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(54) GRIPPER FOR TRANSFER SYSTEM AND TRANSFER SYSTEM COMPRISING SUCH A GRIPPER

(57) Gripper for a stamping press having a transfer system, said gripper having a first and a second gripping arm for gripping a sheet to be stamped and a supporting body in which an actuating piston unit is housed, said piston unit being capable of actuating, via a longitudinal piston rod of the piston unit, said first gripping arm of the part to be stamped, said first arm being articulatedly connected to the supporting body, characterized in that the piston unit comprises at least two pistons in line with each other, separated and configured to work simultaneously and independently by actuating said piston rod.

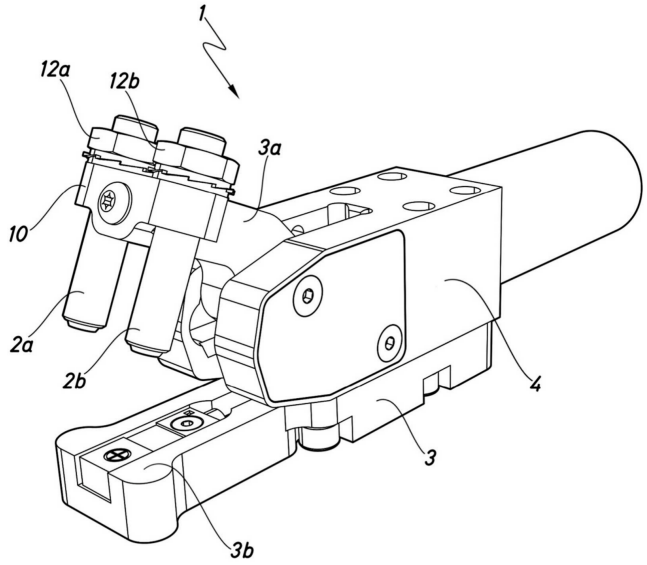


Fig.1

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Description

[0001] The present invention relates to a gripper for a stamping press having a transfer system, (also called "handling system" or "conveyor system") as well as a transfer system for a stamping press incorporating such a gripper.

[0002] Stamping presses are commonly used in industry, in particular in the motor industry, for the shaping of metal workpieces, such as, for example, sheets. These presses include an automatic workpiece positioning and transfer system, commonly referred to as a "conveyor system", 'transfer system' or 'transfer'. Through this system a workpiece can be sequentially stamped and die-cut along a plurality of dies arranged in the press. In the industry, workpieces are commonly referred to as sheets, irrespective of their shape. Both terms will be used interchangeably in the present description.

[0003] The aforementioned automated positioning and transfer system typically includes a series of pneumatic grippers distributed along a linear path. Generally, the grippers are positioned along a pair of gripper-holder profiles that lie parallel or nearly parallel to each other on both sides of consecutive stamping dies in the press. Both gripper-holder profiles are coupled to bars of the transfer system of the press. These bars are able to perform a back-and-forth movement with a component in the forward direction of the workpieces to be stamped, enabling a group of grippers associated with the same die to hold a sheet to be stamped, transfer it to the next die and move back to its original position while the sheet stamping operation is carried out. This process is repeated with subsequent workpieces that are to be stamped or die-cut.

[0004] Pneumatic grippers for stamping presses having a transfer system generally comprise gripping arms for the sheet to be stamped and a supporting body with an inner cavity which houses a single piston unit actuated by a pneumatic system. This pneumatic piston unit has the function of actuating one or more gripping arms of the gripper, which is/are hinged to the supporting body. Each of the grippers may include lines supplying the piston unit's pneumatic circuit and electrical cables that power one or more sensors to detect the presence of the sheet to be stamped. The gripping arms may be of different types, such as, for example, a fixed arm and a movable arm, or all the arms may be movable. In transfer system grippers, both the arms and the piston unit are in line and positioned in a direction approximately perpendicular to the gripper holders, between the sheet and the gripper holders. Documents ES2668371T3 and ES2798024 disclose pneumatic transfer system grippers of this type.

[0005] When in operation, all the gripper devices of a conveyor (transfer) system are synchronized to simultaneously remove a sheet from one die and transfer it to the next. Efficient gripping of the sheet during transfer ("conveying") is of vital importance for correct delivery to the next die in the transfer system. The workstations are referred to in the industry as "dies".

[0006] Stamping processes with presses that include a conveyor system are intended to increase output (i.e. increase the number of workpieces per minute) by increasing the working speed of the system. As the speed increases, acceleration and deceleration of the conveying movement of the gripper with the gripped sheet are also increased. However, the higher the speed of the system, the more force the gripper must exert on the sheet to avoid problems. A first problem that can arise due to insufficient gripping force on the sheet is that the sheet may fall off. Another problem that can occur is that the sheet held by one or more grippers may slip or turn (without falling), which disrupts the entire stamping process and can lead to a serious accident, e.g. when a sheet to be stamped is incorrectly positioned in the next die. Such an incident of incorrect positioning of the sheet can stop the entire stamping process, with an adverse impact on the performance of the entire press (not just that die), and may even damage the die itself.

[0007] This problem of insufficient gripping of the sheets by the grippers is magnified and becomes even more relevant when using presses where the workpieces are cantilevered, as in this case they are only gripped on one side. When gripping the cantilevered sheet, the gripping force on the sheet must be greater so as to counteract the weight of the sheet and the accelerations to which it is subjected at a single point. However, in industry it is common to work with cantilevered workpieces, as this allows two workpieces to be stamped opposite to each other at the same time, each gripped on one side, which doubles production. The problem of inadequate gripping of workpieces is also magnified by the tendency to design workpieces or sheets of considerable length in which the centre of mass is far away from the gripping point.

[0008] One possible solution to increase the gripping force of the grippers could be to increase their size. However, another problem with transfer systems, and parallel to the previous one, relates to the size of the grippers. The grippers currently available on the market are not small enough to access small cavities in the sheet to be stamped. On the other hand, as they are between two parallel gripper holders, and the grippers are arranged perpendicular to these gripper holders, the transfer systems leave very little space for the grippers. It is therefore necessary to design and manufacture special couplings for the grippers of transfer systems, which means higher installation costs. Overall, it can be concluded that known grippers do not have a satisfactory gripping force/size ratio. The industry is looking for smaller grippers and, in general, it is not feasible to increase the size of the gripper to solve the gripping problem.

[0009] There is therefore a need in the industry for grippers that can be of a size equal to or smaller than currently existing grippers, but which simultaneously provide gripping forces greater than or equal to the gripping forces provided by currently known grippers.

[0010] It is one objective of the present invention to provide a solution to such a need in the sector.

[0011] More specifically, the present invention discloses a gripper for a stamping press having a transfer system, said gripper having a first and a second gripping arm for gripping a part to be stamped and a supporting body in which an actuating piston unit is housed, said piston unit being capable of actuating, via a longitudinal piston rod of the piston unit, said first gripping arm of the part to be stamped, said first arm being articulatedly connected to the supporting body. Characteristically, the piston unit comprises two or more pistons in line with each other, separated and working simultaneously and independently by actuating said piston rod.

[0012] Preferably, said piston unit comprises two chambers, each chamber having its corresponding pneumatic fluid inlet and a corresponding piston, both pistons being connected to the longitudinal piston rod of the piston unit in such a way that both pistons exert cumulative forces on said longitudinal piston rod.

[0013] Preferably, each chamber has a front stop for the corresponding piston, the front stop separating both chambers from the rear chamber.

[0014] Thanks to the increased gripping force, the gripper according to the present invention ensures correct entry of the sheet in the most demanding operations, being particularly useful in operations of unloading the last die in the transfer system, where the original sheet has been divided into two parts that are cantilevered and require a firmer grip to avoid unwanted displacements. Furthermore, the present invention ensures correct conveying at high accelerations and thus increased productivity.

[0015] Thanks to its more compact size, the gripper according to the present invention provides simpler conveying applications for cantilevered workpieces (in particular, sheets). It also makes it possible to ensure that the gripper can enter into small cavities in the sheet and to reduce the cost of the conveyor system.

[0016] The present invention achieves the above objective by providing two pistons inside the piston unit which act simultaneously and cumulatively on the piston rod. The applicant has found that this arrangement makes it possible to obtain smaller grippers with gripping forces greater than or equal to those currently available, and also grippers with the same dimensions and with gripping forces almost twice as high as the previous ones (in typical working conditions approximately 84% higher). In particular, the invention does not require an increase in the longitudinal surface of the gripper to accommodate the two piston rods because the degree of opening of the gripping arms required in this application turns out to be typically 25° and even less. The dimensions of the arm can therefore, if necessary, be altered to accommodate an increase in the longitudinal dimension of the piston unit without causing an undue increase in the overall length of the gripper, at the cost of a modification of the arm and/or a reduction in the degree of opening. This will, however, depend on the specific requirements of each application.

[0017] Preferably, the second arm is a fixed gripping arm which is fixedly attached to the supporting body.

[0018] Preferably, said first arm has an end with at least one tip for gripping the sheet to be stamped. More preferably, said at least one tip has at its end a toothed ball and socket joint for contact with the sheet, the ball and socket joint being able to rotate with respect to the tip. Even more preferably, said first arm comprises two gripping tips parallel to each other and connected to a compensating arm fixed to the first arm in a tilting manner, in which the compensating arm is arranged perpendicularly with respect to the tips, said arm being able to rotate with respect to an axis perpendicular to the longitudinal direction of the tips and perpendicular to the longitudinal direction of the compensating arm.

[0019] Preferably, said first arm also comprises a guide for an actuating bearing which is jointly attached to the longitudinal piston rod of the piston unit. More preferably, the supporting body comprises at least one guide for the aforementioned actuating bearing, the path of said guide being parallel to the movement of the aforementioned longitudinal piston rod in the piston unit.

[0020] Preferably, the first arm is articulated with respect to the supporting body around a pivot located between the longitudinal piston rod and the fixed arm. Even more preferably, said pivot is substantially aligned with the fixed arm of the gripper.

[0021] The present invention also comprises a transfer system for a stamping press which in turn comprises at least one gripper according to the present invention.

[0022] More particularly, in advantageous embodiments of the invention, the transfer system comprises:

- a guide comprising two approximately parallel section members,
- a series of positions arranged along the guide, each position comprising, in each of said two section members, a transport element capable of back-and-forth movement along the guide and a workpiece gripping element, each position preferably corresponding to a die,
- means for synchronizing the transport elements and the gripping elements for taking the workpiece from an upstream position and/or transferring it to a downstream position,

in which at least one of the gripping elements is a gripper according to the present invention.

[0023] In certain embodiments, the back-and-forth movement may have components in the direction of the guide and in a direction perpendicular thereto.

[0024] Advantageously, the last transfer position comprises at least one gripper according to the present invention for each section member.

[0025] The advantages of the present invention become more apparent when the gripper according to the

present invention is arranged between the guide and the workpiece, with the longitudinal direction of the pneumatic piston unit of the gripper parallel to the distance separating the guide and the workpiece. In this case, the aforementioned longitudinal direction is perpendicular to the direction of travel of the workpiece and/or perpendicular to the section members and, at the same time, parallel to the main direction of the workpiece.

[0026] In particularly preferred embodiments of the transfer system covered by the present invention, the workpiece is a metal sheet.

[0027] For a better understanding of the above, the following drawings show some of the possible embodiments of the present invention, schematically and by way of non-limiting example only.

Figure 1 shows a perspective view of an exemplary embodiment of a gripper which is the subject of the present invention, in the open position.

Figure 2 shows a perspective view of an exemplary embodiment of a gripper which is the subject of the present invention, in the closed position.

Figure 3 shows a cross-sectional side view of the gripper, in the open position.

Figure 4 shows a cross-sectional side view of the gripper, in the closed position.

Figure 5 is a perspective view showing, diagrammatically, a transfer system according to the present invention.

Figure 6 is a detailed perspective view showing the arrangement of a gripper holding a sheet in the transfer system.

[0028] One possible embodiment of the pneumatic gripper 1 for a stamping press or servo press with a transfer system according to the present invention is described below with reference to attached Figures 1 to 4.

[0029] Figures 1 to 4 show an exemplary embodiment of the pneumatic gripper 1 according to the present invention in the open and closed positions respectively. The pneumatic gripper 1 in the example comprises two gripping arms 3a, 3b for gripping a sheet (depicted in Figures 5 and 6). The gripper also comprises at least one supporting body 3, 4. In the embodiment shown, the supporting body has two portions, a first proximal or rear portion 4, and a second distal or front portion 3. The first proximal or rear portion 4 has within it a pneumatic piston unit 26 which actuates the gripper 1. As regards the arms of the exemplary gripper 1 shown, one gripping arm 3a is movable, while the other gripping arm 3b is fixed with respect to the distal or front portion 3 of the supporting body, being integral with respect thereto. The provision of a fixed arm 3b results in a more rigid gripper, with a smaller degree of opening and a lower risk of slipping of the sheet. In the embodiment shown, the movable gripping arm 3a has two tips 2a, 2b for gripping the sheet to be stamped. The tips 2a, 2b are parallel to each other. Each tip 2a, 2b comprises, at its end intended to contact the sheet which is to be stamped, a respective ball and socket joint provided with a toothed contact surface. Each ball and socket joint can rotate with respect to its respective tip. Each toothed contact surface protrudes slightly from the end of its respective tip. In this way, the coefficient of friction in gripping the sheet which is to be stamped is substantially improved. Furthermore, the fixed arm 3b may have a raised, toothed, profiled or ribbed surface to improve the grip (not shown in the figures).

[0030] Also for the purpose of improving the contact between the gripping tips 2a, 2b and the sheet which is to be stamped, the gripping tips 2a, 2b are located inside two through holes in a compensating arm 10 and secured with two nuts 12a, 12b. The compensating arm 10, arranged perpendicular to the longitudinal direction of the tips 2a, 2b, is fixed to the movable gripping arm 3a by means of a screw 20 and can be swung slightly along an axis which, in the example, is perpendicular to the longitudinal direction of the compensating arm, perpendicular to the longitudinal direction of the tips, and parallel to the longitudinal direction of the movable arm 3a. By tilting the compensating arm 10, good contact between the tips 2a, 2b and the sheet is achieved even in the case of uneven surfaces.

[0031] Furthermore, the movable gripping arm 3a is hinged to the supporting body 3, 4 by means of a pivot 25. The pivot 25 is located close to the fixed arm 3b to reduce the longitudinal dimension of the tips 2a, 2b. The gripping arm 3a also comprises a guide for the actuating head 42 of the pneumatic piston unit. In the embodiment shown, the guide takes the form of a groove 24 with a curved path along which an actuating bearing 31 is moved conjointly with the actuating head 42. Said actuating bearing 31 in turn moves a fixed guide with respect to the supporting body. This fixed guide, in the case shown, comprises two straight grooves 43 parallel to the direction of movement of the actuating head 42, located on both sides of the movable arm 3a. The actuating bearing 31 is arranged perpendicular to the actuating head 42.

[0032] The actuating head 42 is in turn connected to the head 281 of the piston rod of the pneumatic piston unit, and thus to the front piston rod 28' of the pneumatic piston unit 26. The pneumatic piston unit 26 has two chambers 27, 27', with two collinear pistons 40, 40', one in each chamber. Both pistons separate their respective chamber into two parts which are isolated from each other. The two chambers 27, 27' do not communicate with each other, and the pistons 40, 40' actuate the longitudinal piston rod of the piston unit 26. In the example shown, the longitudinal piston rod of the piston unit comprises a thrust rod assembly 28, 28'. The exemplary

rod assembly 28, 28' comprises a front piston rod 28' and a rear piston rod 28. Both piston rods can be solidly attached to each other. The pistons and piston rods are connected to each other in such a way that the forces exerted by the pneumatic fluid on each of the pistons 40, 40' are added together in the piston rod assembly 28, 28'. In the rear piston 40, the pneumatic fluid exerts pressure over the entire area of the piston unit, whereas in the front piston 40', the pneumatic fluid exerts pressure over an area corresponding to the area of the piston unit minus the area of the rear piston rod 28. Thus, the dual chamber of the pneumatic piston unit does not double the force provided by the piston unit, but rather the increase in force is less than 100%, typically around 85%. Each of the chambers 27, 27' of the piston unit has, respectively, a front wall 41, 41' which limits forward movement of the respective piston 40, 40'. The front wall 41 of the rear chamber 27 also acts as a rear stop for the front piston 40' and separates the two chambers from each other, isolating them. In its rearmost position, the piston unit has a cushioning element 29 that acts as a rear stop for the rear piston 40, absorbing the kinetic energy from the movement of the gripper and thus reducing the noise produced by the pneumatic gripper 1 when in operation. The piston unit can be designed so that the rear piston 40/rear piston rod 28 assembly makes contact with the cushioning element 29 before the front piston 40' makes contact with the front wall 41 of the rear chamber 27, such that the cushioning element 29 receives all of the kinetic energy of the assembly.

[0033] Outside the piston unit 26, the piston rod assembly 28, 28' extends into the piston rod head 281, which is larger than the front piston rod 28' at its exit from the piston unit 26. As indicated above, the piston rod head connects to the pusher head 42 which actuates the movable arm 3a.

[0034] In operation, a pneumatic fluid fills both chambers 27, 27' through various orifices (orifices and other details of the pneumatic circuit within the gripper not shown in the figures) and by means of the pistons 40, 40' independently pushes the piston rod assembly 28, 28', which ends up pushing the actuating head 42, causing the actuating bearing to slide simultaneously through the straight grooves 43 and the groove 24 of the movable arm 3a, causing the movable arm 3a to rotate around the pivot 25 towards the fixed arm 3b, transmitting the force exerted by the pneumatic fluid on the pistons 40, 40' to the movable arm 3a with a multiplying effect depending on the geometry of the gripper 1. It is reversed by injecting pneumatic fluid at the other end of both chambers, so that the pistons move back.

[0035] Grippers in the prior art with a symmetry similar to the one shown, with a single-chamber piston unit and an operating pressure of 6 bar, have a gripping force of 180 daN. The two-chamber gripper according to the present invention, with similar dimensions, can provide a gripping force of 330 daN at the same pressure of 6 bar, thanks to its two-chamber piston unit, while maintaining a 25° opening of the gripper arms, corresponding to the maximum opening of the movable arm 3a when the rear piston 40 makes contact with the cushioning element 29.

[0036] Although not shown, the gripper 1 may also have sensors to detect the presence of the part to be stamped.

[0037] Figures 5 and 6 show a transfer system 100 for the conveying or transfer of sheets in a press system. The system includes two gripper-holder section members 101, 102 parallel to each other. The gripper-holder section members 101, 102 have a number of transport elements distributed longitudinally along said section members. Each transport element, in the example shown, carries at least one gripper 1. The transport elements in the example take the form of bars arranged perpendicular to the section members and hold the grippers by means of clamps, positioning the pneumatic grippers 1 approximately perpendicular to the direction of movement of and parallel to the sheets to be stamped 1000. The grippers and transport elements are grouped on both sides of the transfer system, each group corresponding to a stamping position 110, 120, 130, 140, 150, 160, 170, 180, 190. Each different stamping position corresponds to a different die (not shown in the figures). The different positions 110, 120, 130, 140, 150, 160, 170, 180, 190 define a linear path and a feed direction, indicated by an arrow in Figure 5. The transport elements have a back-and-forth movement in the feed direction of the workpieces. In addition to this back-and-forth movement in the forward direction, the transport elements may also possibly have a back-and-forth movement in the vertical direction (perpendicular to the plane of the sheet to be stamped 1000). The back-and-forth movement allows a group of grippers associated with a position to hold said sheet during the stamping operation, transfer it to the next position and return to its initial position to hold a new part to be stamped. A control system (not shown) synchronizes the movement of all the transport elements and grippers. Figure 5 shows the different stages of a part to be stamped 1000 (in particular, a sheet) which starts its run at the first position 110 in the form of a sheet and ends at the last position 190 as two symmetrical, non-connected shaped parts 1001, 1002.

[0038] The grippers corresponding to the different dies or stations may be different from each other. A transfer line according to the present invention comprises at least one gripper 1 according to the present invention. Due to their characteristics, the grippers according to the present invention may be used in any of the positions in the transfer system. However, due to their characteristics, the grippers according to the present invention are particularly suitable in unloading operations at the last position or die, where the part to be stamped is already divided and requires a firmer grip to avoid unwanted displacements. In the example shown, the transfer system features grippers in the first position 110 and in the last position 190, as shown in Figures 1 to 4.

[0039] Figure 6 details an assembly of a gripper 1

similar to that shown in Figures 1 to 4 which includes a transport element comprising a gripper-holder bar 90 at right angles to the section member 102 and capable of sliding along the section member 102 in a back-and-forth movement. The bar 90 holds a gripper 1 via a clamp. The gripper 1 is positioned parallel to the section member 102, at right angles to the gripper-holder bar 90 and parallel to the part to be stamped 1000. The gripper 1 is similar to that shown in Figures 1 to 4, having a movable gripping arm 3a and a fixed arm 3b, which in the closed position enable the part to be stamped 1000 to be gripped. The internal elements, not shown in Figure 6, are as shown in Figures 3 and 4.

[0040] Although the invention has been described with respect to a preferred embodiment, it should be borne in mind that this does not limit the invention, and that it is possible to alter structural and other details which are obvious to a person skilled in the art after interpreting the subject matter disclosed in the present description, claims and drawings. In particular, in principle and unless explicitly cited, all features of the different embodiments and alternatives shown and/or suggested may be combined. Therefore, the protection of the present invention includes any variant or equivalent which may be considered to be covered by the broadest interpretation of the following claims. The scope of the invention will be defined by the broadest interpretation of the following claims.

Claims

1. Gripper for a stamping press having a transfer system, said gripper having a first and a second gripping arm for gripping a sheet to be stamped and a supporting body in which an actuating piston unit is housed, said piston unit being capable of actuating, via a longitudinal piston rod of the piston unit, said first gripping arm of the part to be stamped, said first arm being articulatedly connected to the supporting body, **characterized in that** the piston unit comprises at least two pistons in line with each other, separated and configured to work simultaneously and independently by actuating said piston rod.

2. Gripper according to the preceding claim, **characterized in that** said piston unit comprises two chambers, each chamber having its corresponding pneumatic fluid inlet and a corresponding piston, both pistons being connected to the longitudinal piston rod of the piston unit in such a way that both pistons exert cumulative forces on said longitudinal piston rod.

3. Gripper according to the preceding claim, **characterized in that** each chamber has a front stop for the corresponding piston, the front stop separating both chambers from the rear chamber.

4. Gripper according to any one of the preceding claims, in which the second arm is a fixed gripping arm which is fixedly attached to the supporting body.

5. Gripper according to any one of the preceding claims, **characterized in that** said first arm has an end with at least one tip for gripping the sheet to be stamped.

6. Gripper according to the preceding claim, **characterized in that** said at least one tip has at its end a profiled ball and socket joint for contact with the sheet, the ball and socket joint being able to rotate with respect to the tip.

7. Gripper according to Claim 5 or 6, **characterized in that** said first arm comprises two gripping tips parallel to each other and connected to a compensating arm fixed to the first arm in a tilting manner, in which the compensating arm is arranged perpendicularly with respect to the tips, said arm being able to rotate with respect to an axis perpendicular to the longitudinal direction of the tips and perpendicular to the longitudinal direction of the compensating arm.

8. Gripper according to any one of the preceding claims, **characterized in that** said first arm comprises a guide for an actuating bearing which is jointly attached to the longitudinal piston rod of the piston unit.

9. Gripper according to the preceding claim, **characterized in that** the supporting body comprises at least one guide for the aforementioned actuating bearing, the path of said guide being parallel to the movement of the aforementioned longitudinal piston rod in the piston unit.

10. Gripper according to any one of the preceding claims, **characterized in that** the movable arm is articulated with respect to the supporting body around a pivot located between the longitudinal piston rod and the fixed arm.

11. Transfer system comprising:

    - a guide comprising two approximately parallel section members
    - a series of positions arranged along the guide, each position comprising, in each of said two section members, a transport element capable of back-and-forth movement along the track and a workpiece gripping element
    - means for synchronizing the transport elements and the gripping elements for taking the workpiece from an upstream position and/or transferring it to a downstream position,

in which at least one of the gripping elements is said at least one gripper according to any one of the preceding claims.

12. Transfer system according to the preceding claim, **characterized in that** said gripper is arranged between the guide and the workpiece, with the longitudinal direction of the pneumatic piston unit of the gripper parallel to the distance separating the guide and the workpiece.

13. Transfer system according to Claim 11 or 12, **characterized in that** each of the positions corresponds to a die.

14. Transfer system according to any one of Claims 11 to 13, **characterized in that** the workpiece is a metal sheet.

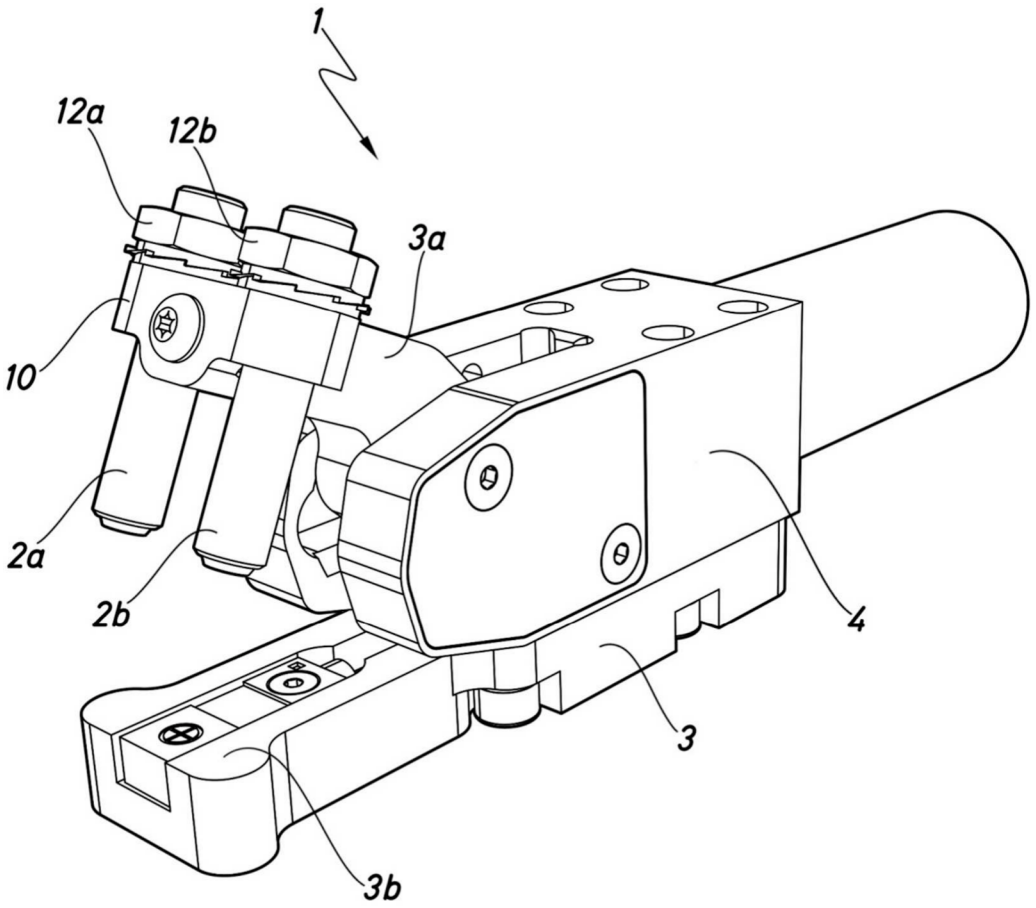


Fig.1

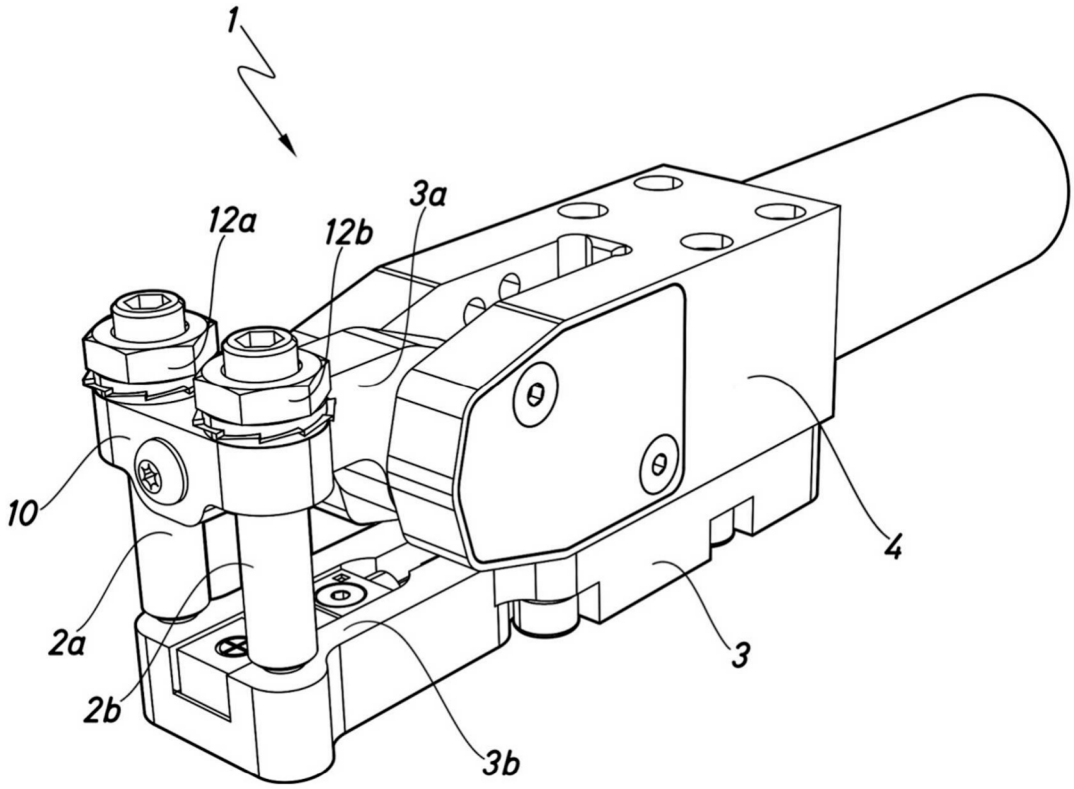


Fig.2

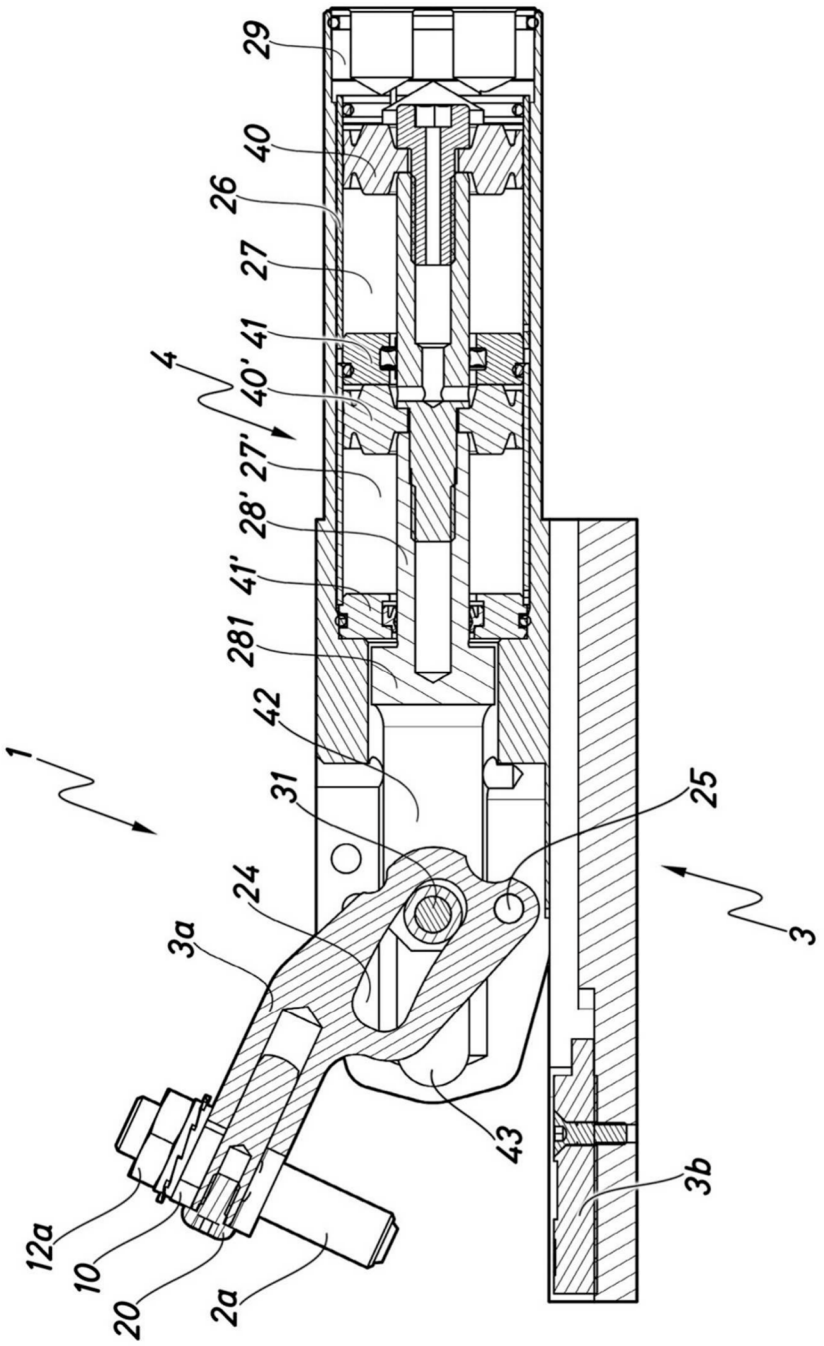


Fig.3

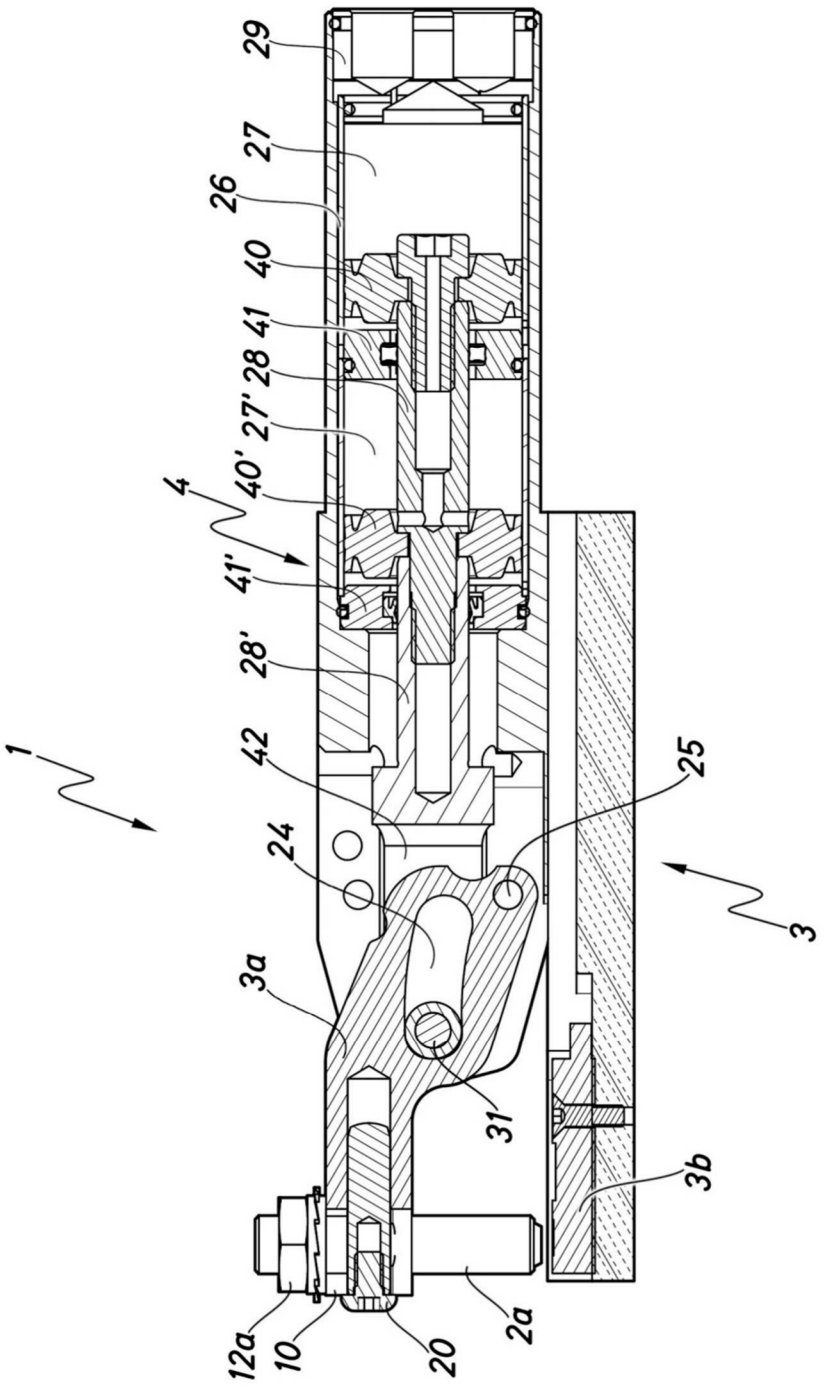


Fig.4

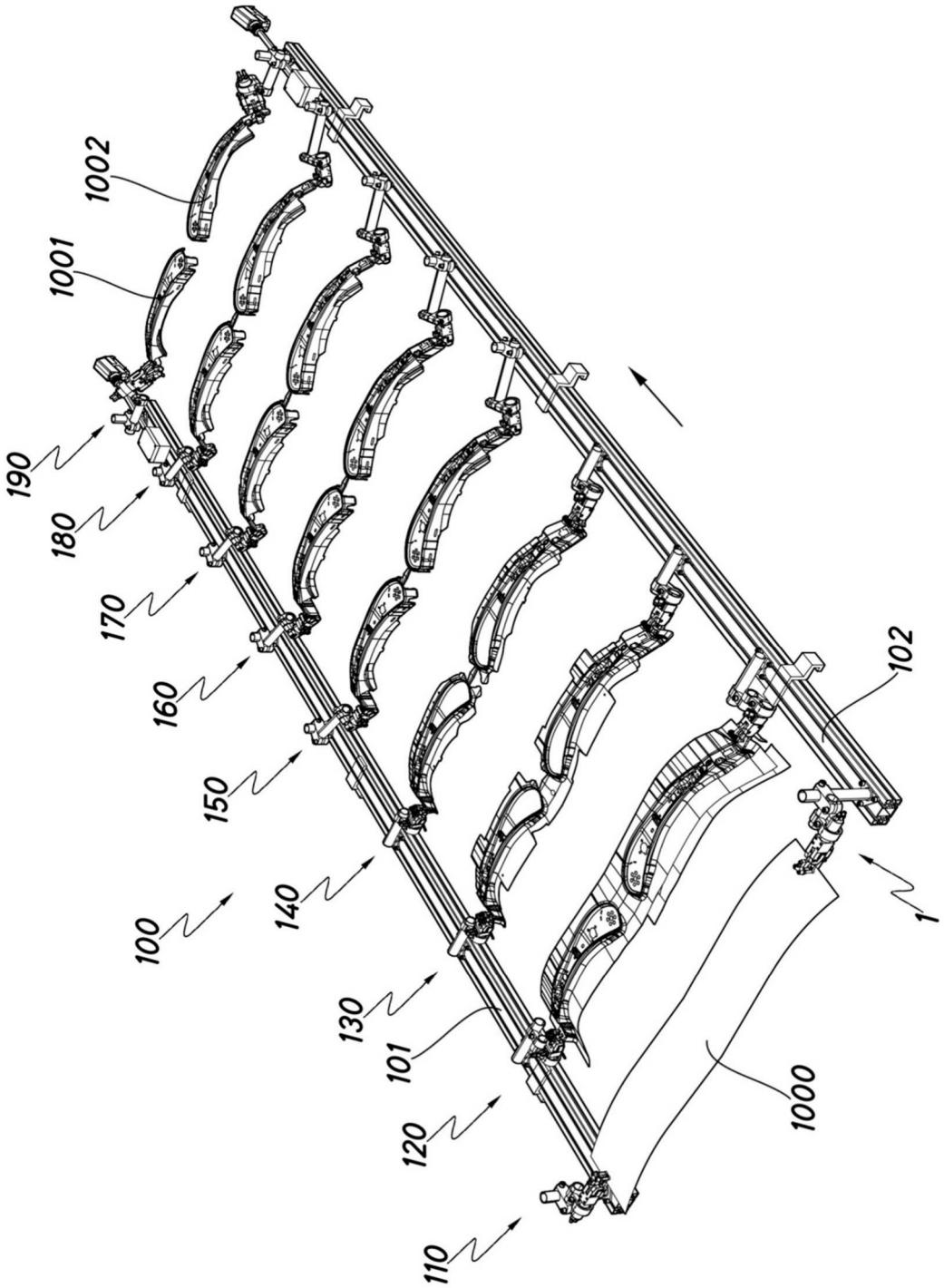


Fig.5

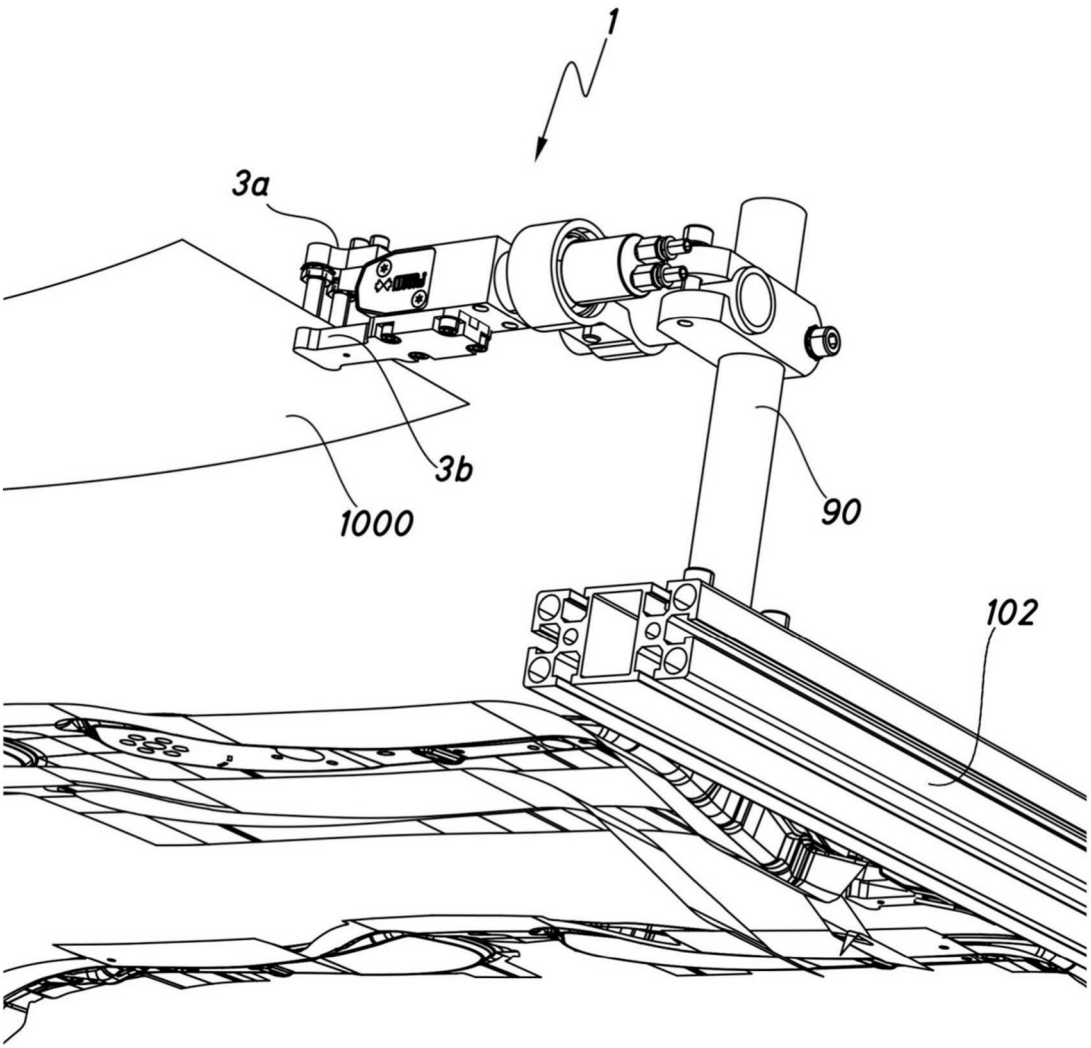


Fig.6

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European Patent Office
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EUROPEAN SEARCH REPORT

Application Number
EP 25 21 3192

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	EP 3 981 546 A1 (SARABIA TRILLA MIQUEL [ES]) 13 April 2022 (2022-04-13) * paragraphs [0003], [0025] - [0027], [0073]; figures 1-28 *	1-14	INV. B21D43/05 B21D43/11 B25B5/06 B25B5/14 B25B5/16
A	DE 20 2014 010281 U1 (DESTACO EUROPE GMBH [DE]) 22 April 2015 (2015-04-22) * paragraph [0026]; figures 1-4 *	1-14	
A	EP 1 023 966 A2 (FESTO AG & CO [DE]) 2 August 2000 (2000-08-02) * paragraph [0008]; figure 1 *	1-14	
A	US 2004/006984 A1 (SAWDON EDWIN G [US]) 15 January 2004 (2004-01-15) * paragraph [0063]; figures 13, 15 *	1-14	
A	EP 4 289 524 A1 (SCHAEFFLER TECHNOLOGIES AG [DE]) 13 December 2023 (2023-12-13) * figure 1 *	1-14	
			TECHNICAL FIELDS SEARCHED (IPC) B21D B25B B25J

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	26 February 2026	Vassoille, Philippe

CATEGORY OF CITED DOCUMENTS

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 3981546 A1	13-04-2022	EP 3981546 A1	13-04-2022
		ES 2798024 A1	04-12-2020
		WO 2020245487 A1	10-12-2020
DE 202014010281 U1	22-04-2015	NONE	
EP 1023966 A2	02-08-2000	DE 29901364 U1	06-05-1999
		EP 1023966 A2	02-08-2000
US 2004006984 A1	15-01-2004	NONE	
EP 4289524 A1	13-12-2023	DE 102022114502 A1	14-12-2023
		EP 4289524 A1	13-12-2023

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Patent documents cited in the description

- ES 2668371 T3 **[0004]**
- ES 2798024 **[0004]**