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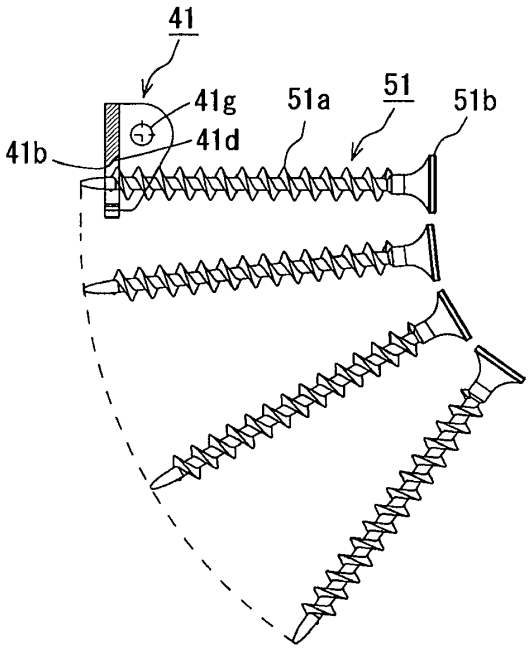
## (54) Screw guide structure of screw driver for collated screws

(57) A screw guide structure of a screw feeding mechanism of a screw driver (10) is provided. The screw feeding mechanism is configured to sequentially feed collated screws (50) to a driving position. The collated screws (50) are plurality of screws (51) connected by a connecting band (52). The screw guide structure includes a base part (24), a nose member (30) provided on a distal end of the base part (24) in a slidable manner, and a straight-driving guide member (41) supported by the nose member (30) in a displaceable manner so as to guide a screw (51) fed by the screw feeding mechanism to be in a straight posture. The straight-driving guide member (41) has a concave guide groove (41b) configured to guide a shaft (51a) of the screw (51). The straight-driving guide member (41) is configured and arranged such that the shaft (51a) of the screw (51) is engaged into the guide groove (41b) when the screw (51) is fed by the screw feeding mechanism, and such that the straight-driving guide member (41) is displaced when a head (51b) of the screw (51) passes by driving the screw (51) engaged into the guide groove (41b).

FIG. 8

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## Description

### Technical Field

**[0001]** The invention relates to a guide structure configured to guide a screw to be in a straight posture in a screw driver having a screw feeding mechanism that sequentially feeds collated screws to a driving position, the collated screws being a plurality of screws connected by a connecting band.

### Background Art

**[0002]** Screw drivers are generally configured such that a nose part is pushed in when pressed onto a workpiece, and in conjunction with this pushing-in operation, a feeding operation of collated screws and a driving operation of the collated screws are performed. JP2008-119789A discloses an example of such a screw driver having a screw tilt preventing mechanism configured to prevent a screw from tilting. The screw tilt preventing mechanism has a pair of tilt members and causes a screw to pass through a hole formed between the tilt members to guide the screw so as to be perpendicular to a workpiece to prevent the screw from tilting.

**[0003]** With a screw driver for collated screws, when the nose part is vigorously pressed onto the workpiece, a speed of pressing the machine becomes faster and a speed of the screw feeding becomes also faster, so that there may be a feeding failure in which the screw is excessively fed beyond an appropriate position due to inertia. When the driving operation is performed in this state, because a shaft of a driver bit and a shaft of the screw are not aligned with each other, the screw is obliquely driven or a distal end of the driver bit does not capture a screw hole and the screw may fly off.

**[0004]** This problem cannot be addressed by the screw tilt preventing mechanism disclosed in JP2008-119789A. That is, since the screw tilt preventing mechanism of JP-2008-119789A does not guide a posture of the screw before the driving operation, excessive feeding of the screw cannot be prevented. When the driving operation is performed with the screw being excessively fed and thus oblique, the screw is driven to hit one of the tilt members, instead of passing between the pair of tilt members, so that the screw may be obliquely driven without suitably being guided by the hole between the tilt members or the screw may come out.

**[0005]** Also, the screw tilt preventing mechanism is provided at both sides with hinges and has a box shape. However, with the box-shaped the screw tilt preventing mechanism, it is difficult to check a driving position and it is troublesome to remove the screw when the screw is jammed.

### Summary of Invention

**[0006]** An object of the invention is to provide a guide structure of a screw feeding mechanism of a screw driver in which collated screws are prevented from being excessively fed due to inertia so that a screw is guided to be in a straight posture, and in which the screw can be easily removed when it is jammed.

**[0007]** According to a first aspect of the invention, a screw guide structure of a screw feeding mechanism of a screw driver is provided. The screw feeding mechanism is configured to sequentially feed collated screws to a driving position. The collated screws are plurality of screws connected by a connecting band. The screw guide structure includes a base part, a nose member provided on a distal end of the base part in a slidable manner, and a straight-driving guide member supported by the nose member in a displaceable manner so as to guide a screw fed by the screw feeding mechanism to be in a straight posture. The straight-driving guide member has a concave guide groove configured to guide a shaft of the screw. The straight-driving guide member is configured and arranged such that the shaft of the screw is engaged into the guide groove when the screw is fed by the screw feeding mechanism, and such that the straight-driving guide member is displaced when a head of the screw passes by driving the screw engaged into the guide groove. The guide groove has, for example, a U shape.

**[0008]** According to a second aspect of the invention, the straight-driving guide member is supported in a rotatable manner by a pivot shaft arranged in a direction perpendicular to a driving direction of the screw and perpendicular to a direction in which the screw is fed by the screw feeding mechanism.

**[0009]** According to a third aspect of the invention, a bottom portion of the guide groove is inclined in a tapered form.

**[0010]** According to a fourth aspect of the invention, the straight-driving guide member is supported by a pair of pivot shafts aligned on the same axis, such that the screw is allowed to pass between the pair of pivot shafts.

**[0011]** According to the first aspect of the invention, the straight-driving guide member has the concave guide groove configured to guide the shaft of the screw, and when the screw is fed by the screw feeding mechanism, the shaft of the screw is engaged into the guide groove, and when the screw engaged into the guide groove is driven and a head of the screw passes, the straight-driving guide member is displaced. That is, since the fed screw is received by the guide groove and a posture of the screw is guided, the posture of the screw can be guided before the driving of the screw. Because the screw is already guided to be in a straight posture before the driving, it is possible to guide the screw to be in a straight posture by preventing the screw from being excessively fed due to the inertia. Also, since the screw is continuously guided to be in a straight posture during the driving, it is possible to maintain the favorable straightness until the end. When the head of the screw passes, since the straight-driving guide member rotates in a displaceable

direction to open the way for the head of the screw, it is possible to allow the head of the screw to pass without any problem.

**[0012]** Also, since the posture of the screw is guided by the cantilever straight-driving guide member, it is not necessary to form a guide portion into a box shape. Thus, when removing the collated screws that is being used to replace a screw to be used, it is possible to smoothly pull out the collated screws. Also, since it is possible to easily see and check an interior of the mechanism and to easily put fingers therein, when the screw is jammed, it is possible to easily perform a screw removing operation. Also, since the guide portion is not formed into a box shape, it is possible to make a machine tip small, so that it is possible to easily aim at a target upon a screwing operation.

**[0013]** According to the configuration disclosed in JP-2008-119789A, the screw is guided by the hole formed by the pair of tilt members. Therefore, the shaft of the screw cannot be guided along with the feeding operation. That is, the shaft of the screw needs to be arranged such that the distal end of the screw oriented to be inserted into the hole between the pair of tilt members during the driving operation. Therefore, it is necessary to provide a certain space between the tilt members and the screw in the driving direction of the screw. This requires that the tilt members be provided in front of the screw, so that the nose part becomes long. In contrast, according to the invention, since the shaft of the screw is received by the straight-driving guide member, it is not necessary to provide length required to arrange the straight-driving guide member in front of the screw. Therefore, it is possible to shorten the nose member, thereby shortening the entire length of the machine. Also, since the structure is simple, it is possible to fabricate a member at low cost by, for example, press working and the like.

**[0014]** According to the second aspect of the invention, the guide member that guides a posture of the fed screw is supported by the pivot shaft arranged in the direction perpendicular to the feeding direction of the screw. Therefore, it is possible to securely hold the fed screw. When the head of the screw passes, the straight-driving guide member rotates in a displaceable direction to open the way for the head of the screw. Therefore, it is possible to allow the head of the screw to pass without any problem.

**[0015]** According to the third aspect of the invention, the bottom portion of the guide groove is inclined in a tapered form. Thus, when removing the collated screws by pulling up the connecting band to change the screw to be used, for example, the distal end of the screw pushes the tapered part to rotate the straight-driving guide member. Therefore, it is possible to easily remove the collated screws.

**[0016]** According to the fourth aspect of the invention, the straight-driving guide member is supported by the pair of pivot shafts aligned on the same axis. Therefore, it is possible to make a rotating arc of the straight-driving guide member small, thereby reducing the entire length of the machine.

## Brief Description of Drawings

**[0017]**

Fig. 1 is a perspective view of an outer appearance of a screw driver for collated screws.
Fig. 2 is a side view of the screw driver.
Fig. 3 illustrates an internal structure of a fastener supply device.
Fig. 4 is a perspective view of an outward appearance of a tip arm.
Fig. 5 is an exploded perspective view of the tip arm.
Fig. 6A is a plan view of the tip arm.
Fig. 6B is a side view of the tip arm.
Fig. 6C is a sectional view of the tip arm taken along the line C-C of Fig. 6A.
Fig. 7A is a plan view of a straight-driving guide member.
Fig. 7B is a front view of the straight-driving guide member.
Fig. 7C is a side view of the straight-driving guide member.
Fig. 7D is a rear view of the straight-driving guide member.
Fig. 7E is a bottom view of the straight-driving guide member.
Fig. 8 shows a relation between a screw and the straight-driving guide member during the feeding operation.
Figs. 9A to 9E show a relation between the screw and the straight-driving guide member when a screw head passes.
Fig. 10 shows a relation between the screw and the straight-driving guide member when removing the screws from the screw driver.
Fig. 11 illustrates an optimal position of a shaft hole of the straight-driving guide member.

## Detailed Description

**[0018]** An embodiment of the invention will be described with reference to the drawings. A screw driver 10 according to this embodiment uses collated screws 50, the collated screws 50 being a plurality of screws 51 connected by a connecting band 52. As shown in Figs. 1 and 2, the screw driver 10 has a tool main body 11 and a fastener supply device 20 mounted on the tool main body 11.

**[0019]** The tool main body 11 has a bit mounting part at a tip thereof that is covered by the fastener supply device 20, and a driver bit is mounted on the bit mounting part. When a trigger 13 of the tool main body 11 is pulled, a motor (not shown) that uses a battery 14 as a drive source is rotated. When a nose member 30 is pressed onto a workpiece while the motor is rotated, the nose member 30 is pushed in, so that the driver bit abuts the

screw 51 held at the nose member 30 and the driver bit is pushed in. Since the rotation of the motor is transmitted to the pushed-in driver bit, the driver bit is rotated, so that the screw 51 is driven into the workpiece tightened.

**[0020]** The fastener supply device 20 has a screw feeding mechanism that sequentially feeds the collated screws 50 to a driving position. As shown in Fig. 3, the fastener supply device 20 has a base part 21 fixed to the distal end of the tool main body 11, the nose member 30 provided at a distal end of the base part 21 in a slidable manner and a spring 40 biasing the nose member 30 in a protruding direction with respect to the base part 21.

**[0021]** The base part 21 is attached to the distal end of the tool main body 11. As shown in Fig. 3, the base part 21 has a square tube-shaped base casing 22, a plate-shaped guide member 24 fixed at an inner side of the base casing 22 and a magazine 23 fixed to a lower part of the base casing 22 and guides the collated screws 50.

**[0022]** As shown in Fig. 3, the nose member 30 has a base part 31 that can slide in the base casing 22 and a tip arm 32 that protrudes in a tip direction of the base part 31.

**[0023]** As shown in Figs. 1 and 3, a distal end of the base part 31 is formed with a holding recess 31a extending continuously in a vertical direction. The holding recess 31a is configured to allow the connecting band 52 of the collated screws 50 to pass therethrough such that, when feeding the collated screws 50, the connecting band 52 of the fed collated screws 50 is introduced through a lower opening of the holding recess 31a and goes through an upper opening thereof. Slits 31b are formed at the front and rear of the holding recess 31a. The driver bit is introduced into the holding recess 31a through the rear slit 31b and pushes out the screw 51 held in the holding recess 31a, and the pushed out screw 51 is struck out from the front slit 31 b.

**[0024]** The tip arm 32 is fixed to the distal end of the base part 31 and has a substantial L shape, when seen from a plan view. The tip arm 32 has a contact part 32a at a tip thereof. The contact part 32a abuts on the workpiece when the nose member 30 is pressed onto the workpiece. The contact part 32a of this embodiment is provided with a configuration of receiving a distal end of the screw 51 fed by the screw feeding mechanism and is formed with an ejection port 32b for driving-guiding the screw 51.

**[0025]** When driving the screw 51 by the screw driver 10 of this embodiment, the nose member 30 (the contact part 32a) is pressed onto the workpiece with the trigger 13 being pulled. By this operation, the nose member 30 is pushed into the base part 21. In conjunction with this operation, a feeding operation of the collated screws 50 and a driving operation of the collated screws 50 are executed.

**[0026]** The feeding operation of the screw 51 is executed by the screw feeding mechanism shown in Fig. 3. As shown in Fig. 3, the screw feeding mechanism has a pair of wheel members 33 supported by the base part 31 so as to be rotatable about an axis, a one-way clutch mechanism (not shown) configured to transmit a rotating force to the wheel members 33, a roller arm 37 connected to the one-way clutch mechanism and a roller 38 rotatably supported at a distal end of the roller arm 37.

**[0027]** The wheel members 33 are a pair of members rotatably supported in the nose member 30. An outer periphery of the wheel member 33 is formed with teeth, which are engaged with notches 52a of the connecting band 52 of the collated screws 50, at the same interval as the notches 52a. As shown in Fig. 3, the wheel member 33 is arranged at a position at which it is engaged with the notch 52a, and is configured to feed the collated screws 50 in an upper direction as it is rotated in a feeding direction (a clockwise direction in Fig. 3).

**[0028]** The one-way clutch mechanism is provided so as to rotate the wheel members 33 only in the feeding direction. The one-way clutch mechanism is configured so that when the roller arm 37 is moved in the feeding direction, the corresponding force is transmitted to the wheel members 33 and when the roller arm 37 is moved in a feeding-opposite direction, the corresponding force thereof is not transmitted to the wheel members 33.

**[0029]** When the nose member 30 is pushed in and slid, moving of the roller 38 is guided by the guide member 24. That is, as shown in Fig. 3, the guide member 24 has a guide portion 24a provided by forming a slot having substantially the same width as the roller 38, and the roller 38 is moved along the guide portion 24a. Since the guide portion 24a is obliquely inclined with respect to a pushing-in direction of the nose member 30, when the roller 38 is moved along the guide portion 24a, the roller arm 37 rotates. As the roller arm 37 rotates, a rotating force is generated and the screw feeding operation is executed using the rotating force. Specifically, when the nose member 30 is pushed in, since the roller arm 37 rotates in the feeding direction, the generated rotating force is transmitted to the wheel members 33 by the one-way clutch mechanism. Thereby, the wheel members 33 are rotated in the feeding direction, thereby feeding the collated screws 50 one by one.

**[0030]** When the driving operation is completed and the nose member 30 is separated from the workpiece, the nose member 30 is returned to a standby position by a biasing force of the spring 40. In conjunction with this operation, the roller 38 is returned to a position before the feeding operation along the guide portion 24a. At this time, although the arm member 37 rotates, this operation is not transmitted due to an operation of the one-way clutch, so that it does not influence the rotation of the wheel member 33.

**[0031]** In this embodiment, as shown in Fig. 4, a distal end of the tip arm 32 is formed with a receiving portion 32c. The receiving portion 32c is configured to receive the fed screw 51. Side walls 32d, which are provided at both sides of the receiving portion 32c, form a passage 32e through which a distal end of the screw 51 can pass.

A straight-driving guide member 41 is rotatably axis-supported by the side walls 32d. The straight-driving guide member 41 1 is configured to receive a distal end portion of the fed screw 51.

**[0032]** The straight-driving guide member 41 forms a guide structure configured to guide the leading screw 51 that is fed by the screw feeding mechanism to be in a straight posture. As shown in Figs. 7A to 7E, the straight-driving guide member 41 is a substantially C-shaped metallic member, when seen from a plan view, and has a central guide plate 41 a and side plates 41f perpendicularly extending from both sides of the guide plate 41a.

**[0033]** The guide plate 41 a is formed with a substantially U-shaped guide groove 41 b that opens in an approach direction of the screw 51. The guide groove 41 b is configured to guide a shaft 51a of the screw 51, and may have a concave shape other than the substantially U shape, such as a substantially V shape, a substantially C shape and the like. The concave shape can guide the shaft 51a of the screw 51 at least at two points. An opening 41c of the guide groove 41 b is enlarged and widened so as to easily put the screw 51 therein. A bottom portion 41d of the guide groove 41b is inclined in a tapered form (which will be described in detail later). A distance between the side portions 41e of the guide groove 41b is substantially the same as a width of the shaft 51a of the screw 51 so as to support the screw 51 from both sides. Because the guide groove 41 b is configured such that the shaft 51a of the screw 51 enters the inside of the concave shape, the screw 51 can be guided from a plurality of directions by the guide member 41.

**[0034]** The side plates 41f are respectively formed with shaft holes 41 g. A pair of pivot shafts 42 is inserted into the respective shaft holes 41g to rotatably support the straight-driving guide member 41. As shown in Figs. 4 to 6, the pair of pivot shafts 42 is respectively inserted into the shaft holes 41g with being aligned on the same axis and is also inserted into support holes 32f formed through the respective side walls 32d of the receiving portion 32c. A ring member 43 for separation prevention is attached to a distal end of the pivot shaft 42.

**[0035]** The two divided pivot shafts 42 are used, so that a space for enabling a head 5 1 b of the screw 51 to pass therethrough is formed between the pivot shafts 42. Accordingly, the screw 51 is allowed to pass between the pivot shafts 42, so that the pivot shafts 42 and the screw 51 (the guide groove 41 b) can come close to each other. Therefore, it is possible to make an entire length and a rotating arc of the straight-driving guide member 41 small, thereby shortening an entire length of the machine.

**[0036]** The straight-driving guide member 41 is biased to stand by at an initial position by a torsion spring 44. Specifically, the torsion spring 44 is engaged with a spring engaging part 41 h that is recessed on the side part of the straight-driving guide member 41. Thereby, the guide plate 41 a is urged to stand by at a position that is substantially perpendicular to a driving direction of the screw 51. At this initial position, when the leading screw 51 is fed by the screw feeding mechanism, the distal end portion of the shaft 51a of the leading screw 51 is engaged into the guide groove 41b, as shown in Fig. 8.

**[0037]** The tip arm 32 is configured so that an attachment position thereof to the base part 31 can be adjusted. Therefore, even when a screw length of the collated screws 50 to be used is changed, it is possible to securely guide the vicinity of the distal end of the fed screw 51 by the straight-driving guide member 41.

**[0038]** When the screw 51 is driven after the screw feeding operation, the screw 51 is vertically driven at a posture that the shaft 51a is guided by the straight-driving guide member 41. Then, when the head 51 b of the screw 51 hits the straight-driving guide member 41, the straight-driving guide member 41 rotates in a displaceable direction against the biasing force of the torsion spring 44 so as to allow the head 51 b of the screw 51 to pass through, as shown in Figs. 9A to 9E. Therefore, the screw 51 is guided at the same straight posture by the straight-driving guide member 41 from just after the screw 51 is fed until the head 51 b of the screw 51 passes.

**[0039]** According to the guide structure of this embodiment, since the bottom portion 41 d of the guide groove 41b is inclined in the tapered form, it is possible to slide and pull out the screw 51 along the inclination. Specifically, as shown in Fig. 10, when the collated screws 50 are upwardly pulled, the distal end of the screw 51 collides with the inclined bottom portion 41d of the straight-driving guide member 41 and is guided in a tilting direction. Also, since the force is applied to the straight-driving guide member 41 in the displaceable direction, the straight-driving guide member 41 rotates in the displaceable direction. Accordingly, the bottom portion 41d of the straight-driving guide member 41 is inclined, so that it is possible to smoothly remove the screw 51 from the screw driver 10.

**[0040]** In this embodiment, as shown in Fig. 11, an angle $\theta 1$ between a surface of the guide plate 41a and a plane passing through the bottom portion 41 d of the guide groove 41 b and the shaft hole 41 g is 45° or smaller. The angle is set in such a way, so that it is possible to vertically hold the screw 51 and to enable the straight-driving guide member 41 to easily rotate when the head 51 b of the screw 51 passes therethrough. That is, if the angle is excessively set to be large (for example, when the angle is 45° or larger, as shown with an angle $\theta 2$ of Fig. 11), when the screw 51 is fed to the straight-driving guide member, the straight-driving guide member 41 is easily rotated by a force applied in a direction of D2, and when the head 51 b of the screw 51 passes, the straight-driving guide member 41 is difficult to rotate by a force applied in a direction of D1. On the other hand, the angle is set to be small, like this embodiment, so that when the screw 51 is fed to the straight-driving guide member, the straight-driving guide member 41 is not rotated and the screw 51 can be thus vertically held even when the force is applied in the direction of D2, and when the head 51

b of the screw 51 passes, the straight-driving guide member 41 is rotated by the force applied in the direction of D1.

**[0041]** Also, since the guide groove 41b has the substantial U shape, the shaft 51a of the fed screw 51 is contacted to the bottom portion 41d. However, when the head 51 b of the screw 51 passes, the side portions 41 e of the guide groove 41b are contacted to the head 51 b. Due to a difference of distances to the pivot shafts 42 in each case, when the force is applied to the side portions 41e of the guide groove 41b while the head 51b of the screw passes, the straight-driving guide member 41 is caused to rotate by the smaller force, as compared with a case in which the screw 51 is fed and the force is thus applied to the guide groove 41 b.

**[0042]** As described above, according to the embodiment, the straight-driving guide member 41 has the substantially U-shaped guide groove 41b that guides the shaft 51a of the screw 51. When the leading screw 51 is fed by the screw feeding mechanism, the shaft 51a of the leading screw 51 is pushed into the guide groove 41 b, and when the leading screw 51 pushed into the guide groove 41b is driven and the head 51b of the leading screw 51 passes, the straight-driving guide member 41 rotates in the displaceable direction. That is, since the fed screw 51 is received by the substantially U-shaped guide groove 41 b and the posture of the screw 51 is thus guided, a posture of the screw 51 can be guided before the driving of the screw 51. Because the screw 51 is already guided to be in a straight posture before the driving, it is possible to guide the screw 51 to be in a straight posture by preventing the collated screws 50 from being excessively fed due to the inertia. Also, since the screw 51 is continuously guided to be in a straight posture during the driving, it is possible to maintain the favorable straightness until the end. When the head 51 b of the screw 51 passes, since the straight-driving guide member 41 rotates in the displaceable direction, it is possible to allow the head 51b of the screw 51 to pass without any problem.

**[0043]** Also, since the posture of the screw 51 is guided by the cantilever-shaped straight-driving guide member 41, it is not necessary to form the straight-driving guide member into a box shape. For this reason, since it is possible to easily check an interior of the mechanism with naked eyes and to easily put a hand therein, when the screw 51 is jammed, the corresponding screw can be easily removed. Also, since the straight-driving guide member is not formed into a box shape, it is possible to make a machine tip small, so that it is possible to easily aim at a target upon a screwing operation.

**[0044]** Also, since it is possible to receive the shaft 51 a of the screw 51 by the straight-driving guide member 41, it is not necessary to provide a length required to arranged the straight-driving guide member 41 in front of the screw 51. Therefore, it is possible to shorten the nose member 30, thereby shortening the entire length of the machine. Also, since the structure is simple, it is possible to fabricate a member at low cost by, for example, press working and the like.

**[0045]** Also, since the bottom portion 41d of the guide groove 41b is inclined in a tapered form, when separating the screw 51 from the machine, it is possible to pull out the screw 51 along the bottom portion 41 d inclined in the tapered form. Also, since the straight-driving guide member 41 rotates in conjunction with this operation, it is possible to easily remove the screw 51.

**[0046]** Also, the straight-driving guide member 41 is supported by the pair of pivot shafts 42 aligned on the same axis, so that the screw 51 is allowed to pass between the pair of pivot shafts 42. Therefore, it is possible to make a rotating arc of the straight-driving guide member 41 small, thereby further reducing the entire length of the machine.

## Claims

1. A screw guide structure of a screw feeding mechanism of a screw driver (10), the screw feeding mechanism being configured to sequentially feed collated screws (50) to a driving position, the collated screws (50) being a plurality of screws (51) connected by a connecting band (52), the screw guide structure comprising:

   a base part (24);
   a nose member (30) provided on a distal end of the base part (24) in a slidable manner; and
   a straight-driving guide member (41) supported by the nose member (30) in a displaceable manner so as to guide a screw (51) fed by the screw feeding mechanism to be in a straight posture,
   wherein the straight-driving guide member (41) has a concave guide groove (41b) configured to guide a shaft (51 a) of the screw (51), and
   wherein, the straight-driving guide member (41) is configured and arranged such that the shaft (51a) of the screw (51) is engaged into the guide groove (4 1 b) when the screw (51) is fed by the screw feeding mechanism, and such that the straight-driving guide member (41) is displaced when a head (51b) of the screw (51) passes by driving the screw (51) engaged into the guide groove (41 b).

2. The screw guide structure according to claim 1, wherein the straight-driving guide member (41) is supported in a rotatable manner by a pivot shaft (42) arranged in a direction perpendicular to a driving direction of the screw (51) and perpendicular to a direction in which the screw (51) is fed by the screw feeding mechanism.

3. The screw guide structure according to claim 1 or 2, wherein a bottom portion (4 1 d) of the guide groove (41 b) is inclined in a tapered form.

**4.** The screw guide structure according to any one of claims 1 to 3, wherein the straight-driving guide member (41) is supported by a pair of pivot shafts (42) aligned on the same axis, such that the screw (51) is allowed to pass between the pair of pivot shafts (42).

**5.** The screw guide structure according to claim 1, wherein the guide groove (41b) has a U shape.

*FIG. 1*

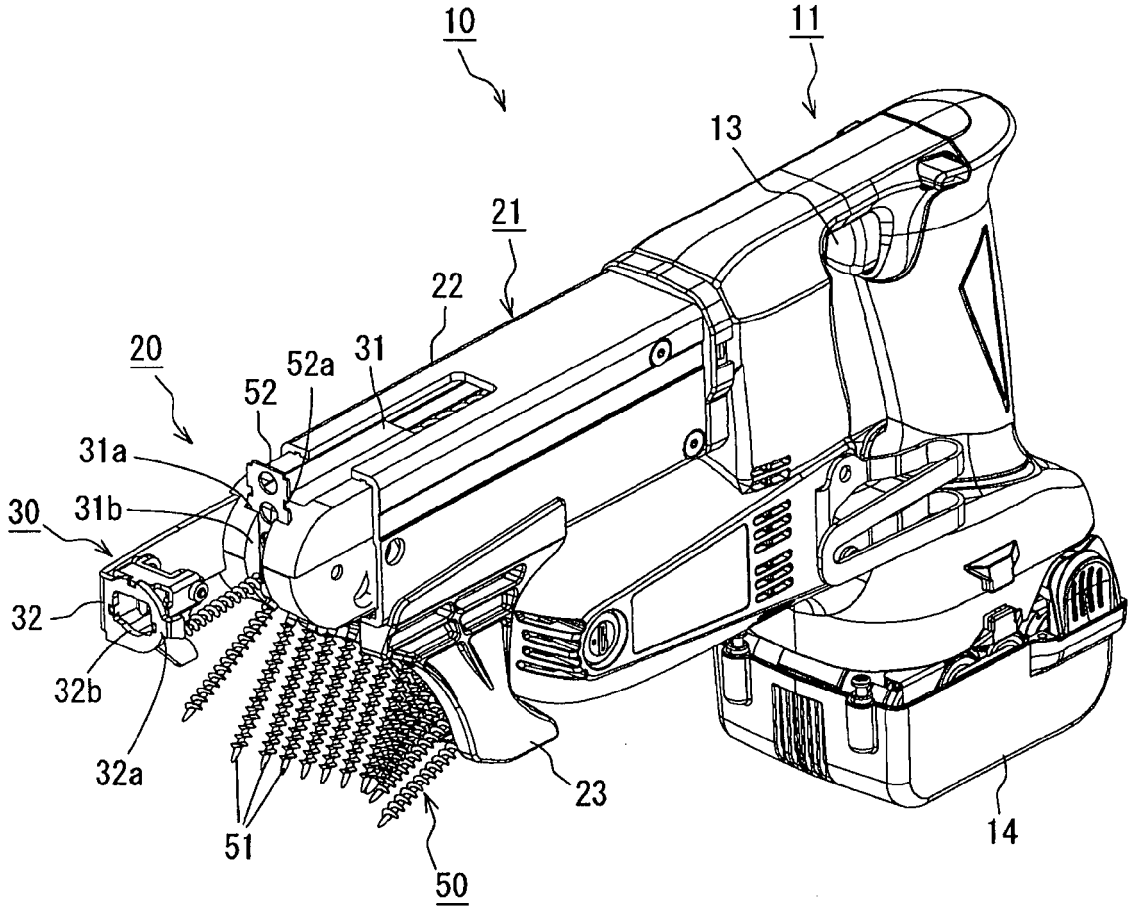


FIG. 2

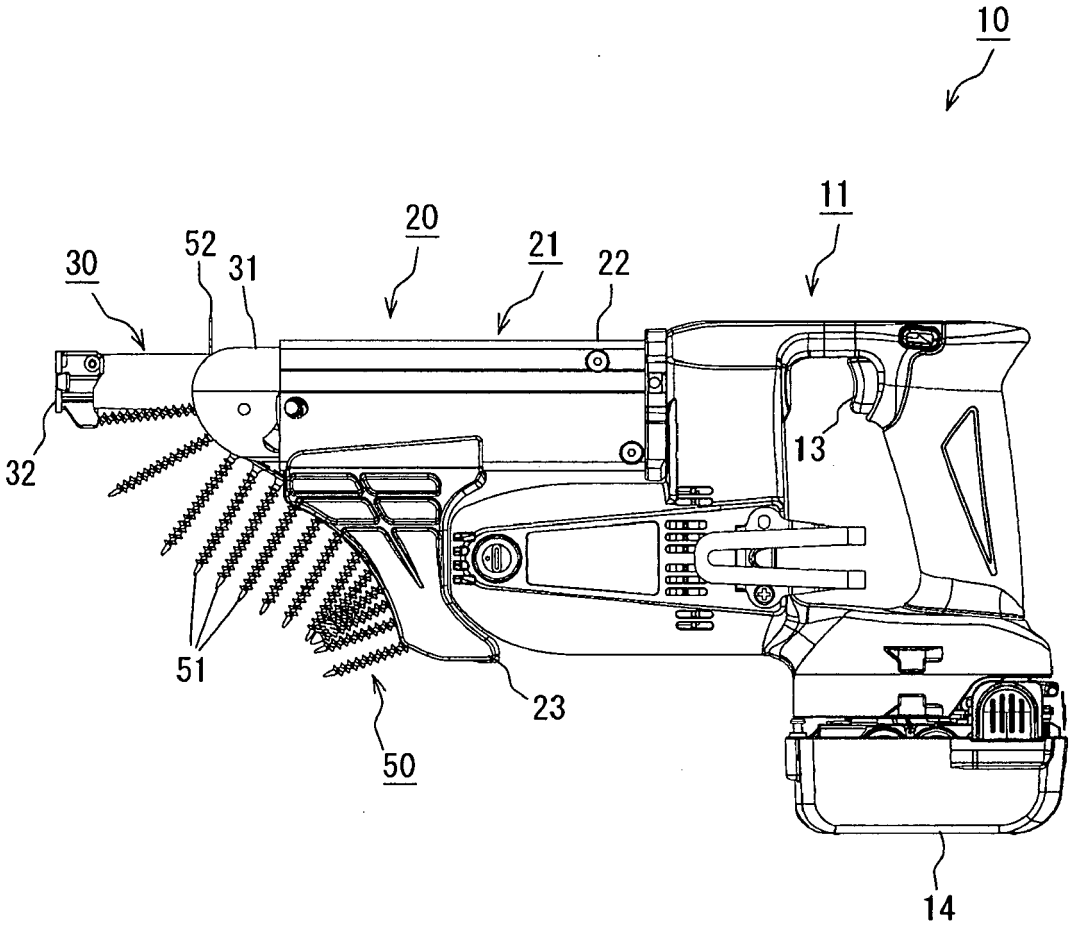


*FIG. 3*

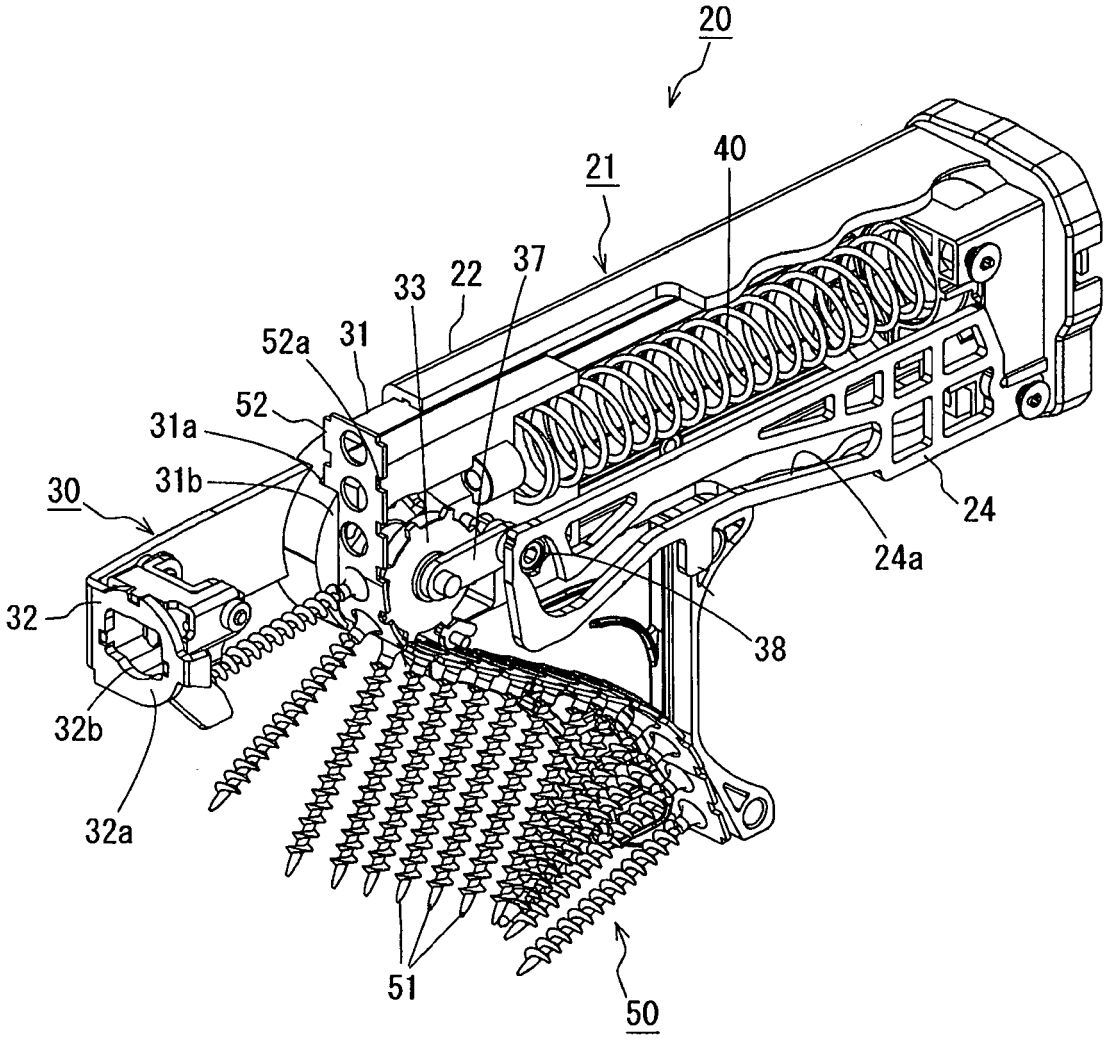


FIG. 4

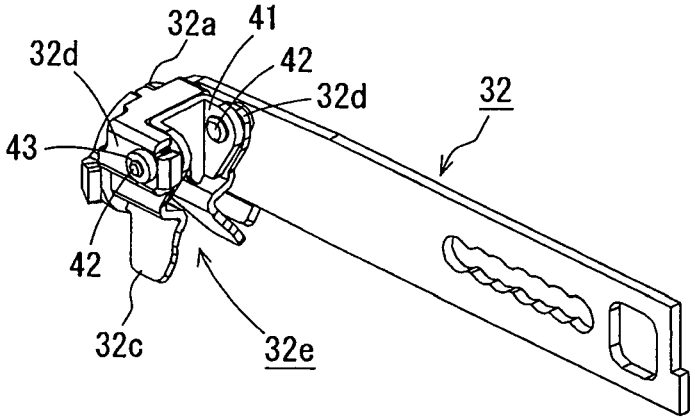

32a
41
32d
42
32d
32
43
42
32c
32e

FIG. 5

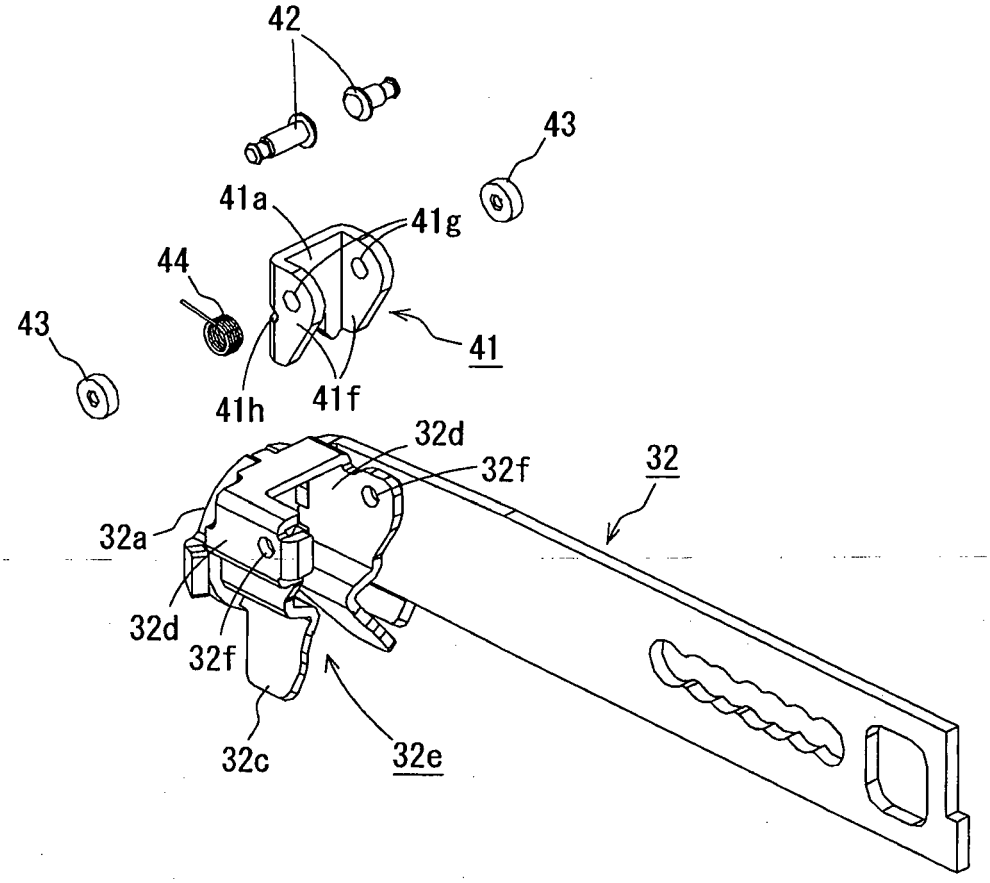

42
43
41a
41g
44
43
41
41h
41f
32d
32f
32
32a
32d
32f
32c
32e

FIG. 6A

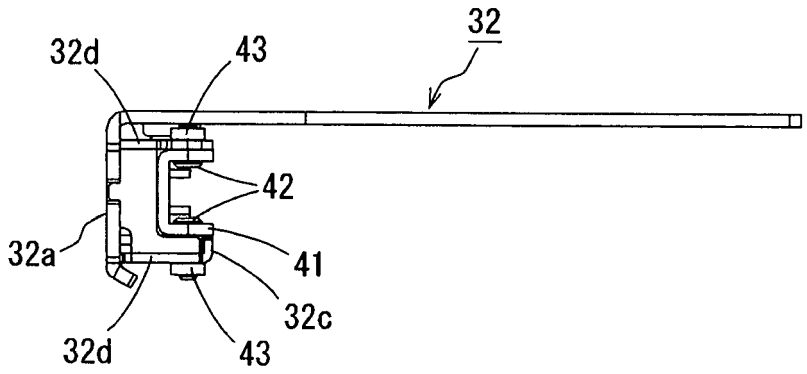



FIG. 6B

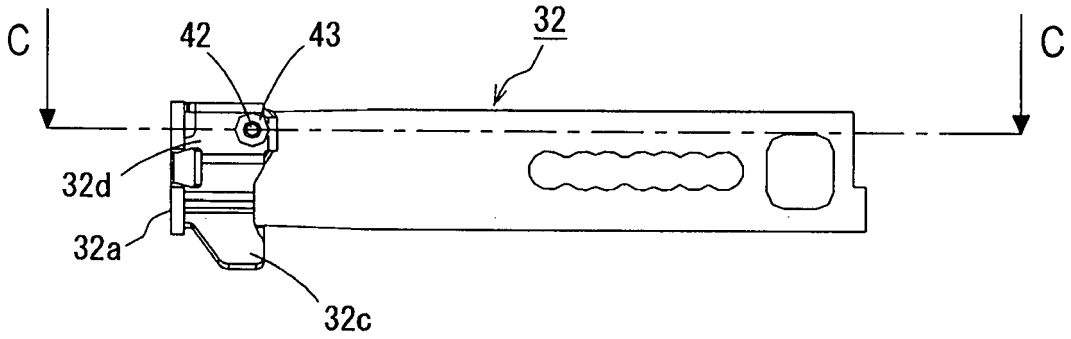



FIG. 6C

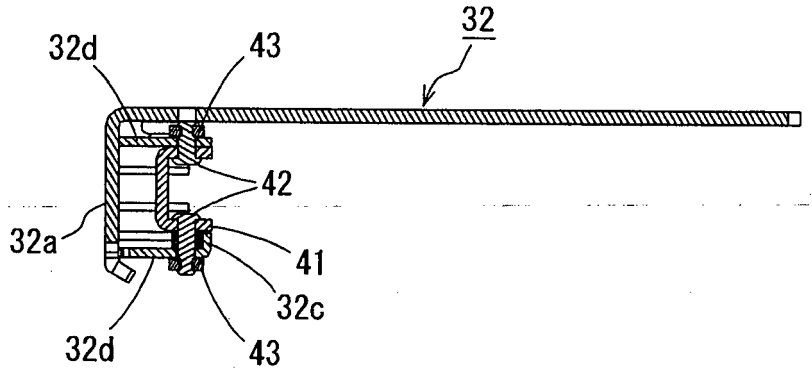


FIG. 7A

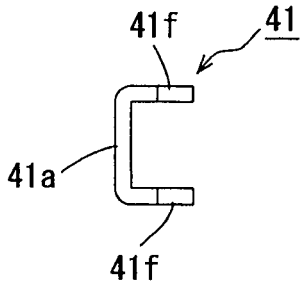



FIG. 7B

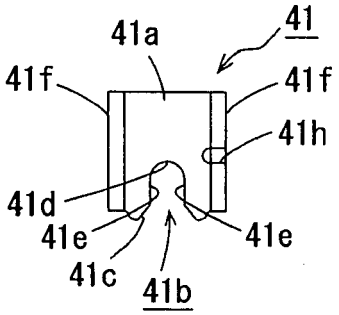



FIG. 7C

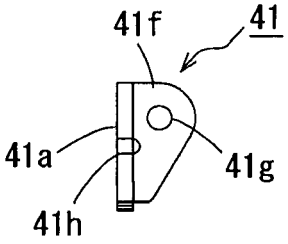



FIG. 7D

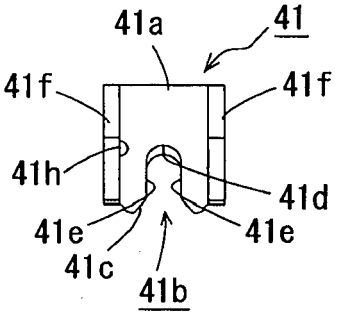



FIG. 7E

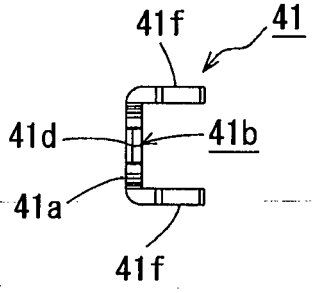


FIG. 8

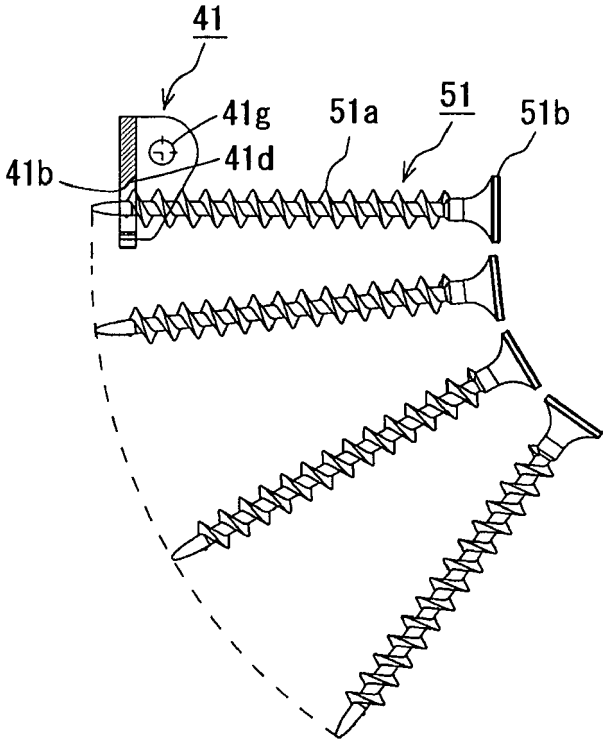


FIG. 9A

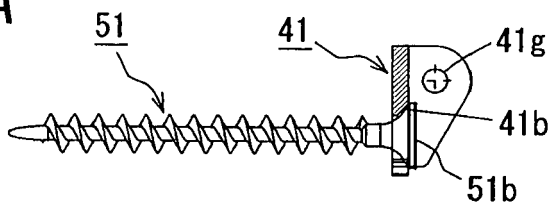



FIG. 9B

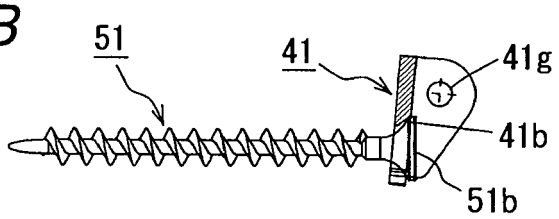



FIG. 9C

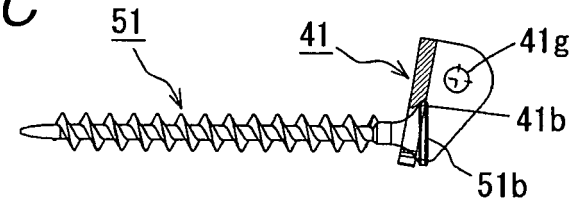



FIG. 9D

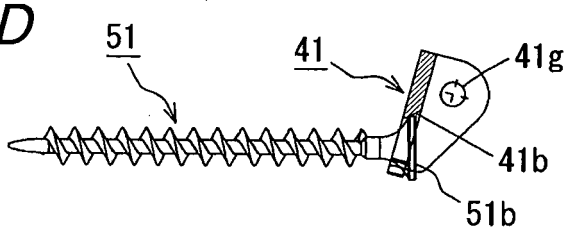



FIG. 9E

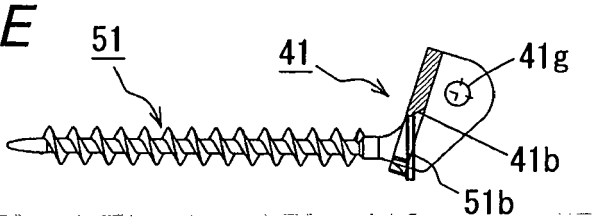


FIG. 10

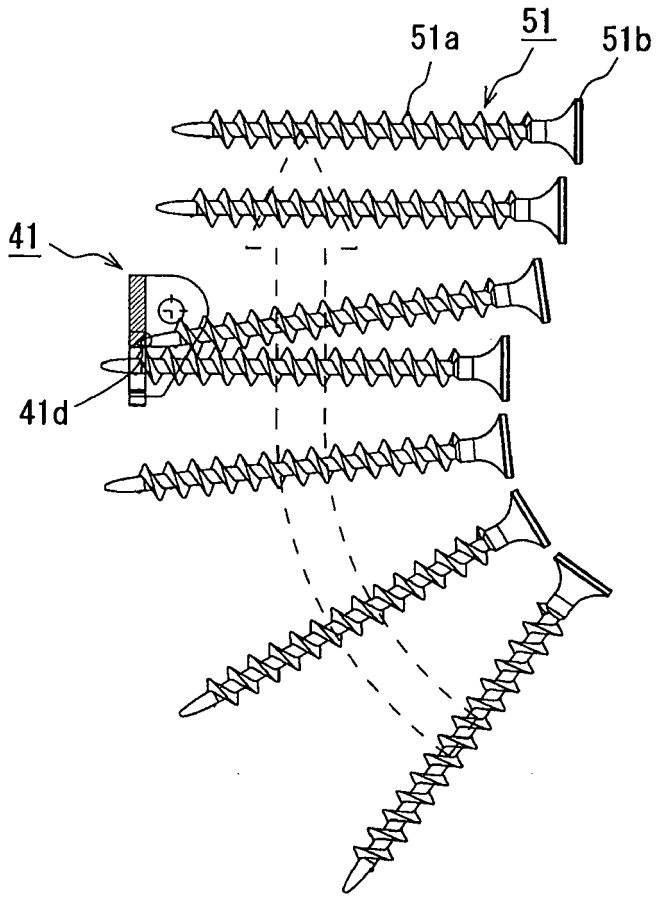
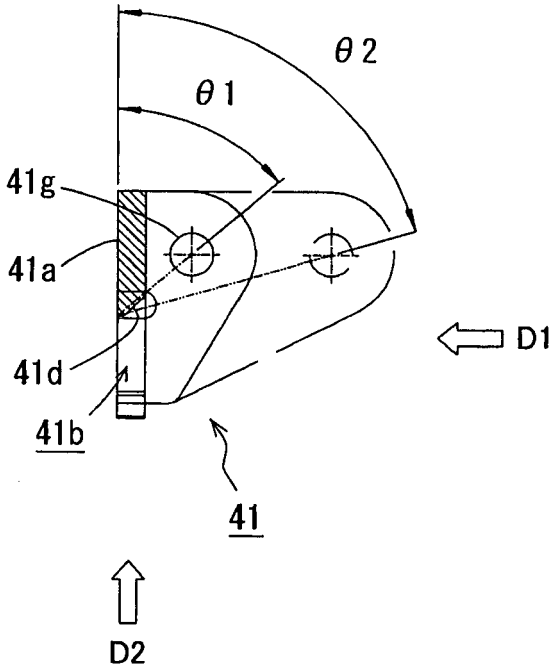


FIG. 11



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| The Hague | 22 May 2014 | Pothmann, Johannes |

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