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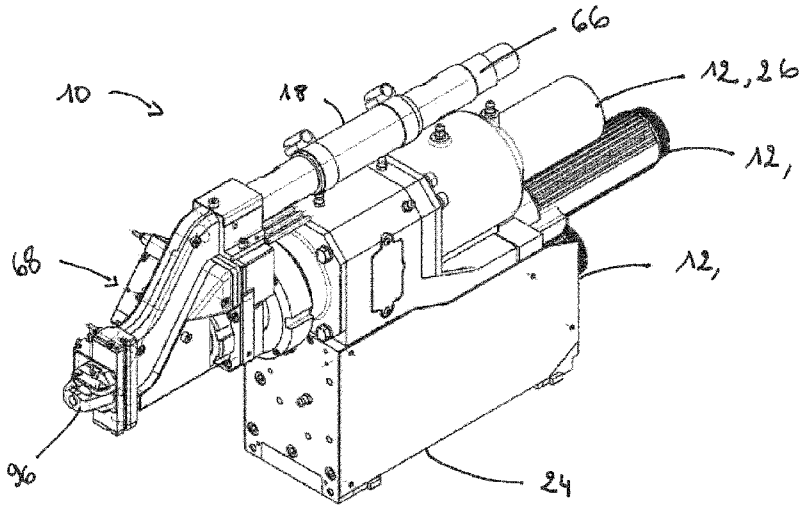


Fig. 1

(57) Abstract: Setting tool (10) for blind rivet nuts comprising a first electric motor (36) with a first drive shaft, which is arranged in a first housing portion (28) and is connected to a tool housing portion (26) via a first transmission device; a tool shaft (32) arranged in the tool housing portion (26), with which a screw tool (34) is connected, wherein the screw tool (34) is rotationally and translationally movable along and around a longitudinal axis (X) between a retracted position and an extended position; a feeder (18) with a fastener delivery tube (66) and a blind rivet nut supply, the delivery tube (66) being connected at a first end to the blind rivet nut supply and at a second end to the tool housing portion (26) for delivering the blind rivet nut in the tool housing portion (26) in front of the screw tool (34) when the screw tool is in the retracted position. The setting tool for blind rivet nuts further comprises a second electric motor (38) with a second drive shaft, which is arranged in a second housing portion (30) and is connected to the tool housing portion (26) via a

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second transmission device. The delivery tube (66) merges with the tool housing portion through a receiver assembly (68), the receiver assembly comprising an interface channel (70) connecting directly the delivery tube with the tool housing portion, such that the screw tool (34) can engage with a blind rivet nut within the tool housing portion.

SETTING TOOL FOR BLIND RIVET NUTS

The present invention is directed to a setting tool for setting a blind rivet nut in a workpiece.

In motor vehicle manufacture it is usual that various components such as strips, rails, equipment etc. are fastened to thin-walled components, such as sheet metal or profiles of aluminium, for example. A common method of connecting components is to use a fastener having a screw thread.

Blind rivet nuts are fastening elements that are to be arranged in an opening, for example, in a through hole of a metal sheet or any other sheet or workpiece. The blind rivet nuts thereby provide an internal thread and thus render possible a screw connection to metal sheets or workpieces, the wall thickness of which is not sufficient to embody a thread. A blind rivet nut setting device or setting tool for blind rivet nuts is used to set the blind rivet nut in the opening of the workpiece. The blind rivet nut has, in a non-deformed state, a hollow cylindrical rivet shank at the one end of which a radially extending set head is embodied and on the other end of which an internal thread is formed.

It is known to use a bolt having an external thread cooperating with the internal thread of the blind rivet nut to set the blind rivet nut in the hole. The internal thread of the blind rivet nut engages with the external thread of the bolt. The blind rivet nut is inserted with the rivet shank first into the hole until the rivet head contacts the sheet. By start-up of the blind rivet nut setting device, the bolt and thus the thread region are then moved axially backwards from the blind rivet nut and the sheet, whereby a compression of the rivet shank occurs. A bead or a bulge is formed at a desired deformation point at the workpiece side facing away from the rivet head. The blind rivet nut is thus held captively in the hole (or opening).

To remove the blind rivet nut setting device from the set blind rivet nut, pressure on the bolt is relieved and it is rotated in the drill-off direction. The blind rivet nut setting device is then available for a new setting operation.

Document EP0886733 for instance discloses a setting device for blind rivet nuts comprising a first actuator adapted to guide along a longitudinal axis the blind rivet nut and a second actuator adapted to rotate the bolt or threaded insert, notably to remove the bolt from the blind rivet nut after the setting step (in other words after the crimping of the blind rivet nut).

Document US7346970 discloses a setting device for blind rivet nuts having a single electric motor with a drive shaft that is positioned in a first housing part and is connected via a transmission means to a tool housing part. The tool housing part is laterally offset relative to the drive shaft and extends in parallel with the drive shaft. A tool shaft is arranged in the tool housing part and has non-rotationally connected thereto a screw type tool which projects from the front end of the tool housing part. Locking means to which the tool housing part and the tool shaft can be coupled together in non-rotational fashion, or decoupled, anti-rotation means with which the tool shaft can be blocked against rotation or can be released for rotation are also provided.

Such setting tools may be cumbersome and needs a minimum time to perform all the steps and motions needed to perform the crimping and then become available for the next setting operation.

It is hence an object of the present invention to at least alleviate the aforementioned shortcomings. More particularly one objective of the present invention is to provide a blind rivet nut setting device which is of a simple design, compact, reliable and allowing a fast setting of blind rivet nuts in order to cut down on production time.

To this aim, according to the invention, it is provided a blind rivet nut setting device comprising a first electric motor with a first drive shaft, which is arranged in a first housing portion and is connected to a tool housing portion via a first transmission device; a tool shaft arranged in the tool housing portion, with which a screw tool is connected, wherein the screw tool is movable rotationally and translationally movable along and around a longitudinal axis X between a retracted position and an extended position; a feeder with a fastener delivery tube and a blind rivet nut supply, the delivery tube being connected at a first end to the blind rivet nut supply and at a second end to the tool housing portion for delivering the blind rivet nut in the tool housing portion in

front of the screw tool when the screw tool is in the retracted position, wherein the setting tool for blind rivet nuts further comprises a second electric motor with a second drive shaft, which is arranged in a second housing portion and is connected to the tool housing portion via a second transmission device, and wherein the delivery tube merges with the tool housing portion through a receiver assembly, the receiver assembly comprising an interface channel connecting directly the delivery tube with the tool housing portion, such that the screw tool can engage with a blind rivet nut within the tool housing portion. .

Such setting tool can be fully automated. The delivery of the blind rivet nut is directly integrated to the tool, such that the setting time is reduced, and no additional delivery mechanism are necessary. The presence of the two motors allows an exact control of the position and the load applicable during the setting process, such that the parameter of the joining can be exactly controlled and adapted to the different blind rivet nuts or workpieces to be joined. The first, second and tool housing portions facilitates maintenance operations.

According to an embodiment, the tool housing portion comprises a solid roller screw connected to the tool shaft, wherein a long gear with an anti-rotation sleeve is arranged around the solid roller screw, said long gear being connected to the second electric motor through a second housing gear. The tool housing portion is robust and allows the presence of load cells if necessary. The solid roller screw allows a good guiding of the tool shaft along its joining axis.

According to an embodiment, the solid roller screw connected to the tool shaft comprises a first end connected to the tool shaft and a second end, opposite the first end, and wherein an anti-rotation hub of the solid roller screw is arranged at the second end.

According to an embodiment, the second housing portion comprises the second electric motor with the second drive shaft, the second housing gear and an interface gear. The second housing portion, which may extend in the vicinity of the tool housing portion, for instance sensibly parallel to the tool housing portion, can be compact.

According to an embodiment, the first housing portion comprises the first electric motor and a first housing gear connected to the interface gear. The second housing portion can extend between the tool housing portion and the first housing portion.

According to an embodiment, the interface gear is further connected to a tool gear, said tool gear being arranged within the tool housing portion and being fixedly connected to a roller screw nut arranged around the solid roller screw. The interface gear is for instance a long gear which allows rotation and translation. The roller screw nut is hollow and interacts with the solid roller screw.

According to an embodiment, the spinning of the first drive shaft creates a linear motion of the solid roller screw. The first transmission device, when controlled alone creates a translation of the solid roller screw and thus of the tool shaft and the screw tool.

According to an embodiment, the spinning of the first and second drive shaft at different speeds creates a linear and rotational motion of the screw tool, such that the screw tool can engage a blind rivet nut. Both motors act together to allow the translation and the rotation of the screw tool. This arrangement ensures a robust connection and an exactly controlled reaction of the screw tools through both motors. The load and setting forces can be controlled through the two motors.

According to an embodiment, the delivery tube extends parallel or sensibly parallel to the tool housing portion, and wherein the interface channel comprises a first portion which is coaxial with the delivery tube and a portion which is align with the longitudinal axis, such that the interface channel is adapted to deliver the blind rivet nut within the tool housing portion. The tool is thus compact and adapted to be used in industrial environments.

According to an embodiment, a clamping device adapted to clamp a blind rivet nut for its engagement with the screw tool is provided, and wherein the clamping device is arranged within the tool housing portion. The clamping device retains the nut within the tool housing portion, such that the engagement with the screw tool is realized in line inside the setting tool. This reduces the setting time.

According to an embodiment, the clamping device comprises two movable jaws adapted to clamp the blind rivet nut. The two movable jaws allow a centered or off-centered clamping and an adaptation of the clamping forces to the nut if necessary. Besides, an off-centered clamping allows a better clamping of nuts having for instance shanks with a hexagonal cross-section.

According to an embodiment, the clamping device further comprises a retaining lever, such that the blind rivet nut is retained in the clamping device during the clamping by the jaws. The lever acts as a gate, maintaining the nut in the clamping device such that the jaws can be actuated.

According to an embodiment, a nose is provided at an end of the tool housing portion, a blind rivet nut being adapted to emerge through the nose, and wherein the clamping device is arranged between the receiver assembly and the nose.

According to an embodiment, the nose comprises a self-centering device, such that the nose is movably mounted to the tool housing portion. For instance, springs can be used to movably attach the nose to the tool housing portion allowing the nose to slide with regard to the tool housing portion. In another embodiment, a ball joint connection may be provided between the nose and the tool housing portion and/or between the screw tool and the tool shaft. This allows tolerance compensation for finding the hole in the workpiece during the insertion of the blind rivet nut into the hole.

According to an embodiment, the screw tool is connected to the tool shaft through a ball joint connection. The ball joint connection allows the tolerance compensation for hole finding. For instance, two ball joint connections may be implemented.

The present disclosure is also directed to a method for setting a blind rivet nut in a workpiece, comprising:

- providing a blind rivet nut setting device as described above;
- providing a blind rivet nut comprising a rivet shank with an internal thread and a rivet head;
- feeding the blind rivet nut in the feeding assembly, such that the blind rivet nut moves through the feeding channel to the retainer;

- retaining the blind rivet nut in the retainer such that the blind rivet nut is in a loading position;
- guiding the screw tool with the first and second transmission devices in a first direction along the longitudinal axis into the blind rivet nut with the shank and engaging with the internal thread of the blind rivet nut;
- guiding the blind rivet nut further in the first direction along the longitudinal axis such as to release the blind rivet nut from the tool housing portion into a nose and then further outside the nose;
- guiding the blind rivet nut through a hole of a workpiece until the head contacts the workpiece and at least a portion of the shank extends in the hole;
- deforming the blind rivet nut through a displacement by the first transmission device in a second direction, opposite the first direction, such as to perform a crimping process of the blind rivet nut;
- guiding the screw tool with the first and the second transmission device in the second direction along the longitudinal axis to disengage the blind rivet nut from the screw tool.

Such method is easy to implement and allows a better control of the setting with a reduced setting time. In an embodiment, a torque test may be performed to check the quality of the crimping and/or the quality of the internal thread after the crimping.

Other characteristics and advantages of the invention will readily appear from the following description of embodiments, provided as non-limitative examples, in reference to the accompanying drawings.

In the drawings:

Fig. 1 shows a schematic perspective view of a setting tool for blind rivet nuts;
Fig. 2 shows a schematic cross-section of the transmission assembly and the feeder of the setting tool according to the invention in a first position;
Fig. 3 shows a schematic cross-section of the transmission assembly and the feeder of the setting tool according to the invention in a second position;
Fig. 4 shows a perspective view of the front of a tool housing portion of a setting tool according to the invention;
Fig. 5A shows a sectional view of front of a tool housing portion movably connected to a nose in a first position, according to an embodiment;

Fig. 5B shows a sectional view of front of a tool housing portion movably connected to a nose in a second position according to the embodiment of Fig. 5A;

Fig. 6A to Fig. 6C show shows a view of a clamping device provided in the tool housing portion with a retaining lever;

Fig. 7A and Fig. 7B shows a detailed view of the clamping device of Fig. 6A to Fig. 6C in two different positions.

On the different figures, the same reference signs designate identical or similar elements.

Fig. 1 schematically shows a setting tool 10 for blind rivet nuts. As illustrated, the setting tool 10 comprises a housing 12 with different housing portions, a nose 14 and a feeder 18 adapted to drive a blind rivet nut 20 to the nose 14 to perform a crimping step.

The housing 12 is adapted to be attached to an arm of a robot through an interface 24. In another embodiment, the housing 12 is fixed to a support through a slide adapted to translate the housing 12. The slide can be actuated by an actuator.

Typically, a blind rivet nut 20 comprises a hollow rivet shank 22 with an internal thread and a rivet head 24 outwardly extending from the rivet shank at one end of the shank. The rivet shank 24 is adapted to be arranged in a hole of a workpiece and the rivet head is adapted to contact a surface of the workpiece. The rivet shank 22 is adapted to be deformed by the setting tool such has to form a crimping bulge on the underside of the workpiece.

The housing 12 is provided with a tool housing portion 26, a first housing portion28 and a second housing portion 30, as depicted in Fig. 2 and Fig. 3.

Transmission

The tool housing portion 26 comprises a tool shaft 32 connected to a screw tool 34, the screw tool 34 being adapted to engage with the internal thread of a blind rivet nut 20. The tool shaft 32 and the tool screw 34 are rotationally and translationally movable through a first and second transmission device which respectively works with a first

and second electric motor 36, 38. The tool shaft 32 and the tool screw 34 are rotationally and translationally movable along and around a longitudinal axis X. The tool housing portion 26 further comprises a solid roller screw 40 connected to the tool shaft 32, and more particularly fixedly assembled to the tool shaft such that a rotation or a translation of the solid roller screw 40 may be transferred to the tool shaft 32.

The solid roller screw 40 comprises a first end 42 adapted to be fixed to the tool shaft and a second end 44 opposite the first end. An anti-rotation hub 46 of the solid roller screw may be arranged at the second end 44. The solid roller screw 40 comprises a first segment in the vicinity of the second end 44 and a second segment in the vicinity of the first end 42. A long gear with an anti-rotation sleeve 48 is arranged around the first segment of the solid roller screw 40. A roller screw nut 50 is arranged around the second segment of the solid roller screw 40 and interacts with said solid roller screw. A tool gear 52 is fixedly connected to the roller screw nut 50. The tool housing portion 26 may also be provided with load cells 54 adapted to determine the load applied to the blind rivet nut 20 during the setting step (or more particularly during the crimping step). The load cell gives the compressing force. Therefore, through the load cells 54 it is possible to read the load applied to set the nut during the crimping. When a pre-determined load is reached, the crimping is properly done and then the motor can shut down.

The long gear allows the sliding of the solid roller screw. However, in another embodiment (not represented), the sliding might be made directly on the shaft and not on the gear. Thus, a long gear may not be required.

The first housing portion 28 is provided with the first electric motor 36 with a first drive shaft 56 and a first housing gear 58 connected to the first drive shaft 56.

The second housing portion 30 is provided with the second electric motor 38 with a second drive shaft 60 connected to a second housing gear 62. An interface gear 64 is also provided in the second housing portion 30. The interface gear 64 is connected to the first housing gear 58.

The first housing portion 28 may extend longitudinally in a direction parallel to the longitudinal direction of the second housing portion 30 and/or the tool housing portion

26. The second housing portion 30 may extend longitudinally in a direction parallel to the longitudinal direction of the tool housing portion. More particularly, the tool housing portion 26 may extend longitudinally around the longitudinal axis X and the first and second housing portions longitudinally extends sensibly parallel to the longitudinal axis X.

The first transmission device comprises the first housing gear 58, the interface gear 64, the tool gear 52 and the roller screw nut 50. The first electric motor 36 is adapted to spin the first drive shaft 56 which spins the first housing gear 58 which interacts with the interface gear 64. The interface gear 64 interacts further with the tool gear 52. The interface gear 64 is for instance a long gear which allows sliding and transfers rotation to the tool gear. Fig. 2 illustrates the tool gear 52 in a first position with regard to the interface gear 64, wherein Fig. 3 illustrates the tool gear 52 in a second position with regard to the interface gear 64. Thus, a translation of the tool housing portion with regard to the first housing portion and the second housing portion may be implemented. In another embodiment, instead of sliding on the interface gear, the sliding can be made on the drive shaft, notably on the second drive shaft. Thus, a long gear is not required.

The second transmission device comprises the second housing gear 62 and the long gear 48 with anti-rotation sleeve. The spinning of the second drive shaft 60 leads to the spinning of the second housing gear 62 which interacts with the long gear 48 allowing translation and rotation of said long gear 48. The long gear 48 transfers a motion to the solid roller screw 40.

When both motors (first electric motor 36 and second electric motor 38) spin together at specified, but different speeds (more particularly, when the first drive shaft and the second drive shaft spin together at specified, but different speeds), the solid roller screw 40 is driven in translational and rotational movement. Thus, the solid roller screw 40 can transfer the translation and the rotation to the screw tool which can engage the internal thread of a blind rivet nut. For instance, the screw tool can translate in a first and in a second direction, opposite the first direction. Besides, the screw tool 34 can rotate in a first rotational direction and in a second rotational direction.

When the second electric motor 38 (or more precisely when the second drive shaft) is prevented from spinning and the first electric motor 36 (or the first drive shaft) spins, a linear motion of the solid roller screw is created. The linear motion may be in a first or in a second direction, opposite the first direction.

Feeder

The feeder 18 (see Fig. 1 and Fig. 4) comprises a fastener delivery tube 66 and a blind rivet nut supply (not represented), the delivery tube 66 being connected at a first end to the blind rivet nut supply and at a second end to the tool housing portion 26 for delivering the blind rivet nut in the tool housing portion 26. An isolated blind rivet nut 20 is directly delivered in the tool housing portion 26 in front of the screw tool 34 such that the setting step can directly be undertaken.

The delivery tube 66 may extend parallel or sensibly parallel to the tool housing portion 26. The delivery tube 66 merges with the tool housing portion 26 through a receiver assembly 68, the receiver assembly 68 comprising an interface channel 70 connecting directly the delivery tube 66 with the tool housing portion 26, such that the screw tool 40 can engage with a blind rivet nut 20 within the tool housing portion 26. The interface channel 70 comprises a first portion 72 which is coaxial with the delivery tube 66 and a portion 74 which is aligned with the longitudinal axis X, such that the interface channel 70 is adapted to deliver the blind rivet nut within the tool housing portion and coaxially to the screw tool 34.

The receiver assembly 68, and more particularly the interface channel, notably on its first portion, is provided with a stop function. A gate or a lever is arranged in the interface channel and is adapted to slow down the blind rivet nut 20 before its arrival in the tool housing portion. The gate or lever is in particular arranged in the first portion. Said gate or lever stops the blind rivet nut in the first portion until a signal is sent that a setting step is needed, and no other blind rivet nut is present in the tool housing portion. The gate or lever also prevents an unwanted falling of the blind rivet nut into the tool housing portion.

A clamping device 76 adapted to clamp a blind rivet nut 20 prior its engagement to the screw tool is provided, as illustrated in Fig. 4, Fig. 6A, Fig. 6B and Fig. 6C. The

clamping device 76 is arranged in the receiver 68, and more particularly in the portion of the interface channel which is coaxial to the screw tool.

The clamping device 76 comprises two jaws 78 movable between an open position and a clamped position, as depicted in Fig. 6A, Fig. 6B, Fig.6C and Fig. 7A and Fig. 7B. As illustrated in Fig.7A and Fig. 7B, the jaws 78 can be identical. Each jaw comprises a curved portion adapted to face and clamp the blind rivet nut, and more particularly the shank of the blind rivet nut. The jaws 78 slide such as to apply a retaining force on the blind rivet nut. For instance, the jaws are driven by an actuator which controls the open and closed position of the jaws 78. The jaws 78 are off-centered with regard to the median axis of the blind rivet nut shank, such that a jaw grips the shank above the median axis, and the other jaw grips the shank below the median axis. In Fig. 7A, the jaws 78 are open. In Fig. 7B the jaws 78 are closed and the blind rivet nut is aligned along the longitudinal axis X. The jaws 78 may be arranged such as to create an eccentric clamping movement. Thus, the blind rivet nut 20 can be adapted to the contour of the jaws 78 and can slide or move into the desired clamping position. This is particularly useful for nuts with hexagonal cross-section profiles.

The clamping device 76 further comprises a retaining lever 80 shown in Fig. 6A, Fig. 6B and Fig. 6C. The retaining lever retains the blind rivet nut in the clamping device during the clamping by the jaws. The retaining lever is more particularly described in Fig. 6A to Fig. 6C. In Fig. 6A, the retaining lever closes the interface channel and the jaws are open. Thus, the blind rivet nut can take place in the receiver in the portion of the interface channel which is coaxial to the screw tool and the blind rivet nut cannot fall further. Then, the jaws 78 close, as depicted in Fig. 6B and the retaining lever 80 still closes the interface channel 70. The blind rivet nut, which is maintained by the jaws, is then ready for engagement with the screw tool 34.

An elastic element or spring S may be arranged beyond the screw tool, more particularly between the screw tool and the tool shaft (see Fig. 2 or Fig. 3). The elastic element S ensures a compensation when the blind rivet nut is in the clamping device for the engagement with the screw tool. Indeed, depending on the blind rivet nut, its internal thread or its position in the clamping device, a compensation along a longitudinal axis may be necessary.

Finally, once the engagement with the screw tool is done, the retaining lever open the interface channel and the jaws open, as depicted in Fig. 6C. The blind rivet nut, which is now engaged with the screw tool is ready for the setting step into the workpiece.

Nose

As illustrated in Fig. 5A and Fig. 5B, a nose 82 is provided at an end of the tool housing portion 26. The blind rivet nut 20 is adapted to emerge through the nose 82 and to be guided in a hole of a workpiece by the nose 82. The nose 82 comprises a cylindrical housing 84 in which the blind rivet nut can be driven by the drive shaft and the screw tool 34. The screw tool 34 can extend in the cylindrical housing 84 and slide into said cylindrical housing 84.

The nose 82 may comprise a self-centering device 86, such that the nose is slidably mounted to the tool housing portion. Such self-centering device allows to compensate tolerances when introducing the blind rivet nut 20 into a hole of a workpiece. Indeed, even if the position of the holes is known before the setting steps, such that the setting tool knows where to introduce the blind rivet nut, manufacturing tolerances always appear. For instance, the self-centering device 86 may comprise two centering rods and three springs 88 arranged in three different directions of the cylindrical housing 84 allowing the nose 82 to move and centre after the crimping step. The springs allow an elastic return of the nose 82 in its rest position.

The screw tool 34 may be connected to the tool shaft through a ball joint connection 90, as visible in Fig. 5A and Fig. 5B. For instance, a centering shaft 92 with two ball joints connection 90, 94 at each end is arranged between the screw tool 34 and the tool shaft 32. The first ball joint connection is provided between the centering shaft and the screw tool 34, whereas the second ball joint connection is provided between the centering shaft 92 and the tool shaft 32. This allows a correct centering of the blind rivet nut with regard to the hole. In Fig. 5A, the nose is centered. In Fig. 5B, the nose is excentric. Thus, a tolerance compensation during hole finding when the blind rivet nut 20 is inserted into a hole of a workpiece may be realized.

In an alternative or additional embodiment, the screw tool and the nose may have a ball joint connection with the rest of the tool housing portion for the tolerance compensation.

In alternative or additional embodiments, a sensor may be provided at the front end of the nose. For example, a radar sensor or an image sensor may be provided. Thus, the exact position of the hole is known, and a tolerance compensation is either not necessary or allows a compensation of the hole localisation when needed. For example, in Fig. 1, Fig. 2, Fig. 3 and Fig. 4, no nose 82, or no self-centering device are provided.

The nose 82 finally comprises a bearing surface 96 onto which the head of the blind rivet nut 20 rests during the crimping step. The bearing surface 96 is for instance formed by two hooks which can open to allow the passage of the blind rivet nut outside the nose and then elastically close to form the bearing surface 96.

Method

A blind rivet nut 20 can be set in a hole of a workpiece with the above-described setting tool as follow.

In a first step, a blind rivet nut is fed through the feeder with the delivery tube. The blind rivet nut 20 is for instance fed with compressed air. The blind rivet nut then reaches the receiver assembly 68 and is maintained in the clamping device 76 by the retaining lever. The jaws grip the blind rivet nut.

Both motors spin together at specified but different speeds to move the screw tool such that it engages with the internal thread of the blind rivet nut 20.

The blind rivet nut engaged with the screw tool 34 is then driven through the tool housing portion and outside the nose. The entire assembly is driven such that the blind rivet nut is inserted into a hole of a workpiece by the arm of a robot. For instance, the arm of the robot can move the entire setting tool 10.

The second motor 38 is prevented from spinning, the first motor 36 is allowed to spin to create linear motion of the solid roller screw and the screw tool in a second direction opposite the direction of the hole. Thus, a portion of the blind rivet nut collapses (the head of the blind rivet nut resting against the bearing surface which does not move during the crimping step). For example, the load may be up to 30 or 35 kilo-Newtons. The tool shaft and the screw tool move during the crimping step to allows the formation of the bulge in the shank of the blind rivet nut and the nose 82 and the tool housing portion remain at the same place. The screw tool, tool shaft and solid roller screw slides within the tool housing portion. Eventually a torque test for checking the crimping function may be undertaken.

Once the crimping step is done, both motors spin together at specified but different speeds to move the threaded rod to disengage with the collapsed blind rivet nut. A torque on and off test for checking the thread may be undertaken.

The torque surveillance may be realized by the second motor. If the torque is too high compared to a reference point or a reference curve, then an alarm might appear during the setting process, highlighting a misfunction. The torque can thus be monitored during the entire setting process.

CLAIMS

1. Setting tool (10) for blind rivet nuts comprising:
   - A first electric motor (36) with a first drive shaft, which is arranged in a first housing portion (28) and is connected to a tool housing portion (26) via a first transmission device
   - a tool shaft (32) arranged in the tool housing portion (26), with which a screw tool (34) is connected, wherein the screw tool (34) is rotationally and translationally movable along and around a longitudinal axis (X) between a retracted position and an extended position,
   - a feeder (18) with a fastener delivery tube (66) and a blind rivet nut supply, the delivery tube (66) being connected at a first end to the blind rivet nut supply and at a second end to the tool housing portion (26) for delivering the blind rivet nut in the tool housing portion (26) in front of the screw tool (34) when the screw tool is in the retracted position

   characterized in that the setting tool for blind rivet nuts further comprises:
   - a second electric motor (38) with a second drive shaft, which is arranged in a second housing portion (30) and is connected to the tool housing portion (26) via a second transmission device, and

   in that

   the delivery tube (66) merges with the tool housing portion through a receiver assembly (68), the receiver assembly comprising an interface channel (70) connecting directly the delivery tube with the tool housing portion, such that the screw tool (34) can engage with a blind rivet nut within the tool housing portion.

2. Setting tool (10) of claim 1, wherein the tool housing portion (26) comprises a solid roller screw (40) connected to the tool shaft, wherein a long gear (48) with an anti-rotation sleeve is arranged around the solid roller screw (40), said long gear being connected to the second electric motor through a second housing gear (62).

3. Setting tool (10) of claim 2, wherein the solid roller screw (40) connected to the tool shaft comprises a first end connected to the tool shaft and a second end, opposite the first end, and wherein an anti-rotation hub (46) of the solid roller screw is arranged at the second end.

4. Setting tool (10) of claim 2 or 3, wherein the second housing portion (30) comprises the second electric motor with the second drive shaft, the second housing gear and an interface gear (64).

5. Setting tool (10) of claim 4, wherein the first housing portion (28) comprises the first electric motor (36) and a first housing gear (58), said first housing gear is connected to the interface gear.

6. Setting tool (10) of claim 4 or 5, wherein the interface gear (64) is further connected to a tool gear (52), said tool gear (52) being arranged within the tool housing portion and being fixedly connected to a roller screw nut (50) arranged around the solid roller screw (40).

7. Setting tool (10) according to any of claims 2 to 6, wherein the spinning of the first drive shaft creates a linear motion of the solid roller screw (40).

8. Setting tool (10) according to any of claims 1 to 7, wherein the spinning of the first and second drive shaft at different speeds creates a linear and rotational motion of the screw tool (34), such that the screw tool can engage a blind rivet nut.

9. Setting tool (10) according to any of claims 1 to 8, wherein the delivery tube (66) extends parallel or sensibly parallel to the tool housing portion (26), and wherein the interface channel (70) comprises a first portion which is coaxial with the delivery tube and a portion which is aligned with the longitudinal axis (X), such that the interface channel is adapted to deliver the blind rivet nut within the tool housing portion.

10. Setting tool (10) according to any of claims 1 to 9, wherein a clamping device (76) adapted to clamp a blind rivet nut for its engagement with the screw tool is provided, and wherein the clamping device (76) is arranged within the tool housing portion.

11. Setting tool (10) according to claim 10, wherein the clamping device (76) comprises two movable jaws adapted to clamp the blind rivet nut.

12. Setting tool (10) according to claim 11, wherein the clamping device (76) further comprises a retaining lever (80), such that the blind rivet nut is retained in the clamping device during the clamping by the jaws (78).

13. Setting tool (10) according to any of claims 10 to 12, wherein a nose (82) is provided at an end of the tool housing portion, a blind rivet nut being adapted to emerge through the nose, and wherein the clamping device is arranged between the receiver assembly and the nose (82).

14. Setting tool (10) according to claim 13, wherein the nose (82) comprises a self-centering device (86), such that the nose is movably mounted to the tool housing portion.

15. Setting tool (10) according to any of claims 1 to 14, wherein the screw tool (34) is connected to the tool shaft through a ball joint connection (90, 94).

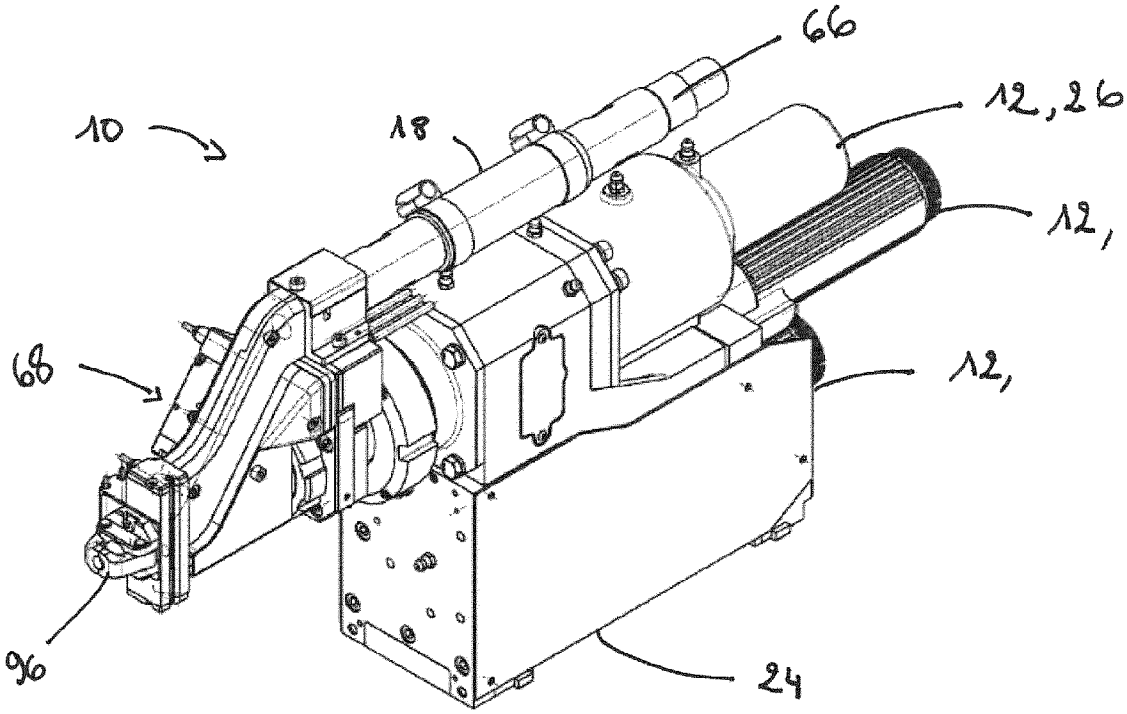

66
12, 26
10
18
12,
68
12,
96
24

Fig. 1

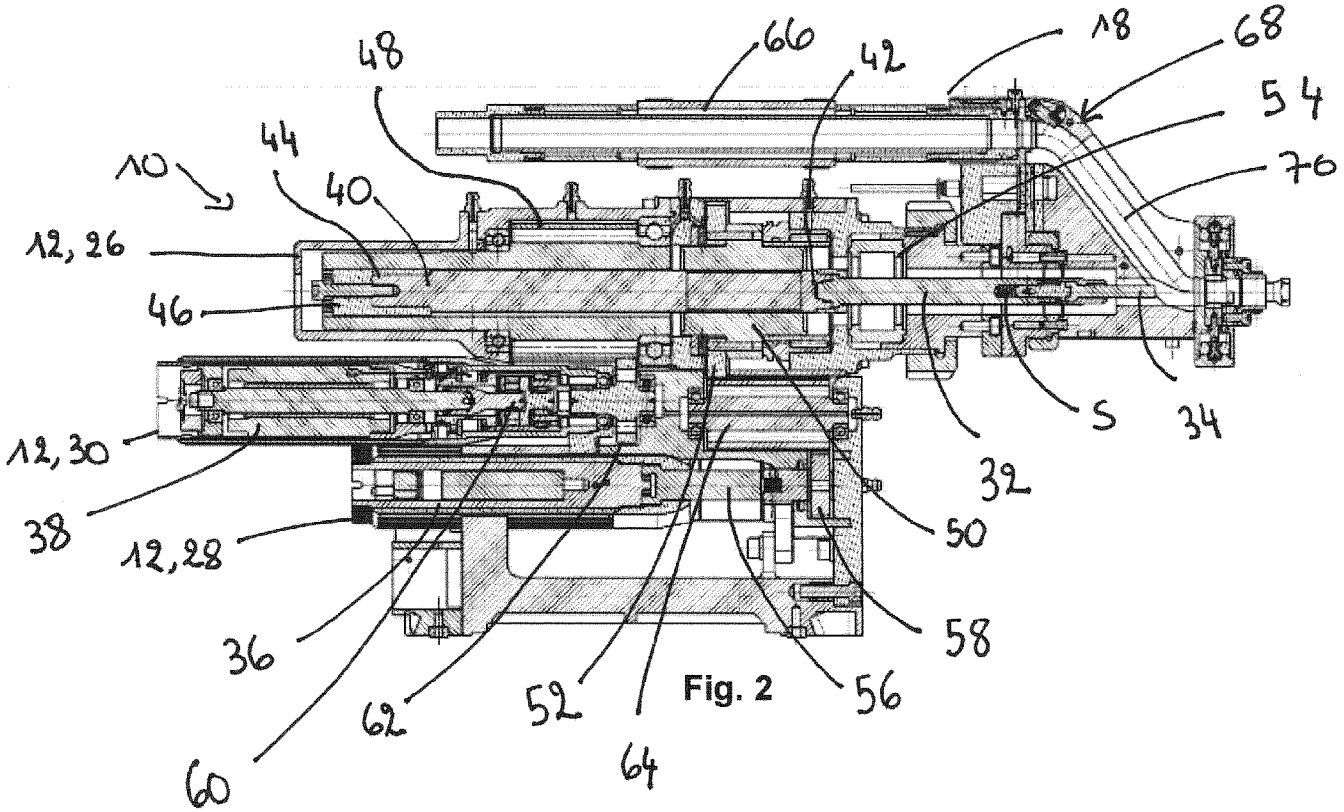

48
66
42
18
68
54
44
10
40
70
12, 26
46
12, 30
38
12, 28
36
60
62
52
64
56
58
50
32
5
34

Fig. 2

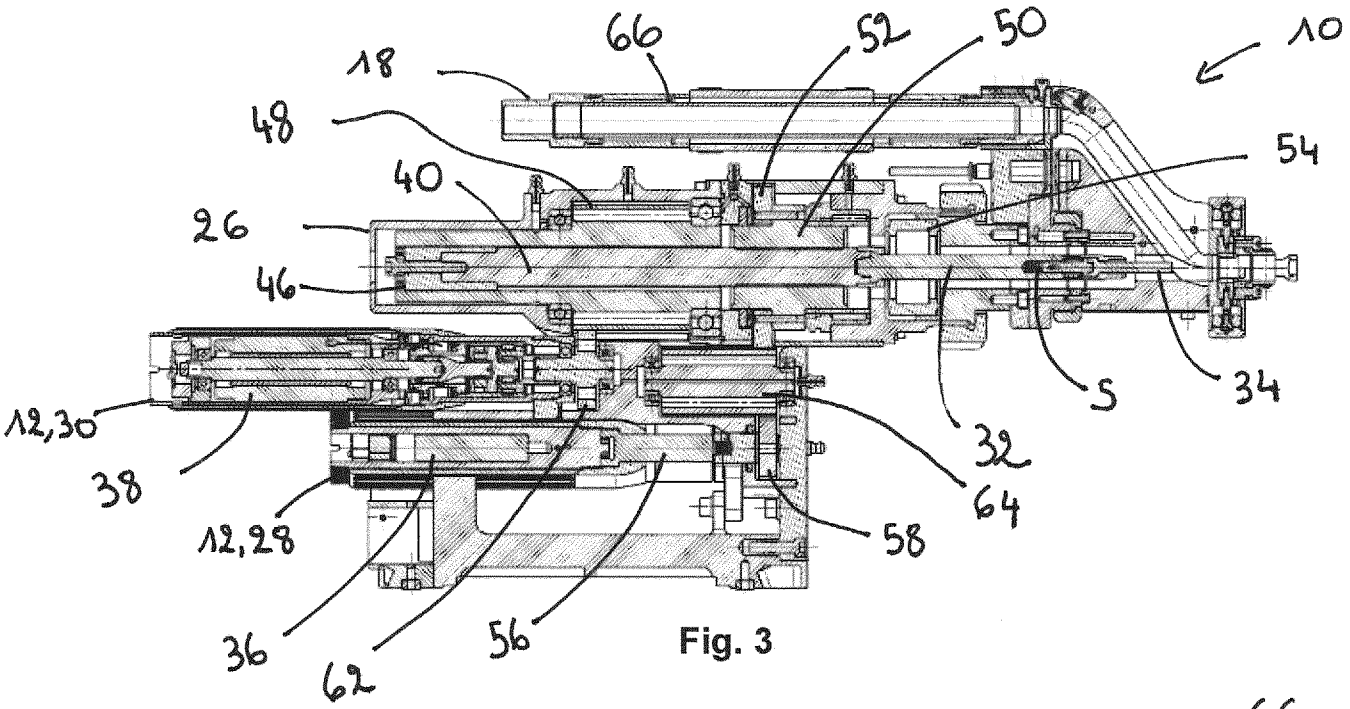

66
52
50
10
18
48
54
40
26
46
12,30
38
12,28
36
62
56
58
64
32
S
34

Fig. 3

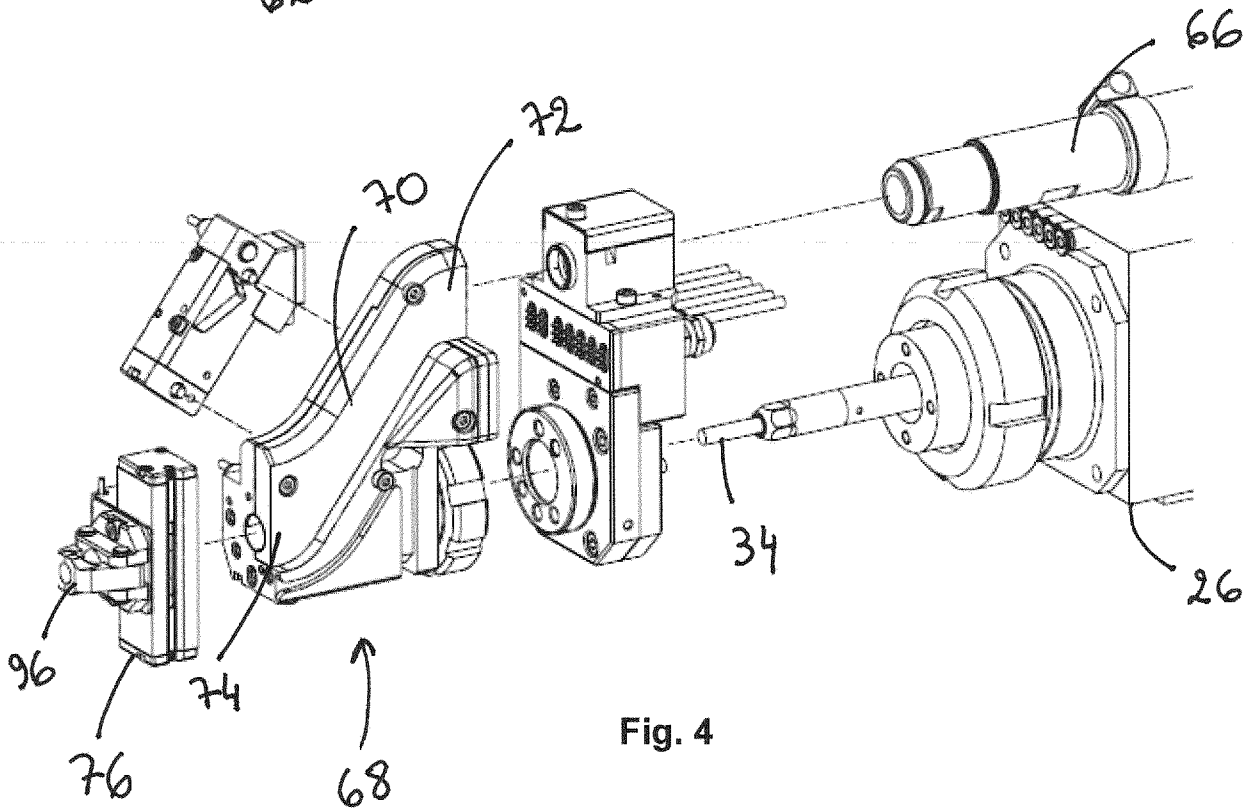

66
72
70
34
26
96
74
76
68

Fig. 4

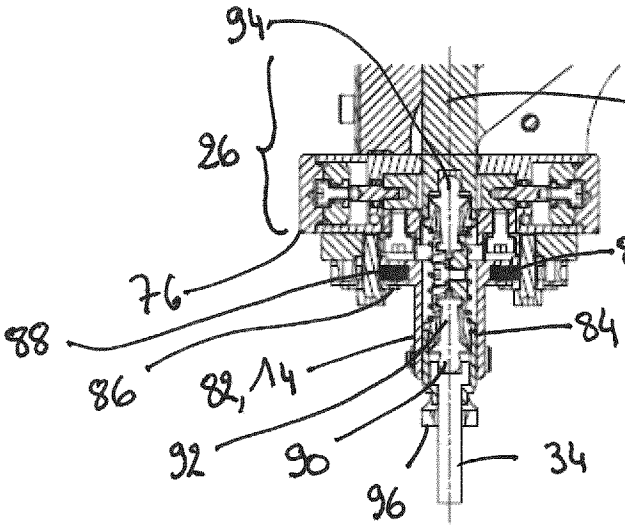


Fig. 5A

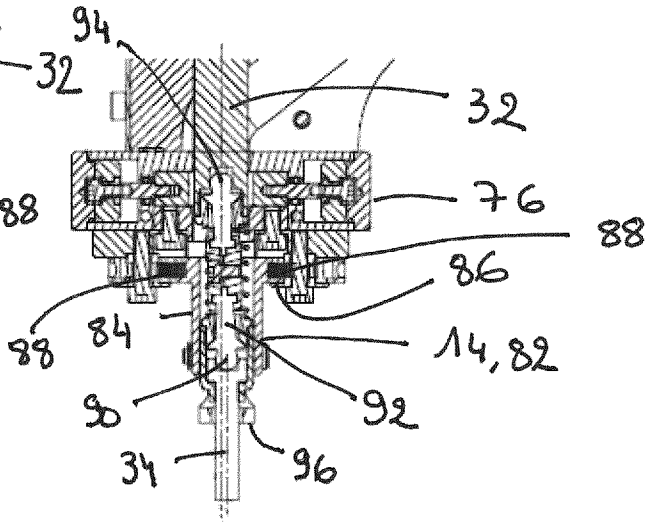


Fig. 5B

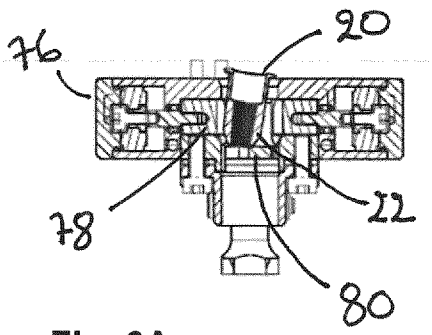


Fig. 6A

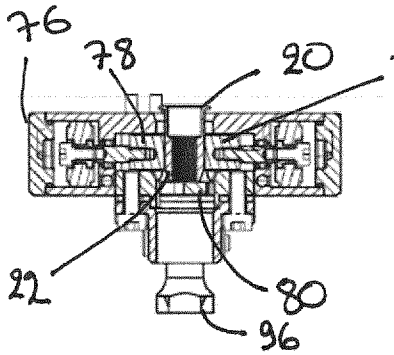


Fig. 6B

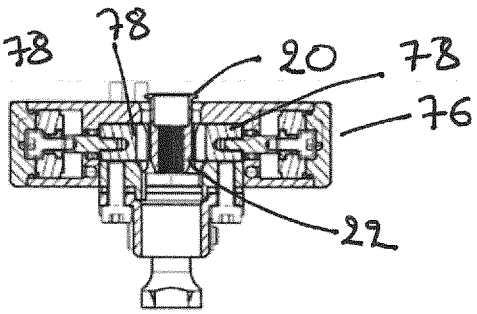


Fig. 6C

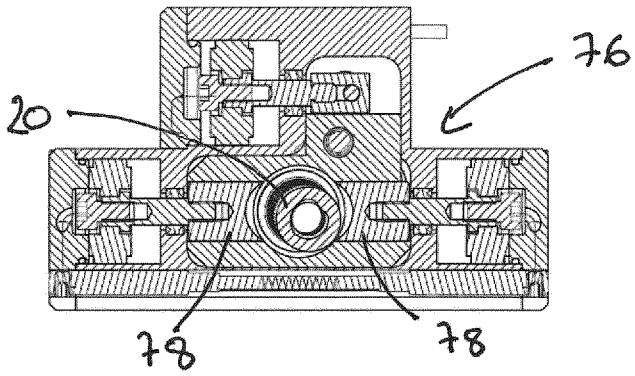


Fig. 7A

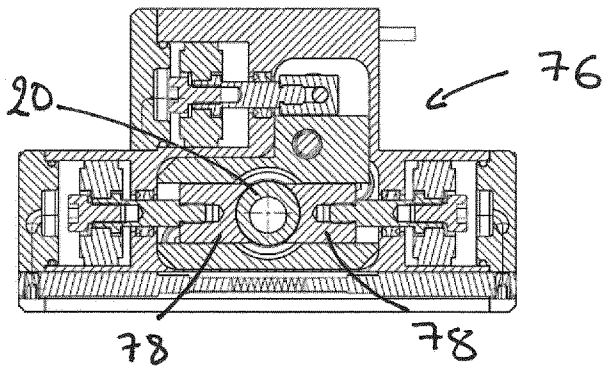


Fig. 7B

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2019/064680

A. CLASSIFICATION OF SUBJECT MATTER
INV. B25B27/00 B21J15/04 B21J15/10 B21J15/26 B21J15/32
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B25B B21L B21J

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2016/114383 A1 (HONSEL MICHAEL H [DE]) 28 April 2016 (2016-04-28) figure 1	1,8-13
Y	WO 94/15736 A1 (HENROB LTD [GB]; BLACKET STUART EDMUND [AU]; FUHRMEISTER RALPH [AU]) 21 July 1994 (1994-07-21) figure 1	1,8-13
Y	DE 33 41 602 A1 (AVDEL LTD [GB]) 24 May 1984 (1984-05-24) figure 11	1,8
A	EP 3 141 316 A1 (HENROB LTD [GB]) 15 March 2017 (2017-03-15) figure 13	2

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
6 February 2020	14/02/2020

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Hartnack, Kai

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
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