



GERMAN
PATENT OFFICE

③① Internal priority: ③② ③③ ③①
08.04.87 DE 87 05 205.9

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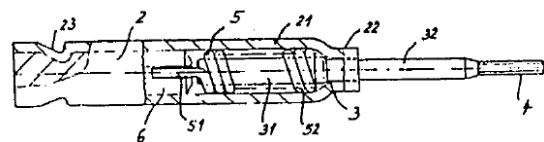
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⑤④ Screwing tool with torque limiting device

A screw-in tool 1 for surgical applications has a handle 2 for receiving a shaft 3 which is connected to a driver 4 and is rotatably mounted in the handle 2. A device for limiting the tightening torque is provided between the shaft 3 and the handle 2 in the form of a helical spring 5 which is frictionally wound around a portion 31 of the shaft 3 and one end 51 of which is fixedly connected to the handle 2. As a result of the elastic deformation of the helical spring, the static friction between the handle 2 and the shaft 3 is increased or reduced as a function of the direction of rotation and the torque exerted on the handle 2 and, when a maximum torque is exceeded, changes into a sliding friction between the handle 2 and the shaft 3.

FIG. 1



Claims

1. A screwing tool comprising a handle for receiving a shaft connected to a driver, **characterized in that** the handle (2) is formed as a hollow housing, in which the shaft (3) is rotatably mounted, and in that between the shaft (3) and the handle (2) there is provided a helical spring (5) which bears frictionally against a portion (31) of the shaft (3) and one end (51) of which is fixedly connected to the handle (2).
2. The screwing tool according to claim 2, characterized in that the handle (2) is hollow-cylindrical and in that a cylindrical helical spring (5) of circular or rectangular cross-section is wound around a first cylindrical portion (31) of the shaft (3).
3. The screwing tool according to claim 2, characterized in that the handle (2) is designed as a hollow cone and a frustoconical spring is wound around a frustoconical portion of the shaft (3).
4. The screwing tool according to any one of the preceding claims, characterized in that the inner surface of the handle (2) bears against the outer surface of the helical spring (5).
5. The screwing tool according to any one of the preceding claims, characterized in that the handle (2) has an axial bore and in that the end (51) of the helical spring (5) connected to the handle (2) is angled in the axial direction and is inserted into a groove (61) of a bolt (6) inserted into the bore of the handle (2) and fixedly connected to the handle (2).
6. The screwing tool according to any one of the preceding claims, characterized by its use for a miniature torque wrench for surgical applications.

Screwing tool with torque limiting device

The invention relates to a screwing tool comprising a handle for receiving a shaft which is connected to a driver.

From DE-OS 25 18 571 a screwing tool of the type mentioned for tightening adjustment screws of a stimulating current device for medical applications is known. The known screwing tool has a driver portion in the form of a hexagon socket wrench, which can be brought into engagement with the hexagon socket of an adjustment screw. The driver is connected to a shaft with a larger diameter than the driver, which in turn merges into a handle. The handle is ribbed to create a gripping surface with which the screwing tool can be rotated. In order that, when the adjustment screws are tightened by means of the screwing tool, no excessive torque can be exerted which would lead to a tearing off of the thread of the adjustment screw or of the threaded bore, the handle of the screwing tool consists of a plastic which is in engagement with a knurled end of the shaft. The plastic handle is provided with longitudinal ribs, but has relatively small dimensions compared to the fingers of the surgeon operating the screwing tool, so that the torque which can be applied to the screwing tool by the surgeon remains below the torque which would lead to the thread of the adjustment screws or the threaded bore being torn off.

However, the handling of the known screwing tool is difficult due to the small dimensions of the handle. The difficult handling has an effect in particular when the adjustment screws are loosened, for which a greater torque is often required than when the adjustment screws are tightened with a limited torque.

It is an object of the present invention to provide a screwing tool of the type mentioned at the outset which is both easy to handle and ensures by simple means that, on the one hand, a maximum tightening torque is not exceeded and, on the other hand, a torque exceeding the maximum tightening torque can be exerted for release.

This object is achieved according to the invention in that the handle is hollow-cylindrical and that a cylindrical helical spring with a circular or rectangular cross-section is wound around a first cylindrical portion of the shaft.

The solution according to the invention allows easy handling of the screwing tool even under difficult conditions and ensures with simple means that a maximum tightening torque is not exceeded in one direction of rotation, while a greater torque than the tightening torque can be exerted in the other direction of rotation.

When the screwing tool is rotated in one direction, the frictional engagement between the helical spring, which is fixedly connected to the handle, and the portion of the shaft is reduced by stretching the helical spring, so that when a maximum torque is exerted in this one direction of rotation, a sliding friction is brought about between the inner side of the helical spring and the outer surface of the portion of the shaft, while in the opposite direction of rotation the helical spring is tightened and thus an increased static friction is provided between the inner surface of the helical spring and the outer surface of the portion of the shaft. Also in this direction of rotation only a maximum torque is possible, since in the case of an excessive torque the static friction between the helical spring and the shaft likewise changes into a sliding friction.

A further advantageous embodiment of the solution according to the invention is characterized in that the inner surface of the handle bears against the outer surface of the helical spring.

This embodiment of the solution according to the invention ensures that the helical spring is also clamped from the outside, so that it cannot deform appreciably. As a result, a firm guidance of the shaft is made possible and a bending of the shaft is prevented.

The screwing tool according to the invention is particularly suitable for use for a miniature torque wrench for surgical applications.

Based on an exemplary embodiment shown in the drawing, the idea underlying the invention will be explained in more detail. In particular:

FIG. 1 is a partial longitudinal sectional view of a screwdriver with a torque limiting device and

FIG. 2 is a partially sectional view of a screwdriver with a torque limiting device which is rotated by 90°

with respect to the illustration according to **FIG. 1**.

The screwing tool 1 shown in **FIGS. 1** and 2, which can be designed both as a screwdriver and as a wrench, has a shaft 3 for receiving a driver 4, which in the illustrated exemplary embodiment is designed as a hexagonal wrench for tightening and loosening screws with a hexagon socket. The shaft 3 consists of a first portion 31 which is arranged in the interior of a hollow cylindrical handle 2 and a second portion 32 which has a diameter which is smaller than that of the first portion 31 and is rotatably mounted in the part adjoining the first portion in a tapered handle portion 22.

A helical spring 5 is wound around the first portion 31 of the shaft 3, the helical windings 52 of the helical spring 5 frictionally bearing against the outer surface of the first portion 31 of the shaft 3.

One end 51 of the helical spring 5 is angled in the axial direction of the screwing tool 1 and is inserted into the groove 61 of a bolt 6 which is fixedly connected to the handle 2. The fixed connection of the bolt 6 to the handle 2 is produced after the insertion of the bolt 6 into the bore of the handle 2 by the provision of notches 23 at the end of the handle 2, as is made clear by the illustration according to **FIG. 2**.

The diameter of the bore of the handle 2 or the inner diameter of the handle 2 is dimensioned such that the outer surface of the helical spring 5 bears tightly against the inner surface of the handle 2, so that the helical spring cannot deform appreciably and a stable mounting of the shaft 3 is provided.

The screwing tool shown in **FIGS. 1** and 2 serves to tighten screws with right-hand threads and can be designed in an analogous manner by opposite winding of the helical spring for screws with left-hand threads.

When tightening a screw with a right-hand thread, the helical spring 5 is rotated apart or rotated against its direction of winding, so that a slight increase in the inner diameter of the helical spring 5 takes place, with the result that the frictional engagement between the inner surface of the helical spring 5 and the outer surface of the first portion 31 of the shaft 3 is reduced. However, the remaining static friction, which increases towards the tapered portion of the handle 2, is sufficient to transmit a definable maximum torque. The part of the helical spring 5 adjacent to the bolt 6 forms an elastic element which deforms in a predetermined manner up to the maximum torque which can be transmitted.

When this torque is exceeded, the static friction between the inner surface of the helical spring 5 and the outer surface of the first portion 31 of the shaft 3 changes into a sliding friction, so that no greater torque can be exerted on the shaft 3 or the driver 4.

If, on the other hand, the screwing tool is rotated in the opposite direction for loosening a screw with a right-hand thread, the helical spring 5 is rotated in the

direction of its winding direction and thus the inner diameter of the helical spring 5 is reduced. The frictional engagement between the inner surface of the helical spring 5 and the outer surface of the first portion 31 of the shaft 3, which is thus increased, leads to an increase in the torque which can be transmitted, so that a greater torque can be transmitted for loosening a screw with a right-hand thread than for tightening the screw. Due to the limited frictional engagement also when the helical spring 5 is firmly tightened, a maximum torque cannot be exceeded even in this direction of rotation of the screwing tool, so that also when a screw with a right-hand thread is loosened, a tearing of the thread or an unscrewing of the screw head is avoided.

From the above description of the functioning of the screwing tool according to the invention, it can be seen that the limitation of the transmittable torque in one or the other direction of rotation depends on the length of the first portion 31 of the shaft 3, the length of the winding portion 52 of the helical spring 5, the spring constant of the helical spring 5, the surface quality of the first portion 31 of the shaft 3, as well as the materials used and the inner diameter of the handle 2. By varying these parameters, the maximum transmittable torques in one or the other direction of rotation can be determined, for example, as a function of the type and size of the driver 4.

In the modification of the illustrated exemplary embodiment, instead of a cylindrical helical spring in connection with a cylindrical first portion 31 of the shaft 3, a frustoconical spring in connection with a frustoconical portion of the shaft 3 can also be used.

FIG. 1

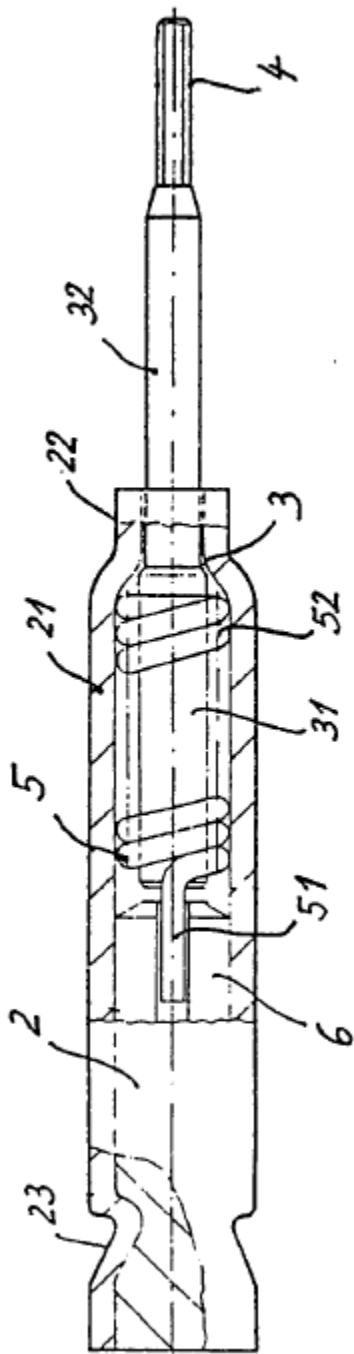
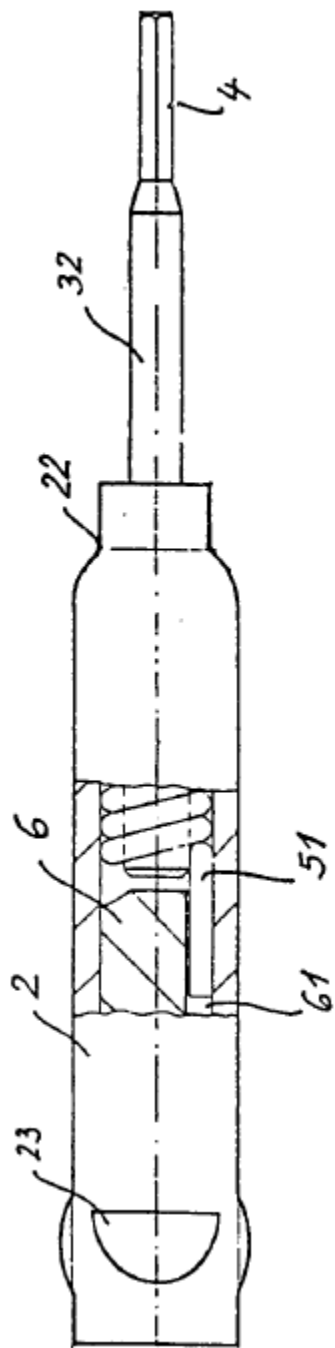


FIG. 2





April 29, 2025

Certification

Welocalize Translations

TRANSLATOR'S DECLARATION:

I, Alessandro Neckels, hereby declare:

1. That I possess advanced knowledge of the English and German languages.
2. That the attached German into English translation has been translated by me, and is a true and accurate translation of DE 3808238A1 to Ruetschi.
3. That all statements made herein are made of my own knowledge and are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

A handwritten signature in black ink, appearing to read "Alessandro Neckels", written over a horizontal line.

ALESSANDRO NECKELS

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