

Description

Drive element

5 The present invention relates to a drive element which - in particular at one end of a shaft - has an inner driving profile which defines a profile axis and has on its inner side a plurality of concave drive surfaces which are distributed uniformly around the profile axis and between which planar or convexly curved transition surfaces are provided, or which has an outer driving profile which
10 defines a profile axis and has on its outer side has a plurality of concave drive surfaces which are distributed uniformly around the profile axis and between which flat or convexly curved transition surfaces are provided, wherein

in cross-section, the transition points or transitions between the drive
15 surfaces and the transition surfaces lie on a common inner circle with the inner diameter D_i , and

the drive surfaces lie on outer circles of diameter D_a distributed uniformly around the profile axis and are formed symmetrically with respect to
20 their longitudinal central plane enclosing the profile axis.

Furthermore, the invention relates to a method for connecting of two components, in particular a screw and a turning tool in a rotationally fixed manner, one of the components being designed as a drive element with an
25 outer driving profile and the other component being designed as a drive element with an inner driving profile, in which the driving profiles of the two components are axially plugged together in order to produce a rotationally fixed connection between the two components.

Screws and turning tools are known from the prior art in various designs. The screws comprise a screw shank with an external thread, on the upper end region of which a driving profile is provided for coupling with a turning tool, which is usually formed on a screw head. The turning tools are formed, for example, in the form of ring or open-end wrenches or comprise interchangeable bits that are connected to a drive, for example in the form of a handle or a cordless screwdriver, via a bit holder. Alternatively, the bit holder can be connected to a screwdriver handle or an angled handle, a ratchet, a torque wrench, a cordless screwdriver or a ratchet screwdriver via an adapter for alternate use.

Screw and turning tool are offered for transmitting a torque from the turning tool to the screw with driving profiles designed complementary to each other. For this purpose, one of the two components has an outer drive profile with outer drive surfaces at one of its free ends, and the other component has an inner drive profile with inner drive surfaces at its one free end, complementary to the outer drive profile. The driving profiles are, for example, in the form of an inner hexagon, an outer hexagon, a Torx profile and a cross-slot profile or slot profile. After coupling the inner drive profile to the outer drive profile, the drive profiles are in contact with each other with play. This means that the driving profiles can become unintentionally detached from one another and it is also not possible to align the driving profiles axially with one another. To simplify handling when screwing in and loosening the screw with the turning tool, turning tools that are provided with a magnet or ferromagnetic turning tools that can be magnetized with a magnet are offered. However, this is associated with additional expense. Furthermore, by using a magnetic turning tool, a coaxial alignment of the driving profiles cannot be achieved either. However, such a coaxial alignment is necessary in order to be able to integrate bolted joints into automatic manufacturing processes.

To solve this problem, it is known from DE 10 2005 011 734 A1 that the drive surface of a turning tool for screwing in and loosening so-called Torx screws is inclined at an acute angle to the profile axis, so that when the drive profiles of the turning tool and the screw are axially fitted together, a tight fit is produced and thus no additional holding means are required to screw the screw into a thread. Similarly, it is known from WO 2013/062895 A1 and US 2010/0269644 A1 to form the drive surfaces of the screw and turning tool at an incline in order to create a tight fit between the components.

10 A problem that repeatedly occurs when screwing in and loosening screws is that the drive profiles are damaged, especially in the area of the edges, if the torques required for screwing in/loosening the screw are too high.

To solve this problem, WO 2019/238250 A1 proposes a drive system with a screw and a turning tool, the driving profiles of which are tapered. Furthermore, the outer driving profile has concave, i.e. inwardly curved driving surfaces in the shape of a segment of a circular arc towards the profile axis, and the inner driving profile has driving surfaces complementary to this. The arrangement is such that, when mated, the drive surfaces of the two components come into contact/engagement on both sides of the apex of the concave curvature when viewed in the circumferential direction.

In addition to a positive and torsionally rigid connection, this design also produces a frictional or clamping connection between the screw and the turning tool, via which the components are axially connected and coaxially aligned with each other. Furthermore, the force or torque is transmitted exclusively via the two-dimensional contact that takes place in the drive surfaces curved in the shape of an arc on both sides of the apex, while there is no contact in the transition areas/transition surfaces located between the

drive surfaces. In this way, damage to the edge regions or peripheral areas of the drive surfaces can be completely avoided.

5 The task of the invention is to further optimize the aforementioned drive system and, in particular, to enable high torque transmission and a high number of load cycles.

10 This task is solved in a drive element of the type mentioned above in that the outer diameter D_a and the center-to-center distance L between the centers of the inner circle and of the outer circles are selected as a function of the inner diameter D_i such that the normal force acting at the transition points between in each case one drive surface and the adjacent transition surface when a torque M_D about the profile axis is introduced into the drive profile is tangential to the drive surface adjacent to the one drive surface or runs within the latter.

15 In other words, the normal force is directed into the central region of the drive profile, which lies between the adjacent drive surface and the profile axis.

Accordingly, the task is solved in a method for the rotationally fixed connection of two components, in particular a screw and a rotary tool, of the type

20 mentioned at the beginning, in that the components are designed as drive elements according to the invention and the driving profiles of the drive elements are selected to be complementary to one another in such a way that the drive surfaces of the components come into contact with one another in a 2-dimensional manner when the driving profiles are axially plugged together,

25 so that a frictional and/or clamping connection, via which the components are axially connected to one another, is produced between the components.

It has been shown that optimum results can be achieved with regard to the achievable number of load cycles and transmissible torques if the normal

30 forces generated during a torque transmission at the drive surfaces are

directed towards the core of the driving profile and thus the areas lying between the concavely curved drive surfaces are not or hardly loaded by the normal forces due to bending and/or shear forces. This is achieved by matching the outer diameter D_a , the inner diameter D_i and the center-to-center distance L in accordance with the invention. Normal force is understood to be that portion of a lever force introduced into the drive profile to generate the torque which runs perpendicular to the respective circular-segment-shaped drive surface and thus through the center of its circle.

- 10 According to one embodiment of the invention, it is provided that the center-to-center distance L is calculated according to the formula $L = F(L, D_i) D_i$, where $F(L, D_i) = 0.494 e^{(0.605K)}$. Here, the running ratio $K = D_a / D_i$ should be in the range of 0.3 and 2.0.

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- According to one embodiment of the invention, it is provided that it has an inner driving profile and the drive surfaces of the inner driving profile are inclined with respect to the profile axis, whereby they approach the profile axis starting from an insertion opening of the inner driving profile towards a rear end of the inner driving profile. A preferred embodiment of this embodiment is characterized in that the drive surfaces of the inner driving profile are inclined relative to the profile axis by an angle of inclination α_i which is at least 1° , in particular at least 1.5° and/or in that the drive surfaces of the inner driving profile are inclined relative to the profile axis by an angle of inclination α_i of at most 5° , in particular at most 3.5° and preferably at most 3° , the angle of inclination α_i preferably being $2^\circ \pm 0.2^\circ$ or $3^\circ \pm 0.2^\circ$.

- In a further embodiment of this embodiment, it can be provided that the transition surfaces are inclined with respect to the profile axis and, starting from an insertion opening of the inner driving profile, approach the profile axis

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towards the rear end of the inner driving profile. One embodiment of this embodiment is characterized in that the transition surfaces are inclined relative to the profile axis by an angle of inclination β_i which is at least 1° , in particular at least 1.5° , and/or in that the transition surfaces of the inner entrainment profile are inclined relative to the profile axis by an angle of inclination β_i of at most 5° , in particular at most 3.5° and preferably at most 3° , the angle of inclination β_i preferably being $2^\circ \pm 0.2^\circ$ or $3^\circ \pm 0.2^\circ$. In a preferred manner, the angle of inclination α_i of the drive surfaces relative to the profile axis is exactly as large as the angle of inclination β_i of the transition surfaces relative to the profile axis.

In other words, the inner drive profiles are designed to converge conically from their insertion opening.

In the same way, the drive surfaces of an outer driving profile of a drive element according to the invention can be inclined relative to the profile axis, whereby they approach the profile axis towards an insertion end of the outer driving profile. It is expedient here to provide that the drive surfaces are inclined relative to the profile axis by an angle of inclination α_A which is at least 0.5° , in particular at least 1° and/or at most 1.5° , the angle of inclination α_A preferably being $1.15^\circ \pm 0.2^\circ$.

In this case, the transition surfaces can run parallel to the profile axis. According to one embodiment of the invention, however, it is provided that the transition surfaces are inclined relative to the profile axis at an angle of inclination β_A which is greater than 0° and less than 0.7° and is preferably $0.4^\circ \pm 0.05^\circ$.

In a further embodiment of this embodiment, it is provided that the angle of inclination β_A of the transition surfaces relative to the profile axis is smaller than

the angle of inclination α_A of the drive surfaces relative to the profile axis, wherein the ratio of the angle of inclination α_A to the angle of inclination β_A is ≥ 2 , in particular ≥ 2.5 , and is preferably 2.8 ± 0.2 .

- 5 According to a preferred embodiment of the invention, the outer diameter D_a is constant over the axial length of the drive profile. It should be taken into account here that the drive surfaces can be manufactured differently in the case of a conically converging driving profile. On the one hand, a cylindrical cutter can be used, which is then adjusted according to the desired taper angle.
- 10 In this case, the drive surfaces have the pure circular shape in a plane perpendicular to the respective flank angle of the tapered driving profile, while the pure circular shape is slightly elliptically distorted in a sectional plane perpendicular to the profile axis. Similar distortions may occur in other manufacturing processes. Such deviations are to be regarded as
- 15 manufacturing tolerances.

- Similarly, the inner diameter D_i can be constant over the axial length of the driving profile or, in adaptation to an inclination of the transition surfaces, increase continuously in the case of an inner driving profile in the direction of
- 20 its insertion opening and, in the case of an outer driving profile, increase starting from its insertion end. In the latter case, the claimed conditions and thus the claimed course of the normal forces must be present at the tapered end of the outer driving profile, preferably over its entire effective length.

- 25 As is usual with screw heads, the driving profile preferably has five or six driving surfaces. However, a different number is possible.

In a preferred manner, the drive element is a screw and the drive profile is formed on the screw head. Likewise, the drive element can be a screw bit.

According to a preferred embodiment of the method according to the invention, it is provided that the driving profiles of the two components have drive surfaces inclined to the profile axis and the driving profiles of the components are selected to be complementary to one another in such a way that the drive surfaces of the components come into 2-dimensional contact with one another when the driving profiles are axially plugged together, so that a frictional and/or clamping connection, via which the components are axially connected to one another, is produced between the components.

In the method according to the invention, pairs of components to be connected in a rotationally fixed manner are assigned to one another in the manner of a kit, the components fitting together and being designed to correspond to one another. In one embodiment of the invention, the two components are selected such that the driving profiles of the two components have driving surfaces inclined to their respective profile axis. In a preferred embodiment, it is provided that the angle of inclination α_i by which the drive surfaces of the inner driving profile are inclined relative to the profile axis is greater than the angle of inclination α_A by which the drive surfaces of the outer driving profile are inclined relative to the profile axis. It may be provided that the angle of inclination α_i of the drive surfaces of the inner driving profile is $3^\circ \pm 0.2^\circ$ and the angle of inclination α_A of the drive surfaces of the outer driving profile is $1.15^\circ \pm 0.15^\circ$ with respect to the profile axis, or that the angle of inclination α_i of the drive surfaces of the inner driving profile relative to the profile axis is $2^\circ \pm 0.2^\circ$ and the angle of inclination α_A of the drive surfaces of the outer driving profile relative to the profile axis is $1.15^\circ \pm 0.15^\circ$. This design ensures that the drive profiles engage at their tapered ends, but that there is a small gap towards the thicker ends. It has been shown that this ensures a secure connection even with force loads directed transverse to the profile axes.

Similarly, it may be provided that the transition surfaces of the driving profiles of the two components are inclined to the respective profile axis, wherein the angle of inclination β_i of the transition surfaces of the inner driving profile relative to the profile axis to the angle of inclination by which the transition surfaces of the outer driving profile are inclined relative to the profile axis is ≥ 5 , in particular ≥ 6 and preferably ≥ 7.5 .

According to a further embodiment of the method according to the invention, it can be provided that drive elements are used in which the outer diameter of the inner driving profile is smaller, in particular by 1.5 - 3% and preferably 2% smaller, than the outer diameter of the outer driving profile.

It has been shown that the slight undersize in the outer driving profile can compensate for wear phenomena on the cutting inserts during the manufacture of the drive surfaces.

In a further embodiment of this embodiment, it can be provided that the drive surfaces of the two components come into 2-dimensional contact with each other over at least 25%, in particular at least 40% and preferably at least 60% of their extension in the circumferential direction.

Preferably, the two components come into contact at each contact surface on both sides of the longitudinal center plane thereof. Likewise, the driving profiles can be designed so that they do not come into contact in the area of the transition surfaces.

Further features and advantages of the present invention are illustrated with reference to the accompanying drawing. In the drawing shows:

Figure 1a a perspective view of a screw with an internal drive profile,

- Figure 2a a perspective view of a drive element in the form of a screw bit with an outer drive profile according to the invention, which corresponds to the drive profile of the screw according to Figure 1,
- Figure 3 schematically an engagement between a screw bit and a screw in a sectional view showing the angle of inclination α of the drive surfaces,
- Figure 4 an enlarged view of detail X from Figure 3,
- Figure 5 schematically the engagement in another sectional view, which shows the angle of inclination β of the transition surface,
- Figure 6 an enlarged view of unit X from Figure 5,
- Figure 7 shows the geometry and the force pathes for an external drive profile of a drive element according to the invention,
- Figure 8 an example of an outer driving profile according to the invention with dimensions.

Figure 1 shows an example of a drive element in the form of a screw 1. The screw 1 comprises a shank 2 which carries an external thread 3 and defines a longitudinal axis of the screw 1. A screw head 4 is provided at the upper end of the shank 2, which has on its inner side an inner driving profile 5 open towards the upper side of the screw head 4 and having inner driving surfaces 6, which defines a profile axis P_1 lying coaxially with the longitudinal axis of the

screw 1. Thereby, the open upper side forms an insertion opening 5a of the inner driving profile 5 for a screw bit.

In cross-section or in plan view, the inner driving profile 5 has the basic shape of a regular hexagon, the side faces of which form the drive surfaces 6, which are inclined with respect to the profile axis P_A or the longitudinal axis of the screw 1 at an angle of inclination α_i of 2° , so that they approach the profile axis P_A from the insertion opening 5a of the inner driving profile 5 towards the rear end of the inner driving profile 5. In other words, the driving profile 5 tapers in the screw head 4. For small screws, the angle of inclination α_i can also be 3° .

The drive surfaces 6 of the inner drive profile 5 have a concave cross-section, i.e. they are curved inwards towards the profile axis P_i . Specifically, the concave drive surfaces 6 each have a circular arc segment shape in cross section, whereby the radius of the drive surfaces 6 is constant over their entire axial length.

The drive surfaces 6 are connected to each other at the six corners by transition areas or transition surfaces 7, which are convexly curved and have the shape of an arc of a circle, as a result of which they project outward in a beam-like manner. The transition between the transition areas 7 and the drive areas 6 is continuous. The transition surfaces 7 are inclined with respect to the profile axis P_i , whereby they approach the profile axis P_i starting from the insertion opening 5a of the inner driving profile 5 towards the rear end of the inner driving profile 5. In this case, the angle of inclination β_i of the transition surfaces 7 with respect to the profile axis P_i is exactly as large as the angle of inclination α_i of the drive surfaces with respect to the profile axis P_i and is thus 2° in the illustrated embodiment example.

In Figure 2, a driving element/turning tool 8 in the form of a screw bit is shown, which is designed to operate the screw 1 shown in Figure 1. The turning tool 8 has an outer driving profile 9, the lower end of which is provided on a shaft of the screw bit that is not shown and is designed to correspond to the driving profile 5 of the screw 1, whereby it defines a profile axis P_A . Correspondingly, the outer driving profile 9 also has the basic shape of the hexagon in cross-section, wherein the drive surfaces 10 of the driving profile 9 are concave, i.e. curved in the direction of the profile axis P_A and run at an angle to the profile axis P_A . Specifically, the drive surfaces 10 of the screw bit are inclined at an angle α_A of 1.15° with respect to the profile axis P_A , whereby they approach the profile axis P_A towards a free insertion end - the upper end in Figure 2 - of the outer driving profile 9, with which the outer driving profile 9 is inserted into the inner driving profile 5 of a screw 1. The drive surfaces 10 of the screw bit thus run somewhat steeper than the drive surfaces 9 of the screw (see Figures 3 and 4). The drive surfaces 10 have a circular arc segment-shaped cross section with a radius that is constant over their axial length and has the same value as the radius of curvature of the drive surfaces 6 of the screw 1.

The drive surfaces 10 are continuously connected to each other by convex transition areas or transition surfaces 7a, which are also tapered and have a circular arc shape.

As with the inner driving profile 5, the transition surfaces 7a of the outer driving profile 9 are inclined relative to the profile axis P_A , approaching the profile axis P_A towards the insertion end of the outer driving profile 9. Thereby, the angle of inclination β_A of the transition surfaces 7a to the profile axis P_A is 0.4° . This means that the angle of inclination β_A of the transition surfaces 7a relative to the profile axis P_A is significantly smaller than the angle of inclination

α_A of the drive surfaces 10 with respect to the profile axis P_A , where the ratio of the angle of inclination α_A / β_A is almost 3. Furthermore, the angle of inclination β_A , by which the transition surfaces 7a of the outer drive profile 9 are inclined relative to the profile axis P, is significantly smaller than the angle of inclination β_I , by which the transition surfaces of the inner drive profile are inclined relative to the profile axis P_I (see Figures 5 and 6). In the present case, the ratio β_I / β_A is 7.5. The arrangement is such that the transition areas of the screw 1 and a corresponding screw bit 8 do not come into contact with each other. Accordingly, the radius of curvature of the transition regions 7a in the bit 8 is larger than the radius of curvature of the transition regions 7 in the screw 1.

In other words, arrangement is made in such a way that a 2-dimensional contact/engagement between the driving profiles 5, 9 takes place exclusively in the region of the drive surfaces 6, 10, but not in the intermediate transition regions 7, 7a, and the contact zones, viewed in the circumferential direction, extend in each case on both sides of the apex of the concavely curved drive surfaces 6, 10. It is desired that there is a 2-dimensional contact between the drive surfaces 6, 10 of the two components 1, 8 in the mated state, so that the two components 1, 8 are aligned exactly coaxially with one another when their two driving profiles 5, 9 are mated axially until a clamping connection is produced between the two components 1, 8 due to the conicity of the driving profiles 5, 9 of the drive surfaces 6, 10. Furthermore, the two-dimensional contact creates a frictional connection via which high torques can be transmitted.

Figure 7 shows the geometry of the outer driving profile 5 of bit 8 at its free, tapered end according to the invention.

It can be seen that the transition surfaces 7 lie on a common circle - the inner circle - with an inner diameter D_a . However, the transition surfaces 7 do not have to have a continuous circular arc shape, but can also be flat, for example. It is essential that the transition points between a drive surface 6 and the adjacent transition surface 7, indicated here once by an arrow P1, lie on the common inner circle.

It is further shown that the drive surfaces 6 are located on outer circles of diameter D_a distributed uniformly around the profile axis P_A and are formed symmetrically with respect to their longitudinal center plane enclosing the profile axis P_A .

The outside diameter D_a as well as the center-to-center distance L between the center points of the inner circle and the outer circles are selected as a function of the inside diameter D_i in such a way that the normal force acting at the transition points between the drive surfaces 6 and the adjacent transition surfaces 7 when a torque M_D about the profile axis P_A is introduced into the drive profile 5 is applied tangentially to the drive surface 6 adjacent to the drive surface. The normal force F_{N1} is indicated as an example for the transition point P1 between the upper contact surface 6 and the transition surface 7 adjacent to the left in Figure 7.

To generate the desired torque M_D , a lever force F_{H1} must act at the point P1. This can be divided into a normal force F_{N1} , which is directed perpendicularly to the outer circle on which the drive surface 6 lies and thus runs through its center, and a tangential force F_{T1} running perpendicularly thereto. As can be seen clearly in Figure 3, the arrangement is such that the normal force F_{N1} runs tangentially to the drive surface 6 located adjacent the upper drive surface 6 to the left thereof. According to the invention, the normal force F_{N1} can also run between the drawn normal force F_{N1} and the profile axis P_A , as is

indicated by way of example for the dashed arrow F_{NB} in Figure 3. It is essential that the normal force F_{N1} is introduced into the central area of the drive profile 9 or of the component 8 designed as a screw bit and that the beam-shaped transition areas 7 between the drive surfaces 6 are not, or hardly, subjected to bending or shear.

For a given inner diameter D_i , the outer diameter D_a and the center-to-center distance L between the center of the inner circle and the centers of the outer circles can be calculated according to the following formula

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$$L = F(L, D_i) D_i .$$

The running ratio $K = D_a/D_i$ can be selected and should be in the range of 0.3 and 2.0.

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An example of the calculation is shown in Figure 8. The parameters are selected as follows:

- $D_i = 5.6 \text{ mm}$
- $K = 0.8$ (freely selected in the above range)
- From this, D_a is calculated with $D_a = D_i K = 5.6 \cdot 0.8 = 4.48$
- with $F(L, D_i) = 0,494 e^{(0,605K)} = 0,494 e^{(0,605 \cdot 0,8)} = 0,8479$ can be calculated L
- $L = F(L, D_i) D_i = 0.8479 \cdot 5.6 = 4.748$.

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From these parameters, the geometry shown in Figure 4 can be constructed.

The geometry of the inner drive profile 5 is selected accordingly with the proviso that the outer diameter D_A of the outer drive profile is about 2% smaller than the diameter D_A of the matching inner profile 5. This takes account of the

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fact that when the drive surfaces are produced by cutting inserts, they are subject to a certain amount of wear, which is greatest in the central area of the drive surfaces because this is where most of the material has to be removed by the cutting inserts. With increasing wear, less material is removed in the
5 central area of the drive surfaces, so that a minimum curvature forms here to compensate for the undersize.

It is noted that the angle of inclination α of the driving surfaces and the angle of inclination β of the transition surfaces are each measured in the
10 circumferential direction centered from the corresponding surface. Thus, the angle is measured in a center plane of the corresponding surface intersecting the profile axis of the respective driving profile.

List of reference signs

	1	screw
	2	shaft
5	3	male thread
	4	screw head
	5	inner driving profile
	5a	insertion opening
	6	drive surface
10	7	transition areas
	7a	transition area
	8	drive element/turning tool/bit
	9	external driving profile
	10	drive surface
15	D _a	outer diameter
	L	center-to center distance
	M _D	torque
	P _I	profile axis
	P _A	profile axis

Claims

1. Drive element (8)

5 which has an inner driving profile (5) which defines a profile axis (P_I) and has on its inner side a plurality of concave drive surfaces (6) which are arranged uniformly distributed around the profile axis (P_I) and between which planar or convexly curved transition surfaces (7) are provided, or

10 which has an outer driving profile (9) which defines a profile axis (P_A) and has on its outside a plurality of concave drive surfaces (10) which are arranged distributed uniformly about the profile axis (P_A) and between which planar or convexly curved transition surfaces (7a) are provided, wherein

15 in cross-section, the transition points (P_1) or transitions between the drive surfaces (5, 10) and the transition surfaces (7, 7a) lie on a common inner circle with the inner diameter D_i , and

20 the drive surfaces (5) lie on outer circles of diameter D_a distributed uniformly around the profile axis (P_I, P_A) and are formed symmetrically with respect to their longitudinal central plane enclosing the profile axis (P_I, P_A), **characterized in that**

25 the outer diameter D_a and the center-to-center distance L between the centers of the outer circles and of the inner circle are selected as a function of the inner diameter D_i such that the normal force acting at the transition points between in each case one drive surface (6, 10) and the adjacent transition surface (7, 7a) when a torque M_D about the profile axis (P_I, P_A) is introduced into the drive profile (5, 9), is tangential to

the drive surface (6, 10) adjacent to the one drive surface (6, 10) or runs within the latter.

2. Drive element according to claim 1, **characterized in** that the running
5 ratio $K = D_a / D_i$ is in the range of 0.3 and 2.0.

3. Drive element according to claim 1 or 2, **characterized in** that the center-to-center distance L is calculated according to the formula $L = F(L, D_i) D_i$, where
10 $F(L, D_i) = 0.494 e^{(0,605K)}$.

4. Drive element according to one of the previous claims, **characterized in**
that it comprises an inner driving profile (5) and the drive surfaces (6) of the
inner driving profile (5) are inclined with respect to the profile axis (P_a),
approaching the profile axis (P_a) starting from an insertion opening (5a) of the
15 inner driving profile (5) towards a rear end of the inner driving profile (5).

5. Drive element according to claim 4, **characterized in** that the drive
surfaces (6) of the inner driving profile (5) are inclined relative to the profile
axis (P_a) by an angle of inclination α_i which is at least 1° , in particular at least
20 $1,5^\circ$ and/or in that the drive surfaces (6) of the inner driving profile (5) are
inclined relative to the profile axis (P_i) by an angle of inclination α_i of at most
 5° , in particular at most $3,5^\circ$ and preferably at most 3° , the angle of inclination
 α_i preferably being $2^\circ \pm 0,2^\circ$ or $3^\circ \pm 0,2^\circ$.

25 6. Drive element according to claim 4 or 5, **characterized in** that the
transition surfaces (7) are inclined with respect to the profile axis (P_i) and
approach the profile axis (P_i) starting from an insertion opening (5a) of the
inner driving profile (5) towards the rear end of the inner driving profile (5).

7. Drive element according to claim 6, **characterized** in that the transition surfaces (7) are inclined relative to the profile axis (P_I) by an angle of inclination β_I which is at least 1° , in particular at least $1,5^\circ$ and/or in that the transition surfaces (7) of the inner driving profile (5) are inclined relative to the profile axis (P_I) by an angle of inclination β_I of at most 5° , in particular at most $3,5^\circ$ and preferably at most 3° , the angle of inclination β_I preferably being $2^\circ \pm 0,2^\circ$ or $3^\circ \pm 0,2^\circ$.

8. Drive element according to claim 6 or 7, **characterized in** that the angle of inclination α_I of the drive surfaces (6) relative to the profile axis (P_I) is as large as the angle of inclination β_I of the transition surfaces (7) relative to the profile axis (P_I).

9. Drive element according to one of the preceding claims, **characterized in** that it has an outer driving profile (9) and the drive surfaces (10) of the outer driving profile (9) are inclined with respect to the profile axis (P_A), approaching the profile axis (P_A) towards an insertion end of the outer driving profile (9).

10. Drive element according to claim 9, **characterized** in that the drive surfaces (10) are inclined with respect to the profile axis (P_A) by an angle of inclination α_A , which is at least $0,5^\circ$, in particular at least 1° and/or is at most $1,5^\circ$, the angle of inclination α_A preferably being $1,15^\circ \pm 0,2^\circ$.

11. Drive element according to claim 9 or 10, **characterized in** that the transition surfaces (7a) are inclined with respect to the profile axis (P_A) at an angle of inclination β_A which is greater than 0° and less than $0,7^\circ$ and is preferably $0,4^\circ \pm 0,05^\circ$.

12. Drive element according to claim 11, **characterized** in that the angle of inclination β_A of the transition surfaces (7a) relative to the profile axis (P_A) is

smaller than the angle of inclination α_A of the drive surfaces (10) relative to the profile axis (P_A), the ratio of the angle of inclination α_A to the angle of inclination β_A being ≥ 2 , in particular ≥ 2.5 , and preferably being 2.8 ± 0.2 .

5 **13.** Drive element according to one of the previous claims, **characterized in** that the outer diameter (D_A) is constant over the axial length of the driving profile (5, 9).

10 **14.** Drive element according to one of the previous claims, **characterized in** that the inner diameter (D_I) over the axial length of the driving profile (5, 9) is constant or increases continuously in adaptation to an inclination of the transition surfaces (7, 7a) with respect to the respective profile axis (P_I , P_A) in the case of an inner driving profile (5) in the direction of its insertion opening (5a) and in the case of an outer driving profile (9) starting from its insertion end.

15 **15.** Drive element according to any one of the preceding claims, **characterized in** that the driving profile (5, 9) has five or six drive surfaces (6, 10).

20 **16.** Drive element according to one of the previous claims, **characterized in** that the drive element (1) is a screw and the driving profile (5) is formed on the screw head (4).

25 **17.** Drive element according to any one of claims 1 to 16, **characterized in** that the drive element (8) is a screw bit.

30 **18.** Method for connecting two components, in particular a screw (1) and a rotary tool (8), in a rotationally fixed manner, one of the components being designed as a drive element (8) with an outer driving profile (5, 9) and the other component being designed as a drive element (1) with an inner driving profile

(5), in which the driving profiles (5, 9) of the two components (1, 8) are plugged together axially in order to produce a rotationally fixed connection between the two components (1, 8), **characterized** in that the components are designed as drive elements (1, 8) according to one of the previous claims and the driving profiles (5, 9) of the drive elements (1, 8) are selected to be complementary to one another in such a way that the drive surfaces (6, 10) of the components (1, 8) come into contact with one another in a 2-dimensional manner when the driving profiles (5, 9) are axially plugged together, so that a frictional and/or clamping connection, via which the components (1, 8) are axially connected to one another, is produced between the components (1, 8).

19. Method according to claim 18, **characterized in that** the driving profiles (5, 9) of the two components (1, 8) have drive surfaces (6, 10) inclined to their respective profile axis (P_I , P_A).

20. Method for the rotationally fixed connection of second components according to claim 19, **characterized** in that the angle of inclination α_i , by which the drive surfaces (6) of the inner driving profile (5) are inclined with respect to the profile axis (P_I), is greater than the angle of inclination α_A , by which the drive surfaces (6) of the outer driving profile (10) are inclined with respect to the profile axis (P_A).

21. Method for the rotationally fixed connection of second components according to claim 20, **characterized** in that the angle of inclination α_i of the drive surfaces (6) of the inner driving profile (5) is $3^\circ \pm 0.2^\circ$ and the angle of inclination α_A of the drive surfaces (10) of the outer driving profile (6) with respect to the profile axis (P_B) is $1,15^\circ \pm 0.15^\circ$, or that the angle of inclination α_i of the drive surfaces (6) of the inner driving profile (5) relative to the profile axis (P_I) is $2^\circ \pm 0.2^\circ$ and the angle of inclination α_A of the drive surfaces (10) of the outer driving profile (6) relative to the profile axis (P_A) is $1.15^\circ \pm 0.15^\circ$.

22. Method for the rotationally fixed connection of two components according to one of claims 18 to 21, **characterized** in that the transition surfaces (7, 7a) of the driving profiles (5, 9) of the two components (1, 8) are inclined with respect to the respective profile axis (P_I , P_A), wherein the angle of inclination β_i of the transition surfaces (7) of the inner driving profile (5) relative to the profile axis (P_I) to the angle of inclination (β_A) by which the transition surfaces (7a) of the outer driving profile (9) are inclined relative to the profile axis (P_I) is ≥ 5 , in particular ≥ 6 and preferably ≥ 7.5 .
23. method according to one of claims 18 to 22, **characterized in** that drive elements (1, 8) are used in which the outer diameter (D_a) of the inner driving profile (5) is smaller, in particular by 1.5 - 3% and preferably by 2% smaller, than the outer diameter (D_a) of the outer driving profile (6).
24. Method according to one of claims 18 to 23, **characterized in that** the drive surfaces (6, 10) of the two components come into surface contact with one another over at least 25%, in particular at least 40% and preferably at least 60% of their extent in the circumferential direction.
25. Method according to one of claims 18 to 24, **characterized in that the** two components come into contact with each contact surface (6, 10) on both sides of the longitudinal center plane thereof.
26. Method according to one of claims 18 to 25, **characterized in that** the entrainment profiles (5, 9) are designed in such a way that they do not come into contact in the region of the transition surfaces (7, 7a).