

(19)



(11)

EP 2 842 695 A1

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:
04.03.2015 Bulletin 2015/10

(51) Int Cl.:
B25C 1/04 (2006.01) B25C 5/16 (2006.01)

(21) Application number: **13004185.8**

(22) Date of filing: **25.08.2013**

(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

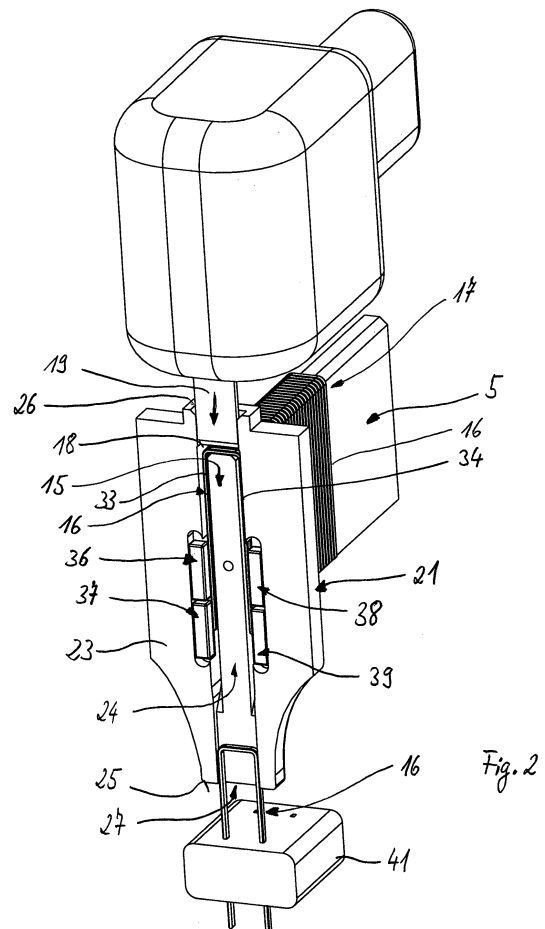
(71) Applicant: **Signode International IP Holdings LLC**
Glenview IL 60026 (US)

(72) Inventor: **Dagman, Bengt**
544 30 Hjo (SE)

(74) Representative: **Klein, Friedrich Jürgen**
Patentanwälte Klein & Klein
Auf der Pirsch 11
67663 Kaiserslautern (DE)

(54) Fastener driving tool

(57) The invention concerns a method for driving a fastener into material, whereby the fastener has at least one leg portion and is arranged within a channel, which is provided with an orifice outlet, the fastener is accelerated by means of a fastener driving element which transfers energy to the fastener so that the fastener moves within the channel into the direction of the orifice outlet of the channel, the at least one leg portion of the fastener which is intended to be introduced into the material has hereby a desired orientation which runs at least essential parallel to the longitudinal direction of the channel. In order to improve the properties of said afore-mentioned fastener driving tool with respect to its reliability to completely intrude fasteners into materials without damaging said material it is proposed that the fastener is on its way through the channel influenced by a force which is acted by a force means in order to orientate the staple within the channel (15) in a predetermined manner and/or to counteract a deformation of the fastener.

*Fig. 2***EP 2 842 695 A1**

Description

[0001] The present invention concerns a method according to the preamble of claim 1. Further, the invention concerns also a fastener driving tool for driving a fastener into material, particularly comprising a housing assembly including a main housing portion and a handle portion extending from the main housing portion, whereas a fastener driving element, which is movable within a channel, said fastener driving element is provided for driving fasteners which are successively feedable from a magazine assembly into a fastener driving track build by means of the channel, a trigger assembly having an actuatable trigger for activating a movement of a fastener within the channel and of an ejection of the fastener, whereby the fastener can be arranged in said channel of said pneumatic fastener tool, in order to be moved by means of said fastener driving element which is able to transfer a driving movement to the fastener for moving said fastener through said channel in a direction to an orifice outlet of said channel and for ejecting said fastener through said orifice outlet.

[0002] Such kind of fastener driving tools are used in order to accelerate fasteners like staples, headed and headless nails, clamp nails and the like and for driving them into items. Fastener driving tools are used for example in the production of framework of the furniture. A further exemplarily application of the present invention is the production of bedding frameworks by using staplings in wooden ribs. Most of the prior known fastener driving tools uses a fluid, particularly compressed air, for accelerating fasteners like staples, headed and headless nails, clamp nails and the like and for driving them into items. Such fastener driving tools usually have a piston which is movable in a cylinder between a top and an upper dead center. A fastener driving element is arranged within the line of motion of the piston and is used for contacting, accelerating and ejecting the fasteners, which are usually fed from a magazine assembly one after the other into the fastener driving track. As result of this contact the fastener is moved in a longitudinal direction and with high speed through a channel of the fastener driving tool, which builds a given and predetermined fastener driving track for the fasteners. At the - with respect to the fastener driving element - opposite end, the channel is provided with an orifice outlet or nozzle, where the respective fastener leaves the channel and the fastener driving tool in order to intrude into the materials which have to be connected to each other.

[0003] In order to achieve a good work result it is important that the fasteners leave the fastener driving tool with a predetermined orientation with respect to its moving direction. The fastener which has usually at least one leg, like a nail or a pin, is ideally moved with its at least one leg parallel to its moving direction. Any misalignment of the fastener can cause a deformation of the fastener before it reach the material which has to be fastened to each other. Such a deformation contains the danger that the fastener can't completely intrude into the material. The same can happen even in case that the fastener is not deformed but leaves the fastener driving tool with an orientation which deviates from a parallel orientation with respect to its moving direction in the channel. Such a misalignment of a fastener can have the consequence that the fastener penetrates not with his full length into the materials which are intended to be connected which each other. Fasteners which are provided with two legs, particularly staples, can have the additional problem that a non-parallel orientation of the two legs can led to products which are junk, particularly because such deformed staples can crack the material.

[0004] Efforts have already been made in order to avoid such problems. For example it is tried to feed the fastener very precisely into the channel in the area of the upper end of the channel where the fastener driving element hits the fastener. Further, it is tried to mechanically guide the fastener on its way through the channel very precisely by providing the channel for the respective fastener with an adequate cross-section of the channel. Despite of all these efforts, the problem that fasteners exit the channel in a deformed manner or with a misalignment still exists.

[0005] It is therefore an object of the present invention to improve the properties of said afore-mentioned fastener driving tool with respect to its reliability to completely intrude fasteners into materials without damaging said material.

[0006] According to a first aspect of the invention this problem is solved by the features of claim 1, which describe a method for driving a fastener into material, whereby the fastener has at least one leg portion and is arranged within a channel, which is provided with an orifice outlet, the fastener is accelerated by means of a fastener driving element which transfers energy to the fastener so that the fastener moves within the channel into the direction of the orifice outlet of the channel, the at least one leg portion of the fastener which is intended to be introduced into the material has hereby a desired orientation which runs at least essentially parallel to the longitudinal direction of the channel. The fastener should hereby on its way through the channel be influenced by a force which is generated by a force means in order to orientate the staple within the channel in a predetermined manner and/or in order to counteract a possible deformation of the fastener. Said force should preferably influence the fastener at least on a part of its way through the channel or on its whole way through the channel. Said force can already be active when the fastener is fed to and/or introduced into the channel or when the fastener is positioned at a place in the channel, where it is intended that the fastener driving element hits the fastener. It is hereby further preferred that the force is acted in a manner by which the at least one leg portion of the fastener receives an orientation which corresponds with the desired orientation of the at least one leg portion parallel to the longitudinal direction of the channel. This longitudinal direction of the channel should preferably also correspond with a desired direction of penetration of the respective fastener into the materials which have to be

connected with each other. The resulting force which acts to the fastener brings and/or holds preferably the at least one leg in the desired orientation relative to the longitudinal extension of the channel and to the desired direction of penetration. Further, it can be preferred, that said force can also act on the fastener when the fastener driving element has no contact with the fastener anymore. As a result of at least some of these provisions according to the invention and to preferred

embodiments of the invention a fastener can penetrate into materials with a higher precision and with an orientation which corresponds with a desired orientation, which is usually parallel to the desired direction of penetration. The danger is thereby decreased that a fastener cracks materials like wood when it penetrates into such material.

[0007] In a further preferred embodiment of the method according to the invention, the at least one force, which acts in addition to the force which is transferred by means of the fastener driving element to the fastener and in addition to any reaction forces resulting from this force of the fastener driving element, is a magnetic force. In order to generate a magnetic force at least one magnetic field can be affected within the channel. The preferable metallic fastener can incorporate with the at least one magnetic field in such a way that the one or more magnetic forces are generated and acts on the fastener. Particularly by means of a certain predetermined orientation of the magnetic field with respect to the longitudinal extension of the channel and with respect to the desired direction of movement of the fastener, it is possible to generated at least one magnetic force which holds and/or brings the at least one leg portion of the fastener into an orientation parallel to the longitudinal extension of the channel.

[0008] Particularly in connection with a staple as fastener which is provided with at least two leg portions, it is preferred that at least two magnetic fields are acting within the channel. Advantageously the at least two magnetic fields are arranged opposite to each other with respect to a direction transverse to the longitudinal extension of the channel. Further, at least one of the magnetic fields should act in an area of a sidewall of the the channel at which one of the leg portions passes the channel. As a result, the magnetic fields generate in each leg portion a magnetic force, which pulls one leg portion of the fastener into the direction of the respective sidewall of the channel. Therefore both leg portions can be hold parallel to each other and parallel with respect to the axis of the channel. Preferably the magnetic fields on both channel sides should by formed at least essentially symmetrically to each other.

[0009] In practice, a magnetic force which can achieve the desired result can be found by varying the magnetic field strength in dependency of the respective kind of metallic staple, length of the leg portion(s), channel design and length and power and speed of the fastener driving fastener element. Further the at least one magnetic force should advantageously be adjusted to the force which is transferred from the fastener driving element to the fastener (and vice versa) in such a way that the fastener has enough speed in order to completely introduce into the material.

[0010] According to a second aspect of the present invention this object is accomplished with a fastener driving tool as mentioned in claim 1. Therefore, according to this aspect of the invention a fastener driving tool which is provided with the features of the preamble of claim 1 should have a force means, which is able to exert in the area of the channel a force to the fastener on its way through the channel, in order to orientate the staple within the channel in a predetermined manner and/or in order to counteract a possible deformation of the fastener, which can arise in the fastener as reaction of the transfer of the drive movement of the fastener driving element to the fastener.

[0011] The invention can enclose the features that preferably in the area of said channel and of a fastener driving track build by the channel, a force means is arranged, which is able to exert a force to the fastener on its way through the channel in order to orientate the fastener and/or at least a part of the fastener in a predetermined manner. The force means should be a means which is in addition to the walls of the channel and in addition to the fastener driving element present. The force means can perform at least one, preferably both of the functions, namely to help to mechanically guide the fastener within the channel relative to the channel and to bring or hold the fastener in a required geometrical shape. The latter is - not only but - of particular importance in connection with staples as fasteners, because staples tend to lose their ideal U-form as result of the hit of the fastener driving element onto the staple crown. The fastener driving element, which strikes the fastener, particularly a staple, with high speed and with an high impulse accelerates the fastener so that the fastener can pass and exit the channel and intrude into the materials. The impetus, which is acted by means of the fastener driving element on the fastener can in prior known fastener driving tool result in a deformation of the respective fastener. After contact with the fastener driving element the staple can have a wedge-like form in which the two free ends of the two legs of the staple have a shorter distance than said two legs have in the area of the joining leg or staple crown, which connects the two legs of an unused staple with a constant distance to each other. Staples which are deformed and have a wedge-like form often cause cracks in the material. According to the invention, the force means acts on the fastener, preferably when and also after the fastener driving element strikes the fastener and before the fastener completely leaves the channel. The force means acts hereby on the fastener in a manner, in which the force which is executed by the force means counteracts a possible deformation of the fastener. The force means, which acts on the fastener within the channel, stabilize or at least supports to stabilize the required geometrical form of the fastener.

[0012] In a preferred embodiment of the invention and in connection with staples as fasteners, the force means acts in a manner in which by means of the force of the force means a non-parallel orientation of the two legs is at least reduced, preferably at least essentially undone or prevented. After the force has acted, resp. during the force of the

force means acts on the staple the two originally parallel to each other orientated legs of the staple, which tends to lose their parallel orientation, holds preferably at least approximately its original form, in which the two legs are orientated parallel or at least nearly parallel to each other.

[0013] In a preferred embodiment of the invention the force means acts a force on the fastener which is transferred to the fastener in a contactless manner. This doesn't exclude that a contact between the force means and the fastener takes place, but it means that the respective force of such embodiments can in principle be acted on and transferred to the fastener without having contact with the fastener. In principle, such forces of a force means which counteracts the deformation caused by the driver blade, can be different kind of forces. In a preferred embodiment a magnetic force is used in which a magnetic force means should be arranged in a manner in the fastener driving tool, in which a magnetic force acts in the area of the channel of the fastener driving tool. This force should act at least - with respect to the longitudinal passage of the channel - in a part of the channel. Said force should preferably pull or push at least a part of the fastener back and/or hold the fastener in its originally form. In case of staples as fasteners the magnetic force should act on the two legs in order to pull it back to and/or to hold it in its original parallel geometrical shape and orientation. The force means can in a very advantageously manner act together with walls of the channel, which can limit the movement of the legs of the staple resulting from the force of the force means. Said movement is directed at least approximately transverse to the movement of the fastener through the channel. Therefore the width of the channel, particularly in the area where the force means are arranged, should correlate with the width of the fastener, preferably the staple, and where the force causes at least one leg, preferably both or all legs, of the fastener to contact the respective wall which is adjacent to the respective leg. The at least one wall of the channel stops the movement of the part of the fastener which is by means of the force hold in or brought back into its original position. The force means can be a part of the wall of the channel and can limit by itself the possible movement of the staple legs which might follow from the force of the force means.

[0014] Instead of a magnetic means which produce such forces which act on the fastener during its way through the channel, also other kind of force means can be used in connection with the invention. Such an alternative kind of force means can be for example an inductance means which can produce in the area of the channel at least one inductive field. Like the at least one magnetic field such an inductive field can work as field of force. In connection with an electrically conductive fastener a force can hereby produced which counteracts a possible deformation of the fastener.

[0015] Further aspects and preferred embodiments are disclosed in the following detailed description, drawings and claims. A possible embodiment of the invention will be described, by way of example only, with reference to the accompanying drawings. These drawings show in a schematical illustration:

Fig. 1 the fastener driving tool according to the invention in a lateral view;

Fig. 2 a schematic illustration of a built in unit of a fastener driving tool for a stationary stapling machine in a front view, showing a rear nozzle plate guide for building a channel of fastener driving tool;

Fig. 3 a schematic illustration of a mobile fastener driving tool of Fig. 1 in a rear view, showing a front nozzle plate guide of a channel of fastener driving tool;

Fig. 4 an enlarged view of the channel as shown in Fig. 2 and Fig. 3;

Fig. 5 a schematic illustration in a front view of a staple between two magnets of the channel in which the magnetic fields, which are generated by the magnets, are schematically shown;

Fig. 6 the fastener and magnets of Fig. 5 in a topview in which the magnetic fields which are generated by the magnets are schematically shown.

[0016] Fig. 1 shows a portable pneumatically actuated fastener driving tool 1, which are also named as staple tool. However, the invention is not limited to pneumatically driven and actuated fastener driving tools. In other embodiments as shown in the figures, also all possible other power supplies than pneumatic power supplies can be used in connection with the invention, particularly fastener driving tools which use electric energy.

[0017] The fastener driving tool has a housing assembly 2. The housing assembly 2 has a main housing portion 3 and a handle part 4, to which a hollow magazine assembly 5 for receiving a supply of fastener is connected. The handle part 4 and the magazine 5 assembly are aligned essentially parallel to each other, whereby the main housing portion 3 is orientated essentially perpendicular with respect to the handle part 4. The handle part 4 contains a not shown connection for an air supply. The magazine assembly 5 can be fastened and at and released from the housing 2.

[0018] A manually actuatable trigger assembly 10 is arranged in an intersection part between the handle part 4 and the main housing portion 3. The trigger assembly can for example be designed and work as described in EP 2 161 104

A1. The disclosure of EP 2 161 104 A1 is hereby incorporated herein by reference. The trigger assembly 10 can be actuated by a user of the tool by means of a trigger 11. A trigger valve acts as a barrier between a pressure reservoir for compressed air and a main valve of the tool (not shown). By actuating the trigger 11 the pressure reservoir can be connected by means of a hose to an external supply of compressed air. The trigger assembly 10 connects the pressure reservoir with a supply channel of the fastener driving tool. Particularly in other embodiments, in which other kinds of energy than compressed air is used for powering the fastener driving element resp. the fastener, also other functional principles of triggers can be used.

[0019] Fig. 2 shows a built-in unit of a fastener driving tool for a stationary machine in the production of framework of furniture. As can be seen in Fig. 2 said fastener driving tool is provided with a channel 15 in which for each shot one staple 16 can be introduced. Fig. 3 shows a mobile fastener driving tool, which can also be used in the production of furniture, and which is also provided with a channel 15. Also in this channel 15 a staple 16 can be introduced in the area of one end of the channel 15 and can be ejected at the other end of the channel 15. In the drawings of Fig. 2 and 3 a cover plate is not shown, which is attached to the rear nozzle plate of Fig. 2 resp. the front nozzle plate of Fig. 3 and which laterally closes the channel 15. The sidewalls of the channel 15 are part of a fastener driving track. In both cases of the preferred embodiments of Fig. 2 and 3, the staples 16 which can be shot out of the channel 15 by means of the fastener driving tool 1 shown in the drawings have a Π -form. For each shot the respective staple 16 can be introduced from a supply of staples 17 which is arranged in the magazine 5 and adjacent to the channel 15. For this introduction the channel is provided in the area of its upper end - with respect to the drawing - at the side of the supply of staples 17 with a recess 18 which corresponds with the Π -form and the size of the staples 16. The staples 16 can therefore be introduced into the channel in an area adjacent to the fastener driving element, which is in case of the embodiment of the drawings a driver blade 19. In Fig. 2 and 3, the driver plate is shown in its upper dead center position resp. slightly below said position.

[0020] In the preferred embodiments which are shown in the Fig. 1-6, the channel 15 is in each case built by a plate guide, particularly a rear nozzle plate guide 21 (Fig. 2) or a front nozzle plate guide 22 (Fig. 3), and a cover plate, which is added to the respective. The cover plate is not shown in Fig. 2 and also not in Fig. 3. The respective rear nozzle plate guide 21 or front nozzle plate guide 22 is joined at its respective flat surface 23 with the respective cover plate. Both plate guides 21, 22 are (in each case) provided with a groove 24 which runs along the whole length of each plate guide 21, 22. Each groove 24 is open at the side of the flat surface 23 of the respective plate 21, 22 and at their upper and lower front sides 26, 27. So the respective plate guide 21 or 22 with the mounted cover plate builds a straight channel 15 which is open at its both ends. At one end - in Fig. 2 and 3 the upper end - the driver blade 19 is introduced into the channel and said driver blade 19 can be moved within the channel 15 along its idle stroke. The length of the channel 15 is considerably longer than the stroke of the driver blade 19.

[0021] As can be seen in the enlarged illustration of the channel 15 in Fig. 4, which represents both embodiments of Fig. 2 and of Fig. 3, the channel 15 is provided at two sides, which are opposed to each other, with a recess 30. The two sides are - with respect to the cross section of the channel 15 - the smaller sides of the at least essentially rectangular cross section. The recesses 30 are arranged at sides 31, 32 of the channel where the legs 33, 34 of a staple 16 are arranged when the staple 16 is introduced into the channel 15. Further, the two recesses 30 are located in positions where the legs 33, 34 of the staples 16 pass the channel 15 by its straight movement through the channel 15. In each of the two recesses 30 are two magnets 36, 37, 38, 39 arranged. As can be seen particularly in Fig. 4 the two magnets 36, 37 and 38, 39 of each recess 30 are aligned with their longitudinal direction one after the other, so that all four magnets 36-39 are arranged parallel to each other. In the preferred embodiment four ferromagnetic magnets 36-39 are used. In this preferred embodiment neodym magnets are used, but in principle also all other kinds of magnets and geometrical shape can be used. In the preferred shown embodiments, the magnets 36-39 have rectangular cross section and a longitudinal extension parallel to the longitudinal extension of the channel. The preferable flat surface 36a, 37a, 38a, 39a of each magnet 36-39, with which each magnet limits the width of the channel 15, can in a preferred embodiment of the invention jut with respect to a lower surface 15a of the channel at the same side of the channel with a minor degree into the channel. This can help to avoid that in the area of the transition between the lower magnets 37, 39 and the lower surfaces 15a of the channel a staple can be blocked by the walls of the channel 15.

[0022] It is hereby preferred that the magnets/recesses 36-39; 30 are arranged with respect to the longitudinal direction of the channel 15 at positions where the free ends and a lower part of the legs 33, 34 are positioned after the staple 16 is introduced into the channel 15 and before it is hit by the driver blade 19. The arrangements of the magnets 36-39 at both sides, which are preferably identical, have hereby a length - with respect to the longitudinal axis 15b of the channel - which extends over the free ends of the respective staple 16. Each of the at least symmetrically - with respect to the longitudinal axis 15b of the channel 15 - on both sides arranged magnets 36-39 have a length which is less than the length of the legs 33, 34 of the staple. Even the overall length of the magnets on each side of the channel is less than the length of each leg 33, 34. With respect to Fig. 4 the lower ends of the magnets 37, 39 have a shorter distance to the orifice outlet 40 of the channel 15 than the free ends of an introduced staple 16 in its position after its introduction into the channel 15 and before the driver blade 19 contacts the staple crown resp. the joining leg 35.

[0023] As can be seen in Fig 5 and 6 each single magnet 36, 37 and 38, 39 has at each long side of the channel 15, which is in alignment with one of the surfaces 15a of the channel, one of the two magnetic poles 44, 45. Preferably identical poles, for example south poles 44, 45, are facing therefore in the channel to each other and are in alignment with surfaces 15a. The opposite long side of each magnet 36, 38, which are therefore the long sides facing away from the channel 15 and surfaces 15a, is provided with the respective other magnetic pole of the magnet, in the shown embodiment the north poles 46, 47.

[0024] From this arrangement magnetic fields results which are schematically indicated in the front view and top view of Fig. 5 and 6 by ring segment lines. As can be seen, the magnetic fields of both magnets extend into the channel 15, at least where the legs 33, 34 pass the magnets 36, 38. The magnetic field of each magnet 36, 38 captures the respective leg 33, 34 and generates a magnetic force 50, 51 which acts on the legs 33, 34. Each leg 33, 34 is thereby pulled in a direction to the respective face of the magnet which is adjacent to the respective leg 33, 34. Since the distance of the two magnets 33, 34 corresponds essentially with the width of the fastener, the distance of the two legs is hold over their hole length constant, so that the legs maintain and retain their desired parallel orientation with respect to each other and also with respect to the longitudinal axis 15b of the channel 15.

[0025] As soon as the staple 16 is introduced into the channel 15, the magnets 36-39 exert a magnetic force on the legs 33, 34 of the staple 16. The contactless transferred magnetic force forces the legs 33, 34 to contact the magnets 36-39. By means of these magnetic forces 50, 51 the legs are pulled at least essentially opposed to each other and transverse to the longitudinal axis 15b of the channel against at least one of the magnets 36, 37; 38, 39, which is adjacent to the respective leg 33, 34 of the staple. The respective leg 33, 34 is hereby pulled away from the respective other leg 33, 34 of the staple. The II-form has therefore the tendency to be widened, that means that as a result of the magnetic forces which acts on each of the legs 33, 34, increases the distance of the free ends of the two legs 33, 34 until the legs contacts the walls of the channel 15 at the respective side of the magnets or the magnets 36-39 itself. The magnetic force is hereby also used in order to align the legs at least essentially parallel to the longitudinal direction of the channel 15 and parallel to each other.

[0026] After the respective one staple 16 is introduced and aligned in the described manner, the ejection of the staple 16 can take place and can be started. Therefore the activation of the trigger 11 leads in a principle already prior known manner to an acceleration of the driver blade 19. The driver blade 19 hits hereby on its straight moving way the joining leg 35 with its contact surface, which is orientated parallel to the joining leg 35 of the staple 16. The driver plate 19 transfers energy to the fastener and starts to push the staple 16 in direction to the outlet 40 of the channel 16. When the driver plate 19 arrives its bottom dead center and when the driver plate 19 loses contact to the staple 16, the impetus, which has been transferred from the drive plate 19 to the staple 16, results in a continued movement of the staple 16 within the channel 15 and that the staple leaves the channel through the outlet 40. The staple intrudes than the respective materials 41, on which the nozzle 42 of the fastener driving tool 1 is arranged and connects these materials with each other.

[0027] During this process of movement and ejecting of the staple 16, the staple is influenced by the magnetic forces at least as long as a part of the staple 16 is arranged directly adjacent to the magnets 36-39 in an area in which the magnetic forces acts onto the staple. At the beginning of said movement, when the driver plate 19 starts to contact the joining leg 35 of the staple, the magnetic forces of the magnets 36-39 support to stabilize the geometric form of the staple 16, namely the II-form. The contactless transferred magnetic forces hold the legs 33, 34 in their at least essential parallel orientation with respect to the longitudinal direction 15b of the channel 15.

[0028] Contrary to prior known fastener driving tools, the magnetic forces which act on the staple 16 when the driver blade 19 strikes the joining leg 35, avoid that as a result of the force of the driver blade 19 which acts to the staple 16 can deform the staple, particularly that this force of the driving plate 19 can change the orientation of one or both legs 33, 34 of the staple. The driver plate 19 pushes the staple 16 and the staple 16 runs with its full length through the channel 15 and passes hereby also with its full length the magnets 36-39. As can be best seen in Fig. 4, the magnets 36-39 are arranged in such a longitudinal position of the channel 15, which ensures that at least the upper end of each of the legs 33, 34 - in the area of the joining leg 35 - is arranged adjacent to one of the magnets at each side of the channel, when the staple starts to leave the channel 15. Therefore, from its starting position in the area of the upper end of the channel 15 on its way to the orifice outlet 40 where the legs 33, 34 starts to leave the channel 15, in preferred embodiments at least a part of each of the legs 33, 34 can be arranged adjacent to at least one of the magnets 36-39 of each channel side, at least until the free ends of the legs 33, 34 starts to leave the channel 15 and starts to be introduced into the material 41. As a result, the geometric form is stabilized by magnetic forces at least as long as the driver blade is in contact with the staple. In the preferred embodiments of the invention according to Fig. 2-6, the magnetic forces of the magnets 36-39 influence therefore the legs 33, 34 of the staple 16 during their complete track through the channel. However, the part of the legs 33, 34, on which the respective currently highest magnetic force acts, changes according to the respective position of the staple in the channel. Initially, an area of the free ends of the legs 33, 34 is biased with the highest magnetic force which is generated by the magnets 36-39 and according to the feed motion of the staple, this position moves continuously to the ends of the legs 33, 34, which are connected to the joining leg 35. Therefore, at least during this time where different areas of the staple passes the magnets 36-39, the two legs 33, 34 are biased with

forces which pulls the legs 33, 34 in opposite orientation and directions against the opposite walls of channel 15.

Reference numerals

5 [0029]

	1	Fastener driving tool	30	Recess
	2	Housing assembly	31	Channel side
	3	Housing portion	32	Channel side
10	4	Handle part	33	Leg
	5	magazine	34	Leg
	10	Trigger assembly	35	Joining leg
	11	Trigger	36	Magnet
15	15	Channel	37	Magnet
	15a	Surface	38	Magnet
	15b	longitudinal axis	39	Magnet
	16	Staple	40	Orifice outlet
	17	Supply of staples	41	Material
20	18	Recess	42	nozzle
	19	Driver blade	44	South pole
	21	Rear nozzle plate guide	45	South pole
	22	Front nozzle plate guide	46	North pole
25	23	Flat surface	47	North pole
	24	Groove	48	Magnetic field
	25	Lower front side	49	Magnetic field
	26	Upper front side	50	Magnetic force
	27	Lower side	51	Magnetic force
30	28			

Claims

- 35 1. A method for driving a fastener into material, whereby the fastener has at least one leg portion and is arranged within a channel, which is provided with an orifice outlet, the fastener is accelerated by means of a fastener driving element which transfers energy to the fastener so that the fastener moves within the channel into the direction of the orifice outlet of the channel, the at least one leg portion of the fastener which is intended to be introduced into the material has hereby a desired orientation which runs at least essential parallel to the longitudinal direction of the channel, **characterized in that** the fastener is on its way through the channel influenced by a force which is acted by a force means in order to orientate the staple within the channel (15) in a predetermined manner and/or to counteract a deformation of the fastener.
- 40
- 45 2. A method according to claim 1, **characterized in that** the force means acts at least along a part of the longitudinal extension of the channel (15).
- 50 3. A method according to one or both of the preceding claims 1 and 2, **characterized in that** the force brings or holds the at least one leg portion which as a linear extension in an orientation parallel to the longitudinal extension of the channel
- 55 4. A method according to at least one of the preceding claims, **characterized in that** at least one magnetic force acts on the fastener on its way through the channel.
5. A fastener driving tool for driving a fastener into material comprising a fastener driving element (19), which is movable within a channel (15), said fastener driving element (19) is provided for driving fasteners which are successively feedable from a magazine assembly (5) into a fastener driving track build by means of the channel (15), whereby the fastener can be arranged in said channel of said pneumatic fastener tool, in order to be moved by

means of said fastener driving element (19) which is able to transfer a driving movement to the fastener for moving said fastener through said channel in a direction to an orifice outlet of said channel (15) and for ejecting said fastener through said orifice outlet (40); **characterized in that**

a force means is arranged, which is able to exert a force to the fastener on the way of the fastener through the channel in order to orientate the staple within the channel (15) in a predetermined manner and/or to counteract a deformation of the fastener.

6. A fastener driving tool according to claim 5, **characterized in that** the force is in a contactless manner exerable to the fastener.

7. A fastener driving tool according to at least one of the preceding claims 5 or 6, **characterized by** a force means which is arranged in an area between an upper dead center of the fastener driving element (19) and the orifice outlet (40) of the channel (15).

8. A fastener driving tool according to at least one of the preceding claims 5 to 7, **characterized in that** the force means is arranged in a fixed manner in the area of the channel (15).

9. A fastener driving tool according to at least one of the preceding claims 5 to 8, **characterized in that** the force means is arranged in the area of two opposite sides of the channel (15).

10. A fastener driving tool according to at least one of the preceding claims 5 to 9, **characterized by** at least two plate means, which are assembled to each other and which builds said channel between each other, whereby said force means, which is able to exert a force to the staple, is arranged in at least one of the plate guides.

11. A fastener driving tool according to at least one of the preceding claims 5 to 10, **characterized in that** said means which is able to exert a force to the fastener is arranged laterally to the channel, preferably in a broadening part of the channel.

12. A fastener driving tool according to at least one of the preceding claims, **characterized by** a force means, which is arranged with respect to a longitudinal direction of the channel (15) between said driving fastener element in its upper dead center position and the outlet of the channel (15).

13. A fastener driving tool according to one of the preceding claims 5 to 11, **characterized by** said means which is able to exert a force to the staple, is provided with a magnetic means which exerts a magnetic force to the fastener on the way of the fastener through the channel (15).

14. A fastener driving tool according to one of the preceding claims 5 to 12, **characterized in that** a housing assembly (2) including a main housing portion (3) and a handle portion (4) extending from the main housing portion (3), whereas a trigger assembly (10) having an actuatable trigger (11) for activating a movement of a fastener within the channel (15) and of an ejection of the fastener, whereby the fastener can be arranged in said channel of said pneumatic fastener tool, in order to be moved by means of said fastener driving element (19) which is able to transfer a driving movement to the fastener for moving said fastener through said channel in a direction to an orifice outlet of said channel (15) and for ejecting said fastener through said orifice outlet (40);

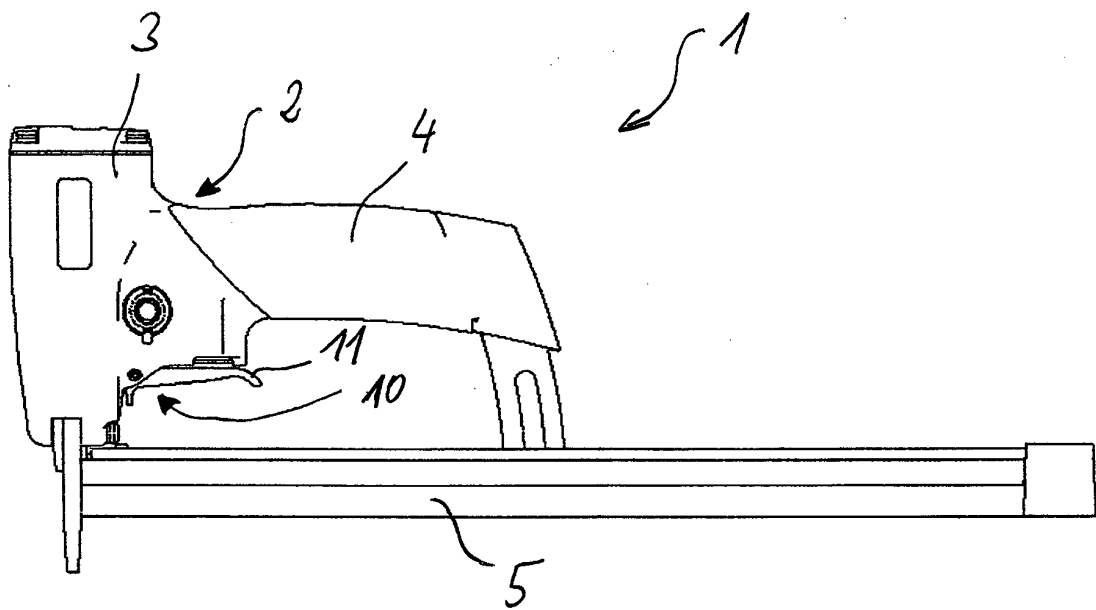


Fig. 1

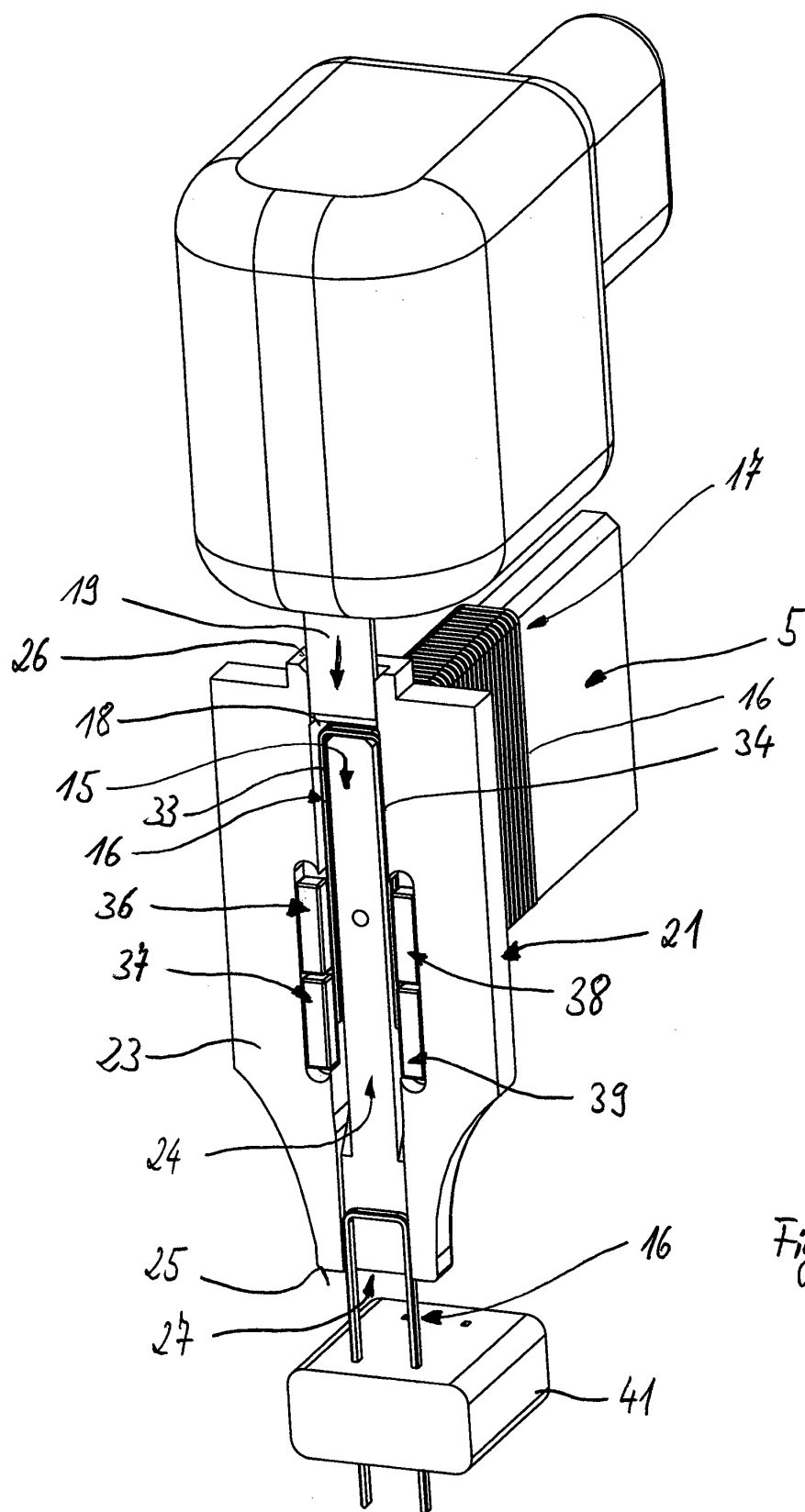
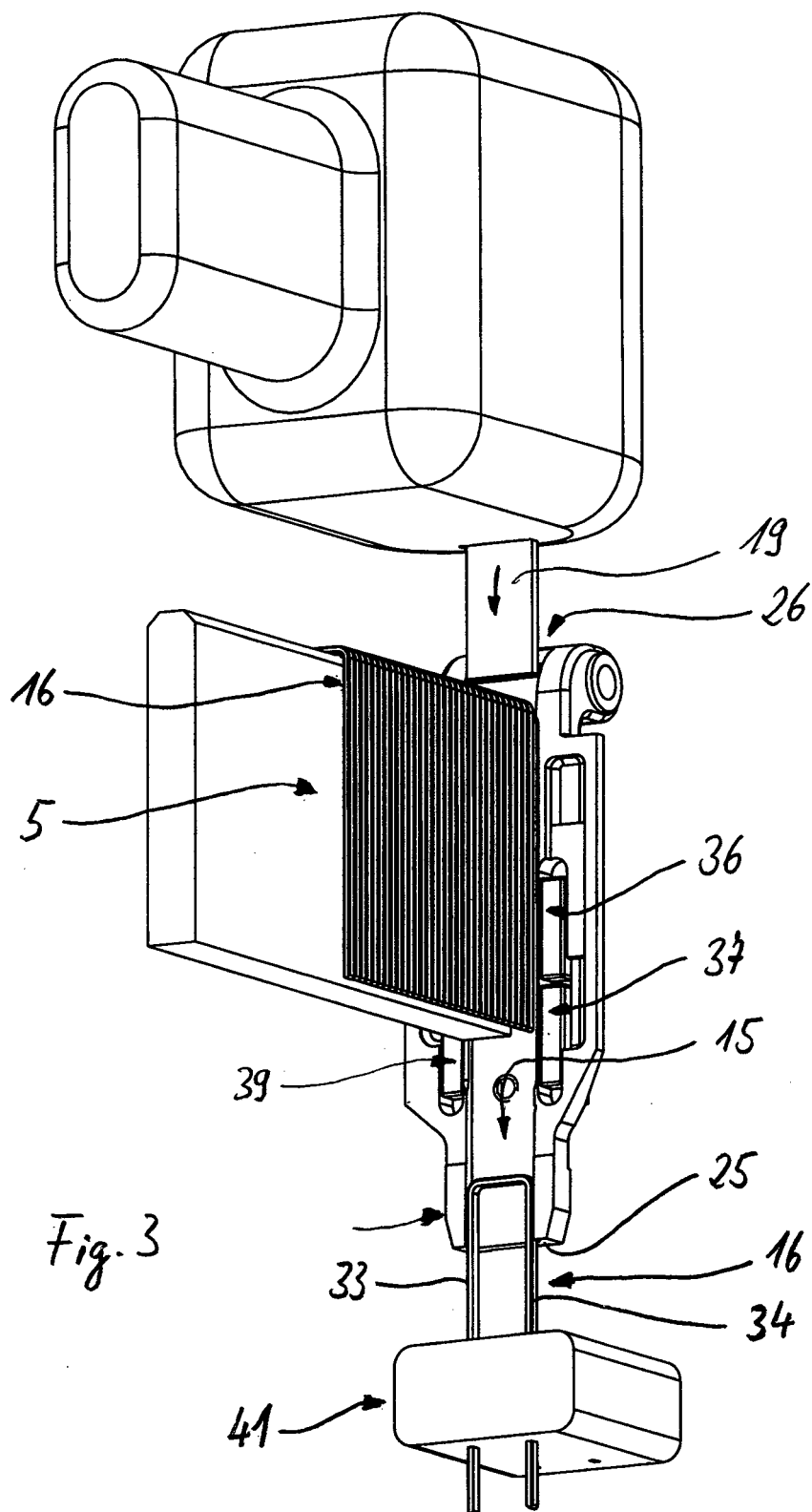
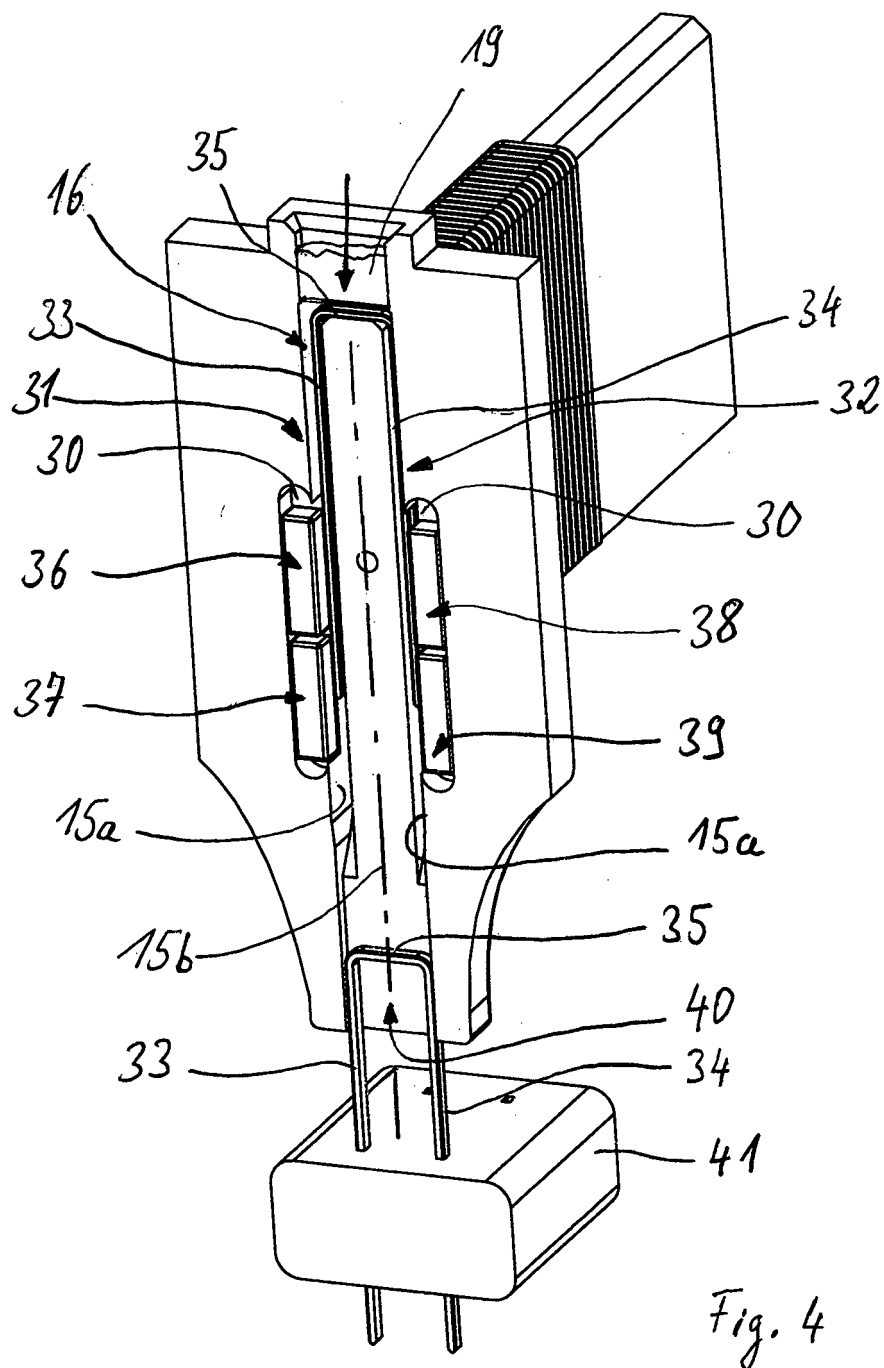
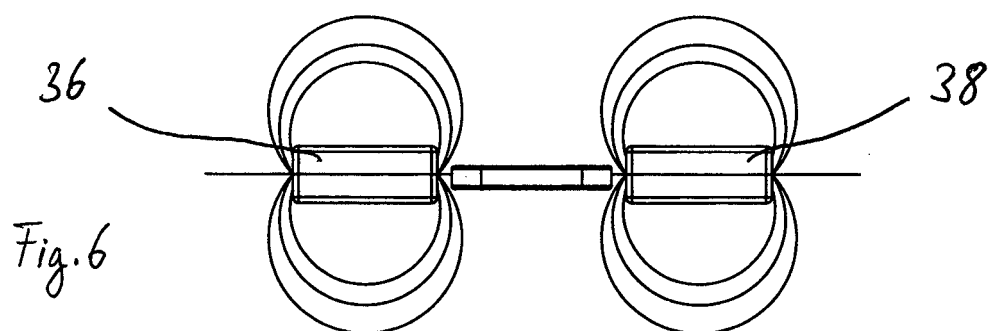
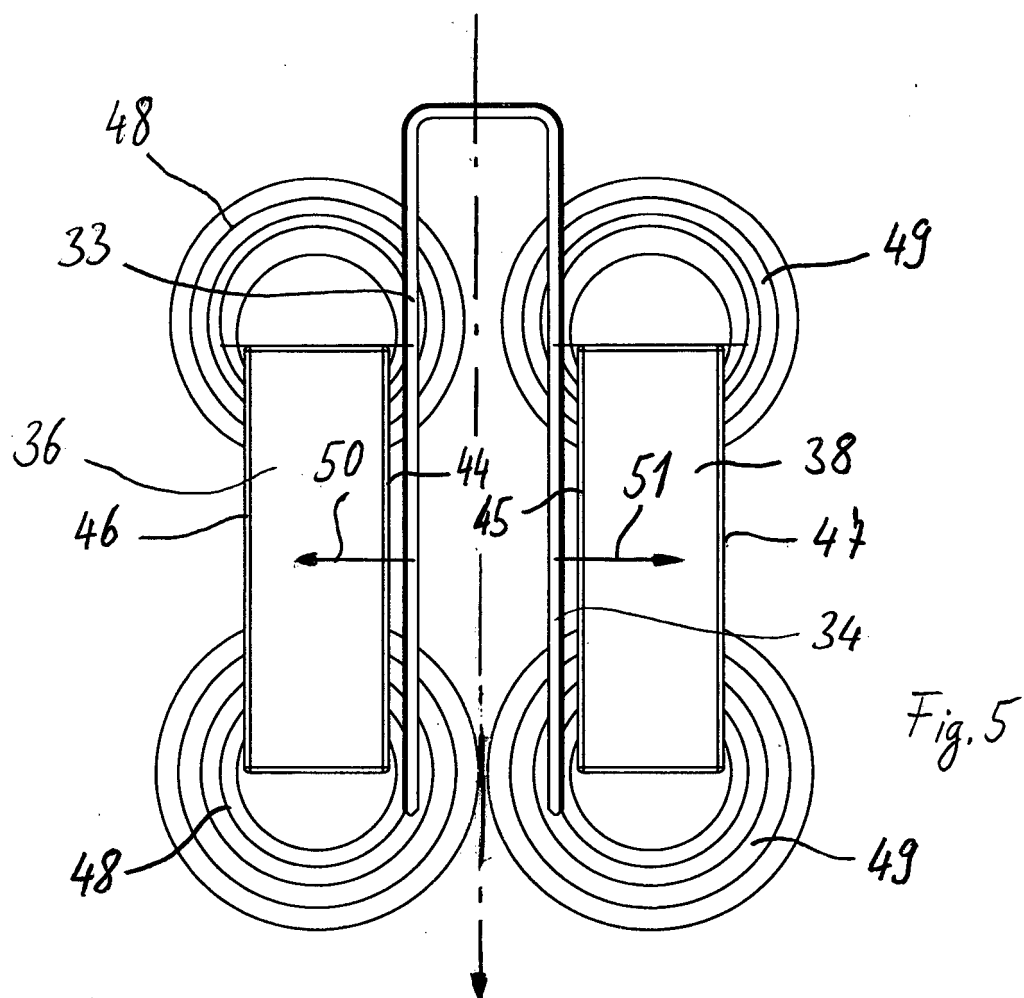


Fig. 2









EUROPEAN SEARCH REPORT

 Application Number
EP 13 00 4185

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	US 3 510 043 A (LARSON CHARLES O) 5 May 1970 (1970-05-05) * column 2, line 63 - column 3, line 44 * * column 6, line 8 - line 65 * * claims 1, 8 * * figures *	1-14	INV. B25C1/04 B25C5/16
X	US 4 389 012 A (GRIKIS RAIMONDS ET AL) 21 June 1983 (1983-06-21) * column 8, line 55 - column 9, line 47 * * figures *	1-14	
X	DE 31 32 451 A1 (HILTI AG [LI]) 24 February 1983 (1983-02-24) * page 4 - page 5 * * page 8 * * figures *	1-14	
X	US 6 851 594 B1 (HUANG SIU-TSAI [TW]) 8 February 2005 (2005-02-08) * column 4, line 47 - line 58 * * claims 1, 5 * * figures *	1-8,10, 12-14	TECHNICAL FIELDS SEARCHED (IPC) B25C
X	US 2003/146262 A1 (HWANG SHIN-LEEI [US] ET AL) 7 August 2003 (2003-08-07) * paragraph [0005] * * paragraph [0017] - paragraph [0018] * * claim 2 * * figures *	1-8,10, 12-14	
X	DE 26 23 105 A1 (GOETZ RUDOLF) 1 December 1977 (1977-12-01) * page 6, paragraph 2 * * page 9, paragraph 3 - paragraph 4 * * page 10, paragraph 2 * * figures *	1-8,10, 12,13	
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 5 March 2014	Examiner van Woerden, N
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 13 00 4185

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.

05-03-2014

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 3510043	A	05-05-1970	NONE
US 4389012	A	21-06-1983	NONE
DE 3132451	A1	24-02-1983	DE 3132451 A1 24-02-1983
		JP 55840276 A	09-03-1983
		SE 8204672 A	12-08-1982
US 6851594	B1	08-02-2005	NONE
US 2003146262	A1	07-08-2003	NONE
DE 2623105	A1	01-12-1977	NONE

EPO FORM P0459

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

REFERENCES CITED IN THE DESCRIPTION

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

Patent documents cited in the description

- EP 2161104 A1 [0018]