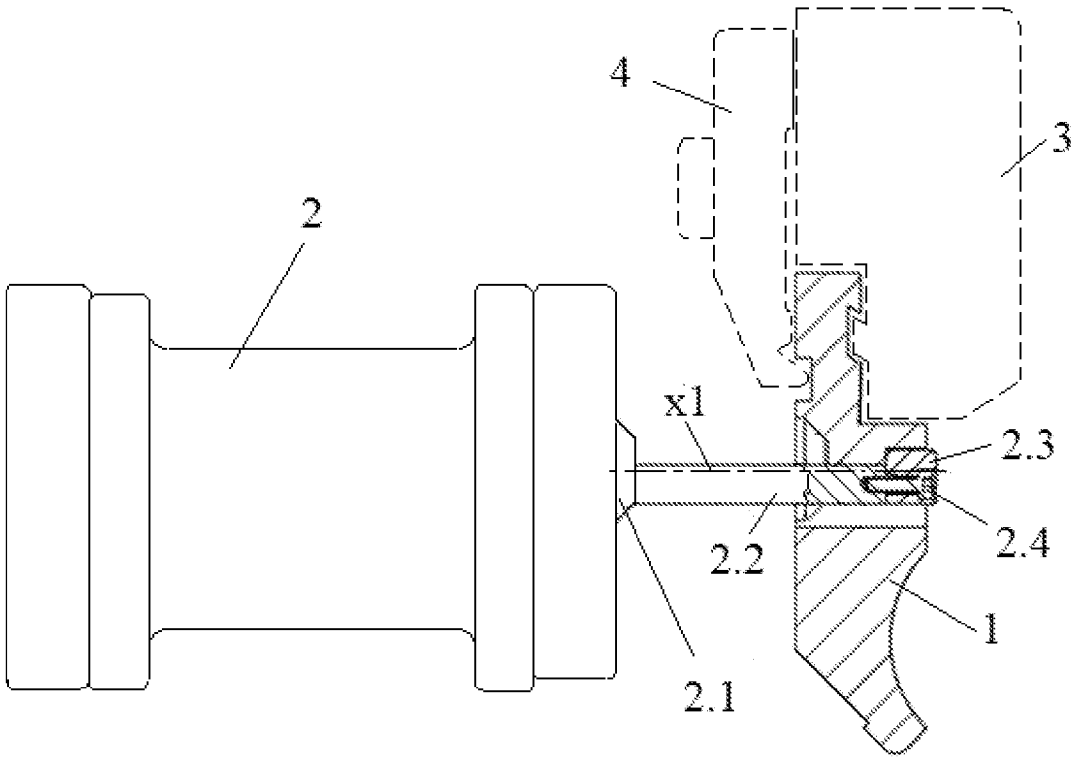


Figure 3

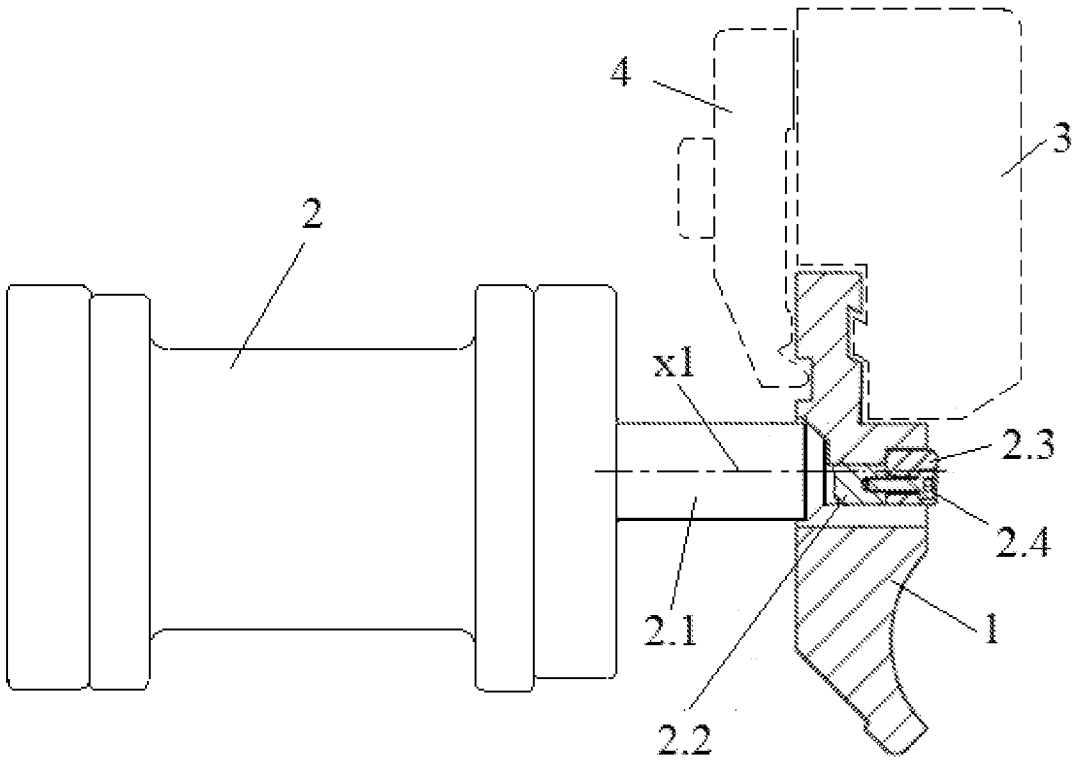


Figure 4

Rijksdienst voor Ondernemend Nederland

OCTROOIAANVRAAG NR.:
NO 143062
NL 2034516

ONDERZOEKSRAPPORT

BETREFFENDE HET RESULTAAT VAN HET ONDERZOEK NAAR DE STAND VAN DE TECHNIEK

RELEVANTE LITERATUUR

Categorie[1]	Literatuur met, voor zover nodig, aanduiding van speciaal van belang zijnde tekstgedeelten of figuren.	Van belang voor conclusie(s) nr:	Classificatie(IPC)
A	IT 2018 0000 6254 A1 (ANDREA ARGENTIN) 12 december 2019 (2019-12-12) * alinea [0065]; figuren *	1-3	INV. B21D5/02
A	CN 106 734 644 A (SHANGHAI MACHINE TOOL WORKS) 31 mei 2017 (2017-05-31) * samenvatting; figuren *	1-3	
A	WO 2008/050458 A1 (KOMATSU IND CORP [JP]; TAGAMI EX CO LTD [JP] ET AL.) 2 mei 2008 (2008-05-02) * figuren *	1-3	
A,D	US 7 632 224 B2 (WILA BV [NL]) 15 december 2009 (2009-12-15) * kolom 4, alinea 2-4; figuren *	1-3	
A	JP 2020 023000 A (AMADA HOLDINGS CO LTD) 13 februari 2020 (2020-02-13) * samenvatting; figuren *	1-3	
X,P	WO 2022/129964 A1 (PMT SZERSZAMGEP KFT [HU]) 23 juni 2022 (2022-06-23) * het gehele document *	1-3	

Onderzochte gebieden van de techniek

B21D

Indien gewijzigde conclusies zijn ingediend, heeft dit rapport betrekking op de conclusies ingediend op:

Plaats van onderzoek:	Datum waarop het onderzoek werd voltooid:	Bevoegd ambtenaar:
München	3 november 2023	Knecht, Frank

[1] NDERLINCATEGORIE VAN DE VERMELDE LITERATUUR

X: de conclusie wordt als niet nieuw of niet inventief beschouwd ten opzichte van deze literatuur
Y: de conclusie wordt als niet inventief beschouwd ten opzichte van de combinatie van deze literatuur met andere geciteerde literatuur van dezelfde categorie, waarbij de combinatie voor de vakman voor de hand liggend wordt geacht
A: niet tot de categorie X of Y behorende literatuur die de stand van de techniek beschrijft
O: niet-schriftelijke stand van de techniek
P: tussen de voorrangsdatum en de indieningsdatum gepubliceerde literatuur
T: na de indieningsdatum of de voorrangsdatum gepubliceerde literatuur die niet bezwarend is voor de octrooiaanvrage, maar wordt vermeld ter verheldering van de theorie of het principe dat ten grondslag ligt aan de uitvinding
E: eerdere octrooi(aanvrage), gepubliceerd op of na de indieningsdatum, waarin dezelfde uitvinding wordt beschreven
D: in de octrooiaanvrage vermeld
L: om andere redenen vermelde literatuur
&: lid van dezelfde octrooifamilie of overeenkomstige octrooipublicatie

EOB FORM 02.83 (P0414B)

AANHANGSEL BEHORENDE BIJ HET RAPPORT BETREFFENDE HET ONDERZOEK NAAR DE STAND VAN DE TECHNIEK, UITGEVOERD IN DE OCTROOIAANVRAGE NR.

NO 143062
NL 2034516

Het aanhangsel bevat een opgave van elders gepubliceerde octrooiaanvragen of octrooien (zogenaamde leden van dezelfde octrooifamilie), die overeenkomen met octrooischriften genoemd in het rapport.
De opgave is samengesteld aan de hand van gegevens uit het computerbestand van het Europees Octrooibureau per
De juistheid en volledigheid van deze opgave wordt noch door het Europees Octrooibureau, noch door het Bureau voor de Industriële eigendom gegarandeerd;; de gegevens worden verstrekt voor informatiedoeleinden.

03-11-2023

In het rapport genoemd octrooigeschrift	Datum van publicatie	Overeenkomend(e) geschrift(en)	Datum van publicatie
IT 201800006254 A1	12-12-2019	----------	
CN 106734644 A	31-05-2017	GEEN	
WO 2008050458 A1	02-05-2008	GEEN	
US 7632224 B2	15-12-2009	AT E501810 T1	15-04-2011
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		JP 5252837 B2	31-07-2013
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		PL 1862255 T3	31-08-2011
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		JP 2020023000 A	13-02-2020
WO 2022129964 A1	23-06-2022	CA 3200415 A1	23-06-2022
		EP 4228853 A1	23-08-2023
		US 2023286176 A1	14-09-2023
		WO 2022129964 A1	23-06-2022

Algemene informatie over dit aanhangsel is gepubliceerd in de 'Official Journal' van het Europees Octrooibureau nr 12/82 blz 448 ev

SCHRIFTELIJKE OPINIE

DOSSIER NUMMER	INDIENINGSDATUM	VOORRANGSDATUM	AANVRAAGNUMMER
NO143062	06.04.2023	08.04.2022	NL2034516

CLASSIFICATIE
INV. B21D5/02

AANVRAGER
PMT Szerszámgép Kereskedelmi és Szerviz Zártkörûen Mûködõ Részvénytársaság

Deze schriftelijke opinie bevat een toelichting op de volgende onderdelen:

- ☒ Onderdeel I Basis van de schriftelijke opinie
- ☐ Onderdeel II Voorrang
- ☐ Onderdeel III Vaststelling nieuwheid, inventiviteit en industriële toepasbaarheid niet mogelijk
- ☐ Onderdeel IV De aanvraag heeft betrekking op meer dan één uitvinding
- ☒ Onderdeel V Gemotiveerde verklaring ten aanzien van nieuwheid, inventiviteit en industriële toepasbaarheid
- ☒ Onderdeel VI Andere geciteerde documenten
- ☐ Onderdeel VII Overige gebreken
- ☐ Onderdeel VIII Overige opmerkingen

DE BEVOEGDE AMBTENAAR
Knecht, Frank

Aanvraag nr.:

SCHRIFTELIJKE OPINIE

NL2034516

Onderdeel I Basis van de Schriftelijke Opinie

1. Deze schriftelijke opinie is opgesteld op basis van de meest recente conclusies ingediend voor aanvang van het onderzoek.

2. Deze motivering is opgesteld, met betrekking tot **nucleotide- en/of aminozuursequenties** die genoemd worden in de aanvraag, op basis van een sequentielijst die:

   a. ☐ is opgenomen in de aanvraag zoals deze oorspronkelijk is ingediend

   b. ☐ aangeleverd is na de indieningsdatum ten behoeve van het onderzoek

      ☐ en vergezeld ging van een verklaring dat de sequentielijst niet meer informatie bevat dan de aanvraag zoals deze oorspronkelijk is ingediend.

3. ☐ Deze motivering is opgesteld, met betrekking tot nucleotide- en/of aminozuursequenties die genoemd worden in de aanvraag, voor zover een zinvolle motivering gevormd kon worden zonder een sequentielijst die voldeed aan WIPO standaard ST.26.

4. Overige opmerkingen:

Onderdeel V Gemotiveerde verklaring ten aanzien van nieuwheid, inventiviteit en industriële toepasbaarheid

1. Verklaring

Nieuwheid	Ja:	Conclusies 1-3
	Nee:	Conclusies
Inventiviteit	Ja:	Conclusies 1-3
	Nee:	Conclusies
Industriële toepasbaarheid	Ja:	Conclusies 1-3
	Nee:	Conclusies

2. Citaties en toelichting:

Zie aparte bladzijde

Onderdeel VI Andere geciteerde documenten

☒ Andere geciteerde openbaarmakingen

Zie aparte bladzijde

☐ Niet schriftelijke openbaarmakingen

Re Item V

Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

Reference is made to the following documents:

D1 IT 2018 0000 6254 A1 12 december 2019 (2019-12-12)

D2 CN 106 734 644 A (SHANGHAI MACHINE TOOL WORKS) 31 mei 2017 (2017-05-31)

D3 WO 2008/050458 A1 (KOMATSU IND CORP [JP]; TAGAMI EX CO LTD [JP] ET AL.) 2 mei 2008 (2008-05-02)

D4 US 7 632 224 B2 (WILA BV [NL]) 15 december 2009 (2009-12-15)

D5 JP 2020 023000 A (AMADA HOLDINGS CO LTD) 13 februari 2020 (2020-02-13)

D6 WO 2022/129964 A1 (PMT SZERSZAMGEP KFT [HU]) 23 juni 2022 (2022-06-23)

1 D1 is regarded as being the prior art closest to the subject-matter of sole independent apparatus claim 1, and discloses (the references in parentheses applying to this document):
Buiggereedschap (MC) (Fig. 1) [dat aansluitbaar is op een gereedschapswisselaar (90), gemonteerd op een robot, met een schouder, een gereedschapshouder-groef en een gereedschapsklem-groef op de gereedschapsromp] (note that the features under brackets [-] are not limiting the scope of protection of the bending tool), waarbij
- een ovaal boorgat (30) is voorzien dat onder de schouder door de gereedschapsromp loopt (Fig. 1; paragraph [0065]).

The subject-matter of claim 1 therefore differs from this known D1 in that

- de gereedschapshouder-groef zijde van de gereedschapsromp een ovale zitting heeft, die verbonden is met het ovale boorgat, waarbij aan een uiteinde daarvan - het uiteinde dat in het gereedschapsromp steekt - een flens is gevormd is die verticaal voorbij het ovale boorgat steekt;
- de gereedschapsklem-groef zijde van het gereedschapsromp een conische

zitting heeft, waarbij de conische zitting cilindrische eindstukken heeft, die in het ovale boorgat uitlopen, waarbij een hartlijn daarvan de flens snijdt boven een bovenrand van het ovale boorgat; en
- het ovale boorgat, de conische zitting en de ovale zitting afmetingen en vormen hebben, die afgestemd zijn op afmetingen en vormen van aan te sluiten structurele elementen van de gereedschapswisselaar.

The subject-matter of claim 1 is therefore new.

The technical effect of the differentiating features is that the design of the through bore and the gripping point, when used with the adequate tool exchange device, allows a firm grip of the tool with anti rotation feature. Furthermore, the claimed geometry is easy to manufacture.

The problems to be solved by the present invention may be regarded as to improve the known tool such that it can be more safely attached to a tool exchange device, while being manufactured in a cost-effective way, while keeping the tool easy to use and maintain.

The solution to this problem proposed in claim 1 of the present application is considered as involving an inventive step for the following reasons:

In D1, the through hole is oval but no oval seat is provided on one face and no flange on the other face.

In D2 an elongated slot hole is shown.

In D3 the tool is provided with a simple through hole and pins are provided on the tool gripping shaft for sandwiching the tool therebetween.

In D4, cited in the application a threaded bushing is provided in the tool such that a manipulator can be screwed into the bush and be tightened to provide a substantially non-rotatable connecting.

None of the tools of the prior art therefore disclose nor suggest the solution mentioned in the characterizing portion of claim 1.

The subject-matter of claim 1 is therefore inventive.

2 Claims 2 and 3 are dependent on claim 1 and as such also meet the requirements of patentability with respect to novelty and inventive step.

Re Item VI

Certain documents cited

Certain published documents

Application No Patent No	Publication date *(day/month/ year)*	Filing date *(day/month/ year)*	Priority date*(valid claim) (day/month/year)*
WO-A-2022129964	23/06/2022	14/12/2021	07/12/2021 16/12/2020

The above late published document D6 discloses all the features of claims 1-3: see fig. 10-12 and page 8, last paragraph to page 9, first paragraph.