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(54) SCREW DRIVING TOOL

(57) The invention relates to a screw driving tool (1), comprising a socket (2) for driving a nut (10), the socket (2), having a cavity (6) for receiving the nut (10), and a screw driver protrusion (28) arranged coaxially within the socket (2) and protruding into the cavity (6) towards an opening of the cavity (6), the screw driver protrusion (28) being coupled in a rotationally rigid manner to the socket (2), and the socket (2) and the screw driver protrusion (28) being at least one of a different drive type and different drive side. Furthermore, the invention relates to the use of a screw driving tool (1) and a method for installing a connection pin (56). In order to install a connection pin (56), it must be ensured that a nut (10) for securing the connection pin (56) does not unwind. With the inventive screw driving tool (1) and method for installing the connection pin (56), unwinding of the nut (10) is prevented and the relative position between the nut (10) and the connection pin (56) is kept constant. Thus, an easy and quick installation is achieved without the need for excessive tool changes.

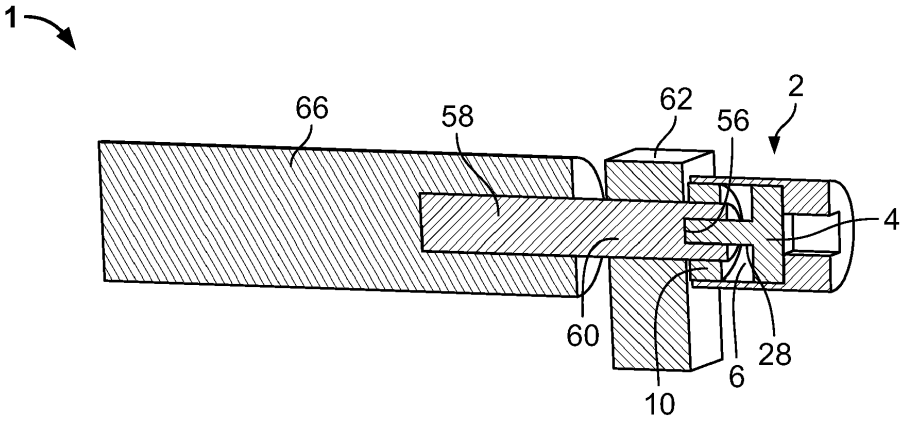

Fig. 10

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Description

[0001] The invention relates to a screw driving tool, the use of a screw driving tool and a method for tightening an electric connection pin together with a nut.

[0002] When installing a connection pin for connecting two components, especially electrical components, e.g. a fixture to a cable lug, the connection pin is inserted into the fixture and then attached tightly to the cable lug with a nut. For easy installation in limited space and to overcome high push-on forces which occur when connecting the two components with an isolation for a waterproof and/or airtight connection, the nut is mounted on the connection pin before completely screwing the connection pin into the fixture. However, the nut may unwind during the screwing of the connection pin into the fixture, due to frictional force exerted on the nut by the cable lug and/or a washer, which can result in the connection pin slipping through a through hole of the second component and a loss of the connection between both components. Thus, it is necessary to alternately tighten the connection pin and nut. This, however, is arduous and time-consuming.

[0003] Consequently, there is a need for a screw driving tool, a process for using a screw driving tool to tighten a connection pin together with a nut and a method for facilitating the installation of a connection pin.

[0004] This problem is solved by the inventive screw driving tool, comprising a socket for driving a nut. The socket has a cavity for receiving the nut. The screw driving tool further comprises a screw driver protrusion arranged coaxially within the socket and protruding into the cavity towards an opening of the cavity, the screw driver protrusion being coupled in a rotationally rigid manner to the socket. Furthermore, the socket and the screw driver protrusion are at least one of a different drive type and/or different drive size.

[0005] The problem is also solved by the use of an insert in a socket for driving a nut, the socket comprising a cavity for receiving the nut and the insert, the insert comprising a screw driver protrusion that is arranged coaxially within the socket and protruding into the cavity towards an opening of the cavity, the screw driver protrusion being coupled in a rotationally rigid manner, wherein the socket and the screw driver protrusion are of at least one of a different drive type or different drive size to tighten an electric connection pin together with the nut. Preferably, the drive type of the socket is an internal drive complementary to the external drive of the nut.

[0006] The problem is further solved by a method for tightening an electric connection pin together with a nut, comprising the steps of:

- simultaneously engaging a nut and a drive of the connection pin with a screw driving tool; and
- simultaneously and synchronously driving the nut and the drive of the connection pin with the screw driving tool.

[0007] The inventive solution ensures that the relative position between the connection pin and the nut remains constant, even when the nut faces resistance, e.g. from a washer and/or a cable lug. Thus, unwinding of the nut during tightening of the connection pin is prevented. This also reduces the risk of the connection pin slipping through the through hole and losing the connection between the two components. Hence, the laborious and time-consuming tool changes are omitted and a quick and easy installation of the connection pin is achieved.

[0008] The screw driving tool, use of the screw driving tool and method for tightening a connection pin according to the invention can be further improved by the following features, which are independent of one another with regard to their respective technical effects, and which can be combined arbitrarily.

[0009] According to a first aspect of the invention, the socket's cavity may comprise a drive type such as a hexagonal, bi-hexagonal, triangular, square, rectangular or pentagonal socket or the like for receiving an external drive type of a standardised nut having a complementary form.

[0010] The drive type of the screw driver protrusion may be complementary to the drive type of the connection pin. The drive of the connection pin may in particular be a screw drive formed at the head of the connection pin. The drive type of the connection pin may in particular be an internal drive type such as an internal polygon, slotted, torx drive or the like. The drive size of the connection pin may preferably be smaller than the inner diameter of a standardised nut complementary to the connection pin.

[0011] In order to reach the connection pin in a tight place, the screw driving tool may comprise a longitudinal body which is long enough to be inserted in an opening of insulation and to engage the nut and the drive of the connection pin, while being accessible outside the insulation.

[0012] The screw driver protrusion may, according to a further aspect of the invention, comprise a standard screw drive, a hexagonal key drive, a Philips drive or the like for engaging the complementary drive of the connection pin.

[0013] The screw driver protrusion may be a part of a separate insert which is inserted or is adapted to be inserted removably into the socket. It is thus not necessary to use two different tools for tightening the connection pin and later tightening the nut on the connection pin.

[0014] A standardised socket or any socket known in the art can be used into which the separate insert can be inserted. After the connection pin is fully screwed into the first component, e.g. the fixture, the separate insert may be removed from the socket, so that only the nut is engaged and can be driven by the screw driving tool, tightening the nut on the connection pin.

[0015] The screw driver protrusion may be a part of a

separate insert which may be adapted to be inserted into the socket in two orientations. Hence, the separate insert can be optimised for different objectives, wherein one objective may be engaging and driving the drive of the connection pin.

[0016] According to another aspect of the invention, the insert may comprise a nut guide protruding into the cavity towards the opening of the cavity in at least one orientation, preferably the first orientation. With the nut guide, a nut can be mounted on the screw driving tool before mounting it on the connection pin. This is especially helpful in tight spaces, where the nut cannot be mounted by hand since there is no space for insertion of the fingers. The nut guide may be a cylindrical protrusion of the same diameter as the connection pin complementary to the inner diameter of the nut. To reduce the risk of the nut falling off the nut guide, the nut guide may be provided with a holding feature such as a spring loaded ball, elastomeric ring, magnet or the like, so that the nut is kept in place on the nut guide. The nut guide may be on the same side as the screw driver protrusion, resulting in a simpler installation, since the insert body does not need to be removed and inserted in a different orientation after mounting the nut on the connection pin.

[0017] However, according to another aspect of the invention, the nut guide may preferably be provided on the other side of the insert opposite to the screw driver protrusion. This leads to an accurate distinction of objectives between the two orientations of the insert body, wherein the sole purpose of the first orientation, whereby the nut guide protrudes into the cavity towards the opening of the cavity, is to mount the nut on the connection pin. The sides of the insert can thus be optimised for their respective tasks, thereby preventing the drive of the connection pin from being engaged by the screw driving tool in the first orientation and ensuring that only the nut is driven by the screw driving tool.

[0018] When changing the orientation of the insert body, both the nut and the connection pin may be engaged by the screw driving tool, resulting in a simultaneous and synchronous movement of the connection pin and nut. Thus, the relative position of the nut on the connection pin does not change and unwinding is prevented, even when the nut faces resistance exerting a frictional force against the rotation direction, e.g. from the cable lug or the washer.

[0019] According to another aspect of the invention, the insert may comprise a base plate of the same drive type and drive size as the socket. Hence, a simple rotationally rigid connection between the socket and the screw driver protrusion is achieved. The screw driver protrusion and the nut guide may be arranged on different sides of the base plate.

[0020] The base plate can comprise a bit reception for receiving the screw driver protrusion in the form of a bit, which is a separate body and can be inserted removably into the bit reception. Therefore, it is possible to use different screwdriver types for a screw driver protrusion and the bit type screw driver protrusion can be easily mounted or removed from the base plate. The bit reception can, for example, be formed by a hexagonal cavity extending from a centre of a front face of the base plate towards the centre of the opposing front side of the base plate.

[0021] According to another embodiment of the invention, the nut guide may be arranged on the same side of the base plate as the screw driver protrusion. In this embodiment, the nut guide may comprise a bit reception, wherein the screw driver protrusion may be removably inserted. The insert consequently has a simple structure and is optimised for two tasks, namely mounting the nut on the connection pin, and simultaneously and synchronously engaging and driving the nut and the drive of the connection pin in one orientation. Thus, it is not necessary to remove the insert from the cavity and insert the insert in a second orientation. In order to mount the nut, the screw driver protrusion is not inserted in the bit reception, so that only the nut is engaged by the screw driving tool and guided by the nut guide onto the connection pin. After mounting the nut, the screw driver protrusion can be installed in the bit reception, so that the screw driving tool is capable of engaging and driving both the nut and the drive of the connection pin at the same time.

[0022] According to another aspect of the invention, the screw driving tool may be provided with a removal aid for removing the insert from the drive of the connection pin. The removal aid may be formed by a through hole in the closed end of the cavity which enables a pulling rod to be inserted through that through hole and being connected to the insert, thereby evenly pulling the screw driver protrusion out at the drive at of the connection pin. For a uniform movement, the through hole can be arranged coaxially to the insert. The screw driver protrusion may jam in the drive of the connection pin and the insert may slide out of the socket when removing the screw driving tool. However, with the removal aid unintentional removal of the insert from the socket can be prevented.

[0023] The pulling rod can be threaded and screwed into a threaded opening of the insert in order to connect the pulling rod with the insert. Alternatively, the pulling rod may be configured as a ball type locking pin, comprising a tubular body with at least one movable ball member which can be moved to an outward operative position, wherein part of the ball member extends radially beyond the external tubular body surface, and a release position radially inward of the operation position. The pulling rod can be inserted in an opening of the insert and locked to the insert in the operation position, wherein the at least one ball member is pressed against the inner wall of the opening. Thus, an easy coupling of the pulling rod and the insert is possible. Furthermore, by pushing the pulling rod further into the cavity, an easy removal of the insert from the cavity is possible.

[0024] Another removal aid may be realised by a pulling eye, which can be formed by a through hole in the insert through which at least one hook can be attached. The through hole may be arranged perpendicular to the

longitudinal direction in which the screw driving protrusion protrudes from the base plate. Further, the through hole may be positioned on the side of the base plate facing away from the screw driver protrusion. Alternatively or additionally, the removal aid can be arranged on the screw driving protrusion and/or on the side of the base plate facing towards the screw driver protrusion.

[0025] The at least one hook may be attached removably to the insert and can be arranged on the side of the base plate facing away from the screw driving protrusion. In this embodiment, the at least one hook may protrude from the base plate through a through hole that extends from the closed end of the socket to the cavity. It can be ensured that the insert can be kept inside the socket when pulling the screw driver protrusion out of the drive of the connection pin by pulling the hooks out of the cavity through the through hole or locking them. Therefore, jamming of the insert and the drive of the connection pin is prevented when removing the screw driving tool. Alternatively or additionally, the pulling eye may be positioned on the screw driver protrusion. The hooks can therefore be attached to the screw driver protrusion and can be used for removal of the screw driving tool if it is used as nut guide without the risk of loosing the insert from the socket. Furthermore, in order to remove the insert from the cavity, the hooks can be attached to the insert on the side facing the opening of the cavity, so that the insert can be pulled out of the cavity.

[0026] With the pulling rod or the hooks inserted in a through hole, a uniform movement of the insert together with the socket is possible, assisting the insertion of the insert on and/or removal of the insert from the drive of the connection pin and/or the socket. The possibility of the insert jamming during removal of said insert is thereby reduced.

[0027] According to another exemplary embodiment of the invention, the screw driver protrusion does not extend more than the sum of depth of the drive, especially the depth of a standardised drive complementary to the connection pin, of the connection pin and length of the nut from one face side to the other face side between which a nut opening of the nut extends, especially the length of a standardised nut complementary to the socket, beyond the cavity when the insert is fully inserted into the socket. Thus, it is ensured that the socket can receive the nut when the screw driver protrusion is engaged with the drive of the connection pin. Preferably, the screw driver protrusion protrudes in the fully inserted state into the cavity so that the distance between the open end of the cavity and the end of the screw driver protrusion is at least as long as the length of a standardised nut complementary to the socket. This ensures that at least half, preferably at least two thirds, of the length of the nut can be received in the socket before the screw driver protrusion engages the drive of the connection pin.

[0028] The distance between the end of the cavity and the end of the protrusion in the fully inserted state may, however, be defined according to the circumstances and user preferences. For example, if the screw driving protrusion needs to be smaller so that at least half, preferably at least two thirds, of the length of the nut can be mounted onto the connection pin before the screw driver protrusion engages the drive of the connection pin, the distance between the open end of the cavity and the end of the protrusion in the fully inserted state may be longer.

[0029] In order for the screw driving tool to be able to receive the nut without contacting the screw driver protrusion, the width of the screw driver protrusion may be smaller than the width of the cavity. Preferably, the distance between a side wall of the screw driver protrusion and a side wall of the cavity may be at least as long as the wall thickness of a standardised nut complementary to the socket.

[0030] According to another aspect of the invention, the socket may comprise a reception opening for receiving the screw driver protrusion. The screw driver protrusion may be a separate body in the form of a bit that can be inserted into the reception opening or can be irremovably fixed to the socket by compression or the like.

[0031] The reception opening can be a through hole of the socket extending through the closed end of the cavity. On one side of the through hole, a driving tool such as a ratchet can be inserted into the socket, while on the other side facing the cavity, the screw driving protrusion may be inserted and combined with the socket, e.g. by compression.

[0032] According to another embodiment of the invention, the screw driving protrusion and the socket may be formed integrally with one another, thus achieving ease of production.

[0033] Furthermore, fewer separate parts are used for the screw driving tool, thereby decreasing the risk of parts being lost.

[0034] According to a preferred embodiment of the invention, the insert body may comprise a shear point. The shear point may be arranged between the base plate and the protrusion. The shear point may be formed by a tapered cross section essentially perpendicular to the longitudinal direction in which the protrusion protrudes into the cavity. The shear point may lead to the screw driving protrusion to be sheared off the insert, when an indicate torque is achieved and the connection pin is fully installed in the first component. After the screw driver protrusion is sheared off the insert, the screw driver protrusion is no longer coupled to the socket in a rotationally rigid manner, so that, when driving the socket, only the nut is tightened without further tightening the connection pin. The nut can thus be wound onto the connection pin, further tightening the nut and completing the instalment of the connection pin in one go, without needing to switch installation tools or remove the insert body from the socket. Hence, the screw driving tool enables fast and easy installation. Furthermore, the screw driving tool can prevent over-tightening of the connection pin, even when a driver tool that does not feature a torque indicator is used to drive the screw driving tool.

[0035] According to another aspect of the invention, the connection pin can be partly screwed into the first component, so that the connection pin protrudes outwards from a threaded opening of the first component. In the case of electrical connectors, the insulation body of both components may lead to high push-on forces, which occur when pressing one component to the other. Here, the user needs to push the connectors towards each other with one hand, while installing the connection pin with the other hand. This can, however, be arduous and tiring. By only partly screwing the connection pin into the first component, the connection pin may penetrate the through hole of the second component, e.g. a cable lug, before the components touch each other.

[0036] A nut can be mounted onto the end of the connection pin protruding from the through hole of the second component, e.g. by hand or with the nut guide of the screw driving tool, so that the connection pin does not slip through the through hole.

[0037] With the screw driving tool, both the nut and the drive of the connection pin may be engaged simultaneously and can be driven synchronously. The nut will therefore not unwind and the connection pin can be fully screwed into the first component.

[0038] After the connection pin is fully screwed into the first component, the insert body and/or screw driver protrusion can be removed from the socket, so that only the nut can be engaged by the screw driving tool. Alternatively, a tool change can be made, so that a standard socket tool is used only for engaging and driving the nut. When tightening the nut, the connection pin and the first component are pulled towards the second component, overcoming high push-on forces until the connection pin is fully installed and the two components are in contact with one another.

[0039] In the following, the screw driving tool according to the invention is explained in greater detail with reference to the accompanying drawings, in which exemplary embodiments are shown.

[0040] In the figures, the same reference numerals are used for elements which correspond to one another in terms of their function and/or structure.

[0041] According to the description of the various aspects and embodiments, elements shown in the drawings can be omitted if the technical effects of these elements are not needed for a particular application, and *vice versa:* i.e. elements that are not shown or described with reference to the figures but are described above can be added if the technical effect of those particular elements is advantageous in a specific application.

[0042] In the figures:

Fig. 1 shows a schematic exploded view of a first embodiment of a screw driving tool according to the invention;

Fig. 2 shows a schematic profile view of the first embodiment of the screw driving tool according to the invention in an assembled state;

Fig. 3 shows a sectional view of the first embodiment of the screw driving tool according to the invention in an assembled state;

Fig. 4 shows a perspective view of second embodiment of an insert for a screw driving tool according to the invention;

Fig. 5 shows a perspective view of a third embodiment of an insert for a screw driving tool according to the invention;

Fig. 6 shows another perspective view of the third embodiment of the insert shown in Fig. 5;

Fig. 7 shows a perspective view of a fourth embodiment of an insert for a screw driving tool according to the invention;

Fig. 8 shows another perspective view of the fourth embodiment of the insert shown in Fig. 7;

Fig. 9 shows a sectional view of a screw driving tool engaging a connection pin and a nut according to the invention;

Fig. 10 shows a sectional view of a screw driving tool screwing in the connection pin in a first component according to the invention; and

Fig. 11 shows a sectional view of a completely installed connection pin.

[0043] In Fig. 1 a screw driving tool 1 is shown in an exploded view. The screw driving tool 1 comprises a socket 2 and an insert 4, which can be inserted in two different orientations into an open end 32 of a cavity 6. The insert 4 can be inserted into the cavity 6 until it contacts a closed end 30 of the cavity in the fully inserted state.

[0044] The socket 2 comprises a longitudinal cylindrical body 8 with the one side open cavity 6. The cavity 6 extends in the longitudinal direction coaxially with the cylindrical body 8 and comprises the shape of a hexagon, so that a complementary nut 10 can be received in the cavity 6 and driven by the socket 2. However, according to the form and size of the nut 10, different forms and/or sizes of the cavity and/or socket 2 are possible, for example a bi-hexagonal form.

[0045] The insert 4 comprises a base plate 12 with a hexagonal shape and the width of the cavity 6, so that the insert 4 can be coupled to the socket 2 in a rotationally rigid manner, wherein the rotational movement of the socket 2 is transferred to the base plate 12. The insert 4 can be inserted into the cavity 6 in two different orientations. A first orientation 14 is shown in Fig. 1. In this first

orientation 14 a nut guide 16, protrudes from a font face 18 towards the open end 32 of the cavity 6 when the insert 4 is fully inserted into the cavity 6.

[0046] The nut guide 16 is formed by a cylindrical protrusion 20 with an outer diameter 22 that corresponds to an inner diameter 24 of the complementary nut 10. The nut 10 can be mounted onto the nut guide 16 in order to facilitate assembly of the nut 10 on a connection pin in tight spaces, where mounting of the nut 10 onto the connection pin by hand is not possible or bothersome.

[0047] On the opposite front face 26 of the base plate 12 facing the closed end of the cavity 6, a screw driver protrusion 28 protrudes from the base plate 12. The screw driver protrusion 28 comprises the shape of a hex key so that a hexagonal socket drive of a connection pin may be engaged by the screw driver protrusion 28. However, the shape of the screw driver protrusion 28 may be adapted according to the drive type of the connection pin. Thus, a screw driver protrusion 28 with the form of a standard flat shaped screw drive, a socket connection, a Phillips screwdriver or any other drive types known to a skilled person are possible.

[0048] The width of the screw driver protrusion 22 perpendicular to the longitudinal direction is designed complementary to the drive of the connection pin and is smaller than the inner diameter 24 of the nut 10. Thus, a contact between the nut 10 and the screw driver protrusion 22 is prevented.

[0049] Both the screw driver protrusion 22 and the nut guide 16 are arranged coaxially on the base plate 12 and are therefore also coaxially arranged to the socket 2 when the insert 4 is inserted into the cavity 6.

[0050] After the nut 10 has been mounted onto the connection pin, the insert 4 can be removed from the cavity 6 and inserted into the cavity 6 in a second orientation, wherein the nut guide 16 faces the closed end of the cavity and the screw driver protrusion 28 protrudes towards the open end of the cavity 6. In this orientation, the drive of the connection pin and the nut 10 can both be engaged by the screw driving tool 1 and simultaneously and synchronously be driven by said screw driving tool 1.

[0051] In Figs. 2 and 3, the screw driving tool 1 according to the embodiment shown in Fig. 1 is displayed in an assembled state. In Fig. 2, a perspective view is shown, while in Fig. 3, a sectional view showing the inside of the socket 2 can be seen.

[0052] The insert 4 is inserted in the first orientation 14, so that the screw driver protrusion 28 faces the closed end 30 of the cavity 6, while the nut guide 16 protrudes towards the open end 32 of the cavity 6. The base plate 12 is form-fittingly received in the cavity 6, resulting in a rotationally rigid coupling between the socket 2 and the insert 4.

[0053] The closed end of the socket 2 opposite the cavity 6 comprises an opening 34 for receiving a socket connection of a socket driving tool for rotating the socket 2 (not shown). The opening 34 extends from the closed end 30 of the cavity 6 to the end of the socket 2 facing away from the cavity 6. Due to the socket connection being positioned inside the opening 34, movement of the insert 4 further into the cavity 6 in the first orientation 14 is prevented. Thus, the free end of the screw driver protrusion 28 is aligned with the closed end 30 of the cavity 6.

[0054] As can be seen in Fig. 3, the cavity 6 comprises a length 36, which is longer than a length 38 of the insert 4. Thus, the nut 10 can be received by the socket 2 when the insert 4 is fully inserted into the cavity 6. As shown in Fig. 2, the nut 10 may protrude partially from the cavity 6. However, preferred is if more than two thirds of the nut 10 are received inside the cavity 6. This ensures that the nut 10 does not fall out of the socket 2 and a high rotational force can be transmitted by the socket 2 to the nut 10.

[0055] The nut guide 16 extends from the base plate 12 with a length 14 that is essentially smaller than a length 42 of the nut 10. Thus, the nut guide 16 does not block the free end of the connection pin from protruding partially into the opening of the nut 10 in order to mount the nut 10 on the connection pin. The nut guide 16 may have a holding feature (not shown) such as a spring loaded ball, elastomeric ring, magnet or the like, so that the nut 10 does not accidentally fall off the nut guide 16.

[0056] In the second orientation (not shown), the nut guide 16 is aligned with the closed end 30 of the cavity 6. The screw driver protrusion 28 does not extend beyond the cavity 6 and ends before the open end 32 of the cavity 6. Therefore, when engaging the drive of the connection pin the socket 2 can still engage the nut 10, which is mounted on the connection pin. However, the length 38 of the insert 4 and therefore the difference in length between the open end 30 of the cavity 6 and the end of the insert 4 facing the open end 30 of the cavity 6 can be different according to the circumstances, such as the depth of the connection pin's drive or the desired relative position of the nut 10 and the connection pin. In order to ensure that the at least half of the nut 10, preferably at least two thirds of the nut 10, can be received in the socket, the screw driver protrusion 28 does not extend more than the sum of the depth of the connection pin's drive and the length 42 of the nut 10 beyond the cavity 6.

[0057] In Fig. 4 another embodiment of the insert 4 is shown.

[0058] The insert 4 comprises a base plate 12 and a screw driver protrusion 28 protruding from the front face 26 of the base plate 12. Similar to the embodiment shown in Figs. 1 to 3, the base plate 12 has a hexagonal shape, so that it can be form-fittingly received inside the cavity 6 of the socket 2. Between the free end of the screw driver protrusion 28 and the base plate 12, the insert 4 features a segment with a tapered cross section 44. The tapered cross section 44 creates a shear point 46, at which the screw driver protrusion 28 is sheared off from the base plate 12, so that a rotation of the base plate 12 is no longer transmitted to the screw driver protrusion 28. Thus, the drive of the connection pin is no longer driven, while the nut 10 may still be tightened by the socket 2.

In this embodiment, it is possible to install the connection pin without a single tool change or any need to remove the insert 4 from the socket 2. The shear point 46 can be designed for specifically shearing off the screw driver protrusion 28 from the insert when a desired torque is achieved.

[0059] In the embodiments of the insert 4 previously shown, the insert 4 is a monolithic compound, wherein the different parts are formed integrally with one another. However, different embodiments, wherein the screw driver protrusion 28 is a separate part adapted to be inserted into a bit reception of the base plate 12 and/or the socket 2, are also possible. A screw driving tool 1 comprising separate parts may have the advantage that the screw driver protrusion 28 is interchangeable, so that a complete set of bits can be used according to the drive of the connection pin.

[0060] In a different embodiment (not shown), the socket 2 and the screw driver protrusion 28 can be formed integrally with one another. This embodiment prevents the loss of parts of the screw driving tool 1 and is easily produced.

[0061] In the embodiment shown in Figs. 5 and 6, the insert 4 is provided with a through hole 48 extending from one side of the base plate 12 to the opposite side of the base plate 12 parallel to the front face of said base plate. The through hole 48 is formed by a notch 50 on the front face side 18, which is opposite the front face side 26 from which the screw driver protrusion 28 extends, and serves as a removal aid 51. The notch is closed at the centre of the front face 18 by a bridge. This through hole can be used for installing hooks or the like. The removal aid 51 can ensure a uniform movement of the insert 4 from the connection pin 58 and thus prevent jamming.

[0062] Not shown are different options for positioning the through hole 48, e.g. on the screw driver protrusion 28, so that the hooks can be attached to the screw driver protrusion 28, which is easily accessible. Another embodiment not shown here utilises a pushing rod, which can be inserted through an opening from the front face of the socket opposite the cavity 6 in order to push the insert 4 out of the cavity 6.

[0063] In the embodiment shown in Figs. 7 and 8, the insert 4 does not comprise a base plate 12. Rather, the insert 4 is formed only by the screw driver protrusion 28 in the form of a straight hex key. The socket 2 comprises a hexagonal bit reception 54 at the closed end 30 of the cavity 6. The screw driver protrusion 28 can be inserted into the bit reception 54 and can be further combined by compression or similar. The screw driver protrusion 28 can also be a bit that can be removably inserted into the bit reception 54. Further, the opening 34 is shown, which has a square form so that a pin end for a socket connection of a ratchet or the like can be coupled to the socket. However, different socket drivers known to the skilled person in the art can be combined with the screw driving tool 1 according to the invention, e.g. the socket can have a fixed T-shaped handle or the socket can be attached to a shaft and an essentially cylindrical handle.

[0064] The bit reception 54 and the opening 34 are arranged coaxially adjoining each other, so that they form a through hole from the end of the socket 2 opposite the cavity 6. Thus, a pushing rod can be used to push the screw driver protrusion 28 out of the cavity 6.

[0065] The following describes the advantages of the screw driving tool 1, how the screw driving tool 1 is used and the method for installing a connection pin, with reference to Figs. 9 to 11.

[0066] In these three figures, a screw driving tool 1 is shown, wherein the insert 4 is inserted into the cavity 6 of the socket 2 so that the screw driver protrusion 28 protrudes into the cavity 6 towards the open end 32 of the cavity 6. The screw driver protrusion 28 is form-fittingly inserted into a complementary drive 56 of a connection pin 58, while a nut 10 is received in the cavity 6 and can be driven by the socket 2. The connection pin 58 penetrates through an eye 60 of a cable lug 62 and is partly screwed into a threaded opening 64 of a fixture 66 in order to prevent the connection pin 58 from slipping through the eye 60 of the cable lug 62. The cable lug 62 must be protected with a washer (not shown) and secured by the nut 10 on the side of the cable lug 62 facing away from the fixture 66.

[0067] In an exemplary embodiment, the connection pin 58 is partly screwed into the threaded opening 64 of the fixture 66. The cable lug 62 is then pushed towards the fixture 66 until the connection pin 58 penetrates through the eye 60 of the cable lug 62 and the nut 10 is screwed onto the end of the connection pin 58 on the side of the cable lug 62 facing away from the fixture 66.

[0068] Since the socket 2 and the insert 4 are coupled with one another in a rotationally rigid manner, a rotational movement 67 induced by a socket driver (not shown) is transmitted to the screw driver protrusion 28. Thus, both the nut 10 and the connection pin 58 are synchronously and simultaneously driven by the screw driving tool 1.

[0069] Without the use of the inventive screw driving tool 1, as the nut 10 touches the cable lug 62, a frictional force is exerted onto the nut 10, hindering the rotational movement 67 of the nut 10. As a result, the nut 10 unwinds from the connection pin 58 when screwing in the connection pin 58 into the threaded opening 64 of the fixture 66. Thus, the nut 10 needs to be re-tightened before it falls off the connection pin 58 and the connection pin 58 slips through the eye 60. This requires several tool changes in order to tighten the nut 10 and the connection pin 58 alternately.

[0070] However, with the inventive screw driving tool 1, both the nut 10 and the connection pin 58 are engaged and rotated at the same time. Consequently, the relative position between the nut 10 and the connection pin 58 remains constant and the connection pin 58 can be completely screwed into the threaded opening 64 of the fixture 66 as is shown in Fig. 10 without the risk that the nut 10 will fall off the connection pin 58. During this step, the

fixture is brought closer to the cable lug 62, overcoming installation difficulties like high push-on forces caused by the insulation bodies of both components (not shown), whose dimensions are designed in such a way as to ensure an electrically functional waterproof and air tight connection between these two components.

[0071] After the connection pin 58 is completely screwed into the fixture 66, the insert 6 is removed from the socket 2 or a different tool, for example a standard socket, is used to only engage the nut 10, as shown in Fig. 11. By tightening the nut 10, the connection pin 58 is further pulled towards the socket 2 until the nut 10 is completely tightened and the fixture 66 contacts the cable lug 62 completing the connection between the two components.

[0072] Thus, by using the inventive screw driving tool 1, an easy and fast installation of a connection pin 58, especially in tight spaces, is achieved.

Reference numerals

[0073]

1 screw driving tool
2 socket
4 insert
6 cavity
8 cylindrical body
10 nut
12 baseplate
14 first orientation
16 nut guide
18 front face
20 cylindrical protrusion
22 outer diameter
24 inner diameter
26 front face
28 screw driver protrusion
30 closed end
32 open end
34 opening
36 length of the cavity
38 length of the insert
40 length of the nut guide
42 length of the nut
44 tapered cross section
46 shear point
48 through hole
50 notch
51 removal aid
52 bridge
54 bit reception
56 drive
58 connection pin
60 eye
62 cable lug
64 threaded opening
66 fixture
68 rotational direction

Claims

1. Screw driving tool (1) comprising a socket (2) for driving a nut (10), the socket (2), having a cavity (6) for receiving the nut (10), and a screw driver protrusion (28) arranged coaxially within the socket (2), and protruding into the cavity (6) towards an opening of the cavity (6), the screw driver protrusion (28) being coupled in a rotationally rigid manner to the socket (2), and the socket (2) and the screw driver protrusion (28) being at least one of a different drive type and different drive size.

2. Screw driving tool (1) according to claim 1, wherein the screw driver protrusion (28) is at least part of a separate insert (4) which is inserted or is adapted to be inserted removably into the socket (2).

3. Screw driving tool (1) according to claim 2, wherein the insert (4) is adapted to be inserted in two orientations into the socket (2).

4. Screw driving tool (1) according to any one of claims 2 to 3, wherein at least in one orientation a nut guide (16) of the insert (4) protrudes into the cavity (6) towards the opening of the cavity (6).

5. Screw driving tool (1) according to claim 3 or 4, wherein the screw driver protrusion (28) protrudes into the cavity (6) in at least one orientation.

6. Screw driving tool (1) according to any one of claims 2 to 5, wherein the insert (4) comprises a base plate (12) of the same drive type and drive size as the socket (2).

7. Screw driving tool (1) according to claim 6, wherein the base plate (12) and the screw driver protrusion (28) are separate bodies, and the base plate (12) features a bit reception for removably attaching the screw driver protrusion (28) to the base plate (12).

8. Screw driving tool (1) according to any one of claims 2 to 7, wherein the screw driving tool (1) is provided with a removal aid for removing the insert (4) from the connection pin (58).

9. Screw driving tool (1) according to any one of claims 1 to 8, wherein the screw driving protrusion (28) does not extend more than the sum of depth of the drive (56) and length (42) of the nut (10) beyond the cavity (6) when the screw driving protrusion (28) is fully inserted in the socket (6).

10. Screw driving tool (1) according to any one of claims

1 to 9, wherein the distance between the open end (32) of the cavity (6) and the end of the screw driver protrusion (28) directed towards the open end (32) is at least as long as half of or two thirds of the length (42) of a standardised nut (10) complementary to the socket (2).

11. Screw driving tool (1) according to any one of claims 1 to 10, wherein the distance between a side wall of the cavity (6) and a side wall of the screw driver protrusion (28) is as least as long as the width of a standardised nut (10) complementary to the socket (2).

12. Screw driving tool (1) according to claim 1 or any one of claims 9 to 11, wherein the screw driving protrusion (28) and the socket (2) are formed integrally with one another.

13. Screw driving tool (1) according to any one of claims 2 to 11, wherein the insert (4) comprises a shear point (46).

14. Method for tightening a connection pin (58) together with a nut (10), comprising the steps of:

- simultaneously engaging a nut (10) and a drive (56) of the connection pin (58) with a screw driving tool (1); and
- simultaneously and synchronously driving the nut (10) and the drive (56) of the connection pin (58) with the screw driving tool (1).

15. Use of an insert (4) in a socket (2) for driving a nut (10), the socket (10) having a cavity (6) for receiving the nut (10) and the insert (4), the insert (4) comprising a screw driver protrusion (28) arranged coaxially within the socket (2) and protruding towards an opening of the cavity (6), the screw driving protrusion (28) being coupled to the socket (2) in a rotationally rigid manner, wherein the screw driver protrusion (28) and the socket (2) are at least one of a different drive type and different drive size, to tighten an electric connection pin (58) together with a nut (10).

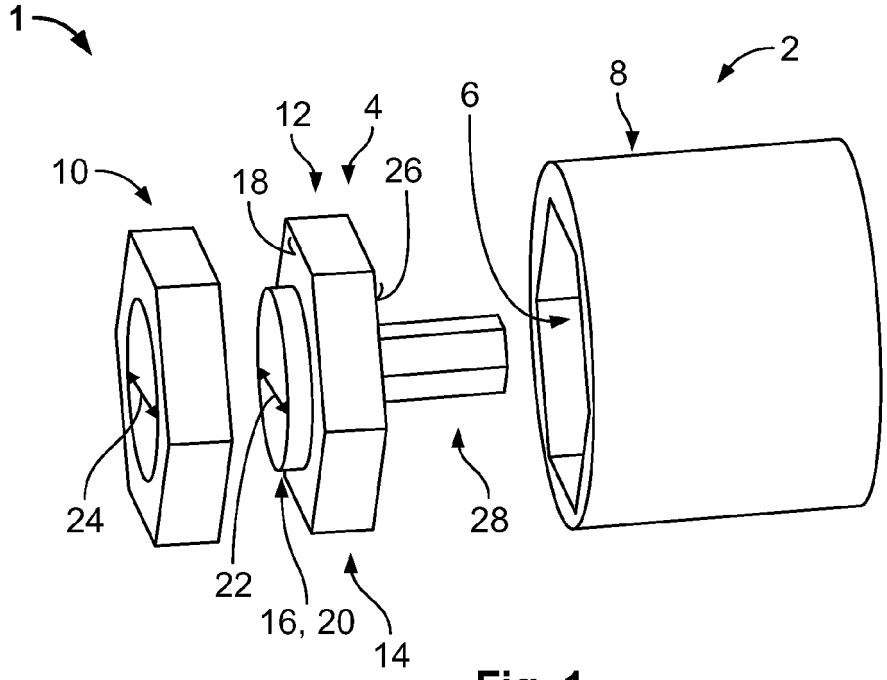

Fig. 1

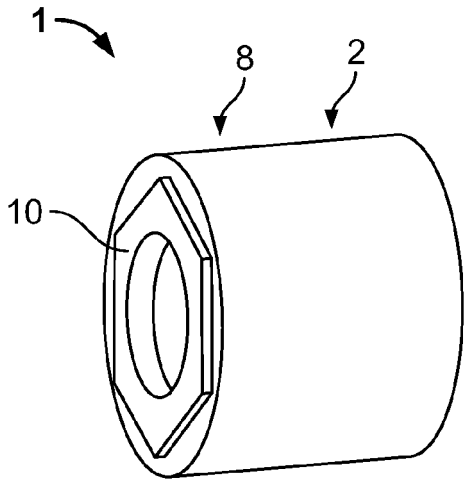

Fig. 2

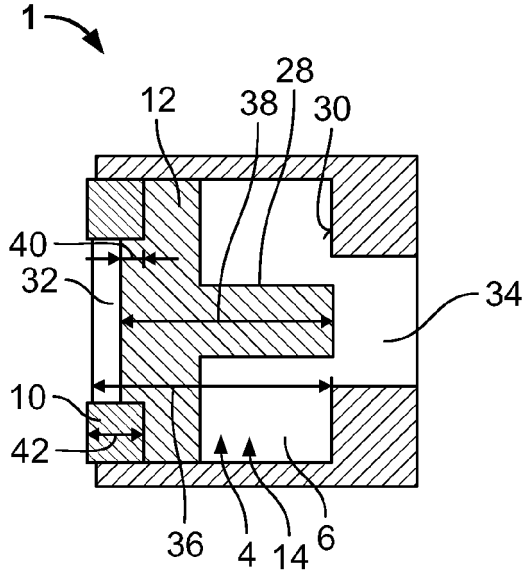

Fig. 3

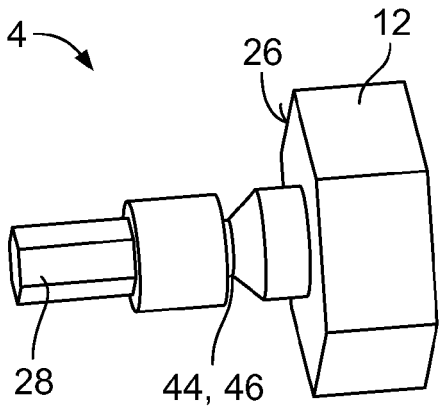

Fig. 4

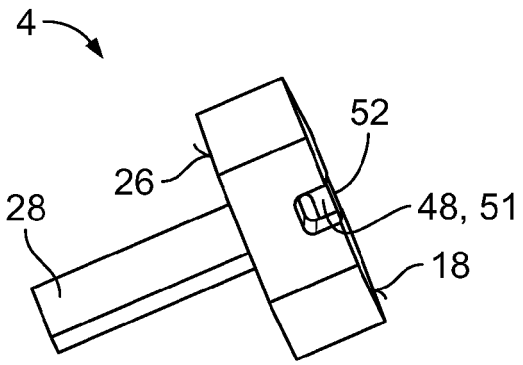

Fig. 5

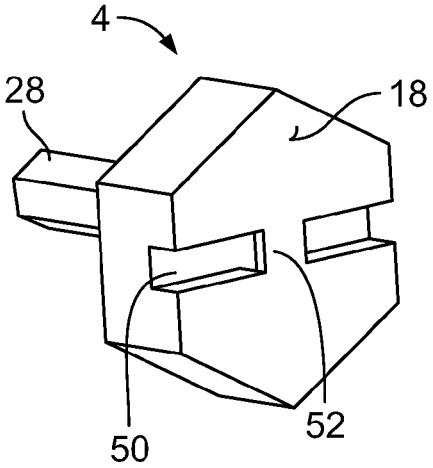

Fig. 6

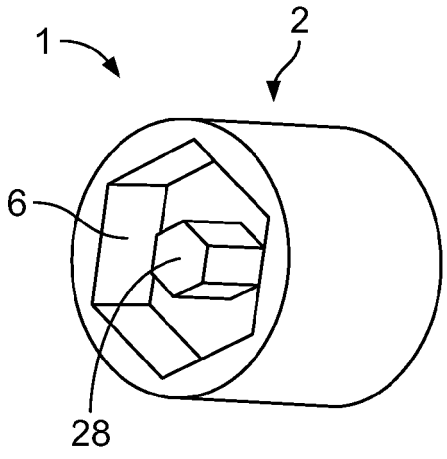

Fig. 7

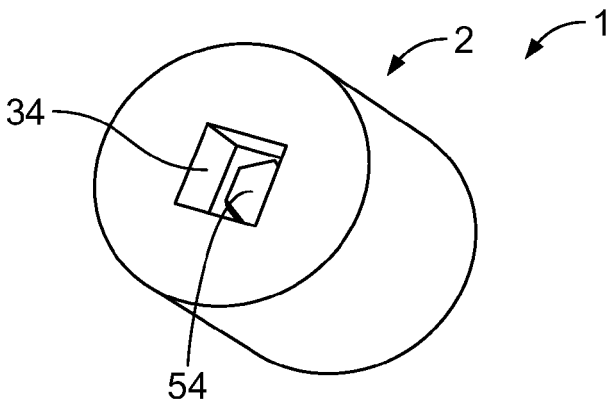

Fig. 8

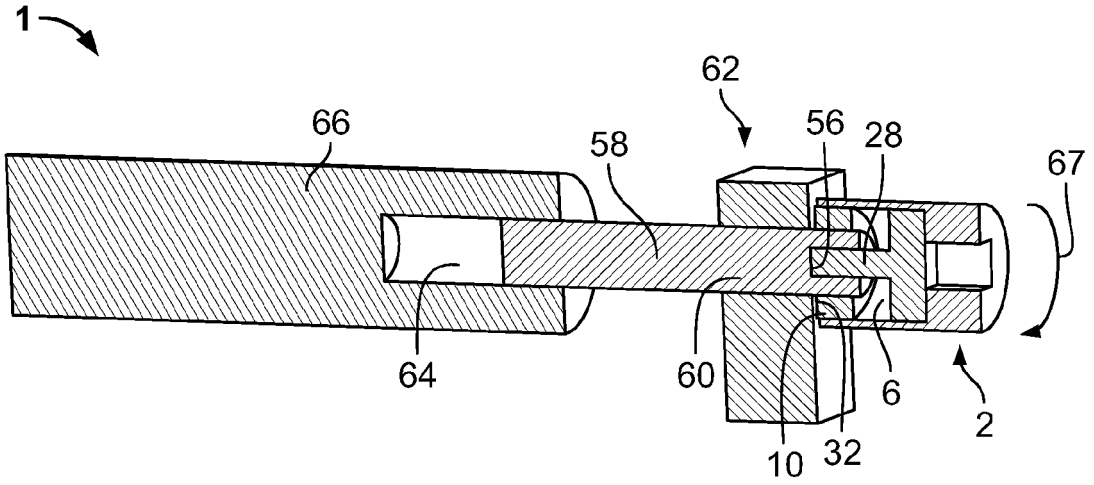

Fig. 9

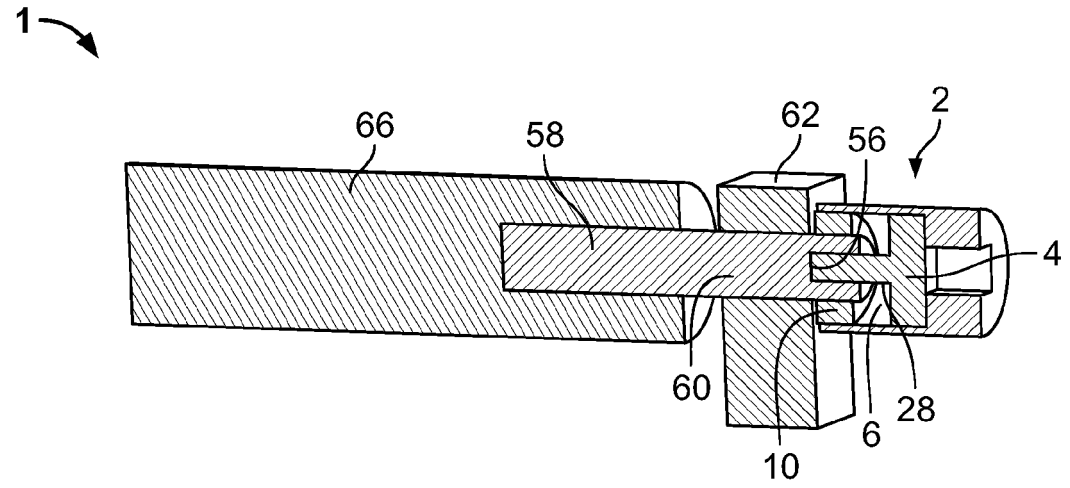

Fig. 10

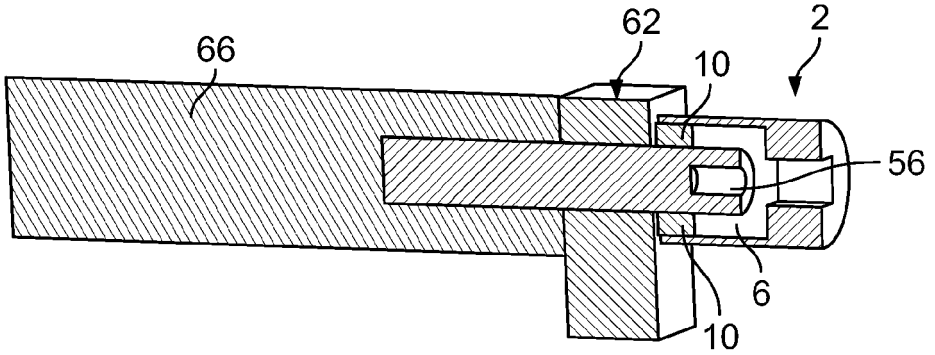

Fig. 11

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EUROPEAN SEARCH REPORT

Application Number
EP 18 17 1108

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	13 November 2018	Pastramas, Nikolaos

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