GRIPPER, TWISTING HEAD AND TWISTING APPARATUS

The invention relates to a gripper for electrical or optical lines such as wires, cable, line bundles, optical fibres , according to the preamble of claim 1, a twisting head for the twisting of such electrical or optical lines according to the preamble of claim 5 as well as to a twisting apparatus for the twisting of such electrical or optical lines according to the preamble of claim 11.

The starting point for the present invention is a typical configuration of such a gripper having at least one gripper jaw which can be moved relative to a counterbearing by means of a drive arrangement. Preferably provided are two gripper jaws which can be moved relative to one another. This gripper is used in twisting heads which are typically provided in twisting apparatus for example, for wires, cables, line bundles, optical fibres etc. and at the same time can be rotated by means of at least one drive.

DE 10 2010 017981 A1 discloses a device for combining conductors to produce a double crimp connection. The (double) grippers used therein possess gripper arms held in a guide, which are displaceable vertically to the gripper plane.

EP 1 032 095 A1 relates to a processing and twisting of a pair of conductors. The grippers as a whole are pivotable individually by means of a lever mechanism associated with a pivoting unit. However, the gripping of the wire is not accomplished by the lever mechanism shown.

EP 1 691 457 A1 discloses an untwisting unit associated with a cable processing device. A gripper is driven pneumatically (for example, closed pneumatically and opened by means of spring force).

US 4,272,951 A discloses a twisting apparatus in which the twisting is accomplished by a roller or belt arrangement which embraces the wires to be

twisted from two sides. In this case, these rollers or belt arrangement can be twisted. A completely different principle is involved here.

US 5605181 A discloses a portable twisting tool where the wires to be twisted are clamped by an apparatus at the centre of their length. At their ends the wires are fixed stationarily by means of fastening devices. The twisting apparatus consists of a sleeve having an elongated cut-out into which a part is inserted which sits on a second sleeve and projects between the two wires.

DE 10107670 A1 discloses a twisting head which has three gripper jaws which can be moved relative to a counterbearing, which are opened or closed via a mechanical link chain by a drive in the form of a fluidic working cylinder. In this case the gripper jaws move with their front end radially in relation to the line to be clamped whereas the drive acts predominantly parallel to the line.

All the solutions known in the prior art have in common that they are mechanically complex and have a high weight. Twisting apparatuses are therefore very expensive and the drive requirement is high. In addition, the holding force for line ends is not adjustable.

The object of the present invention is to provide a gripper, a twisting head and a twisting apparatus which does not have these disadvantages and which allows two or more, possibly contacted line ends to be gripped automatically, held securely and allows the lines to be twisted into one another at high rotational speed. In this case, in particular the problem of achieving the twisting function with all automatic mechanisms is to be solved, with at the same time low mass of the twisting head and simple and cost-effective structure. The gripper mechanics should hold the lines securely with an adjustable holding force independently of occurring centrifugal forces without expensive exchange or adaptation work.

The objects are solved by the features of the independent claims. Advantageous further developments are set out in the figures and in the respective dependent patent claims,

This invention achieves this object with a gripper whose drive arrangement comprises at least one drive having adjustable force, which acts via a preferably mechanical link chain on the or each gripper jaw, according to the invention whereby the link chain has a section parallel to the drive which is movable in the opposite direction. Preferably a mechanical link chain is used. As a result of these features, a compact arrangement of gripper and drive can be achieved as a result of the parallel and closely adjacent positioning.

The ratio of drive force to holding force is precisely defined by the specified lever ratios of the link chain. Therefore the holding force on the line can be adjusted precisely by adjustment of the drive force which is transferred indirectly via the link chain in a precisely determinable manner to the holding jaws, so that the optimal gripper closing force for the secure gripping and holding of the line ends can be adjusted as a function of line cross-section and line quality. The programmable value of the adjusting parameters can be ascribed to the respective case of application and stored at any time so that it can be retrieved again, which enables an automatic setting up of the twisting process without manual equipping/setting up of components of the gripper or the twisting head using this gripper. In particular, the drive force can be preselected per program, stored matched to production parameters and retrieved again at any time. No power or signal lines are required to the gripper, which is typically part of a rotating twisting head.

A preferred example for a drive with adjustable force is a fluidic working cylinder having programmable supply pressure. Preferably pneumatic cylinders are used for this purpose. The supply pressure of a pneumatic cylinder and therefore its drive force can be programmed adjustably by means a suitable selectable control valve. The holding force of the gripper jaws can thus be set precisely via the link chain with precisely defined force transmission ratio.

Preferably the direction of movement of the gripper jaws has a predominant component radially in relation to the line for the purpose of a good holding effect and force direction. Preferably the direction of movement runs precisely radially in relation to the line. A reference to "the line" here and also throughout the following text is a designation of that point of the apparatus and that direction in which, when the gripper or the apparatus or parts of apparatus defined in detail by this expression, at which the line to be gripped lies or in which direction this line is oriented.

An advantageous embodiment of the gripper according to the invention is further characterised in that the direction of action of the drive is predominantly accomplished parallel in relation to the line, where via the link chain, a force deflection into a direction of action in the direction of the movement direction of the gripper jaws is provided. With this feature a very compact arrangement of gripper and drive is possible which as a result can be positioned parallel and closely adjacent to one another.

For a twisting head, the initially formulated object is solved by the features according to the invention whereby the gripper is configured according to any one of the preceding paragraphs,

and the co-rotating section of the link chain is formed by elements movable parallel to the drive, and opposite to the direction of movement of the drive and by the or each gripper jaw. These features ensure a compact, space-saving and secure structure of the twisting head. As a result of the deflection of the drive effect from the drive onto the gripper by substantially 180°, the drive and a long section of the link chain can be disposed parallel. Such a parallel arrangement enables a short overall length of the arrangement. The drive of the gripper is in this case disposed in a fixed position which contributes to a very simple, compact and also light structure of the twisting head. The heavy drive need not be co-moved with the twisting head and/or the gripper, which also substantially simplifies the supply with power and operating means. This twisting head design enables a fully automatic twisting pro-

cess of line pairs which have already been cut to length and contacted on both sides with very good shielding or damage protection of the contacted line ends.

For a simple, compact and reliable structure, it is preferably provided in both variants of the twisting head that the link chain comprises a positionally fixed deflecting lever, via which the drive acts on the movable elements of the link chain. Particularly advantageous for the distribution and introduction of force is the configuration of the deflecting lever as a fork lever. In order to minimise friction losses, an axial roller bearing can be interposed between lever and link chain. Alternatively or additionally the installation of a pressure ring which can be positioned coaxially to the line is provided.

The movable elements and the or each gripper jaw are mounted on a co-rotating, preferably pot-like supporting structure. This has at least one recess extending parallel to the direction of the lines in such a dimension and shape that the lines can be removed. Such a design allows a large, largely cylindrical chamber interior with a relatively thin outer shell of the twisting head compared to the relatively small receiving volume of conventional grippers or twisting heads having mostly higher weight.

In this case, it is particularly advantageous if a tubular sleeve is provided as a cover coaxially to the supporting structure, which has at least one recess extending parallel to the direction of the line for removal of the lines. This tubular sleeve in this case corotates either with the twisting head or is locked in a non-rotatable position. The corotating tubular sleeve together with a pot-like supporting structure can form an optimal circumferentially closed shielding of the twisting region. When locked in a non-rotatable position, the recesses can be brought to overlap by relative twisting of supporting structure and tubular sleeve and a loading and removal opening is thereby exposed. It is thereby possible to avoid components which in the opened state of the gripper are splayed very widely outwards so that there was a risk of collision when the rotational movement was accidentally started up, in particular dur-

ing the referencing travel of the system. As a result of the opening and closing of the receiving chamber for the lines by means of the tubular sleeve, a secure processing and simple loading and ejection of the line is ensured through a compact and simple design.

A further embodiment of the twisting head according to the invention is characterised in that the gripper jaws consist of a metal material. Preferably hard-anodised aluminium is used for this purpose. Furthermore a fluting or roughening of the gripper surfaces can be provided, at best a plasma-coated surface or also other surface structures. The surface of the gripper jaws gripping the lines can also be formed at least partially from an elastic material, particularly preferably from an elastomer. Preferably at least the surfaces coming in contact with the lines to be gripped are covered with hard material particles such as, for example, corundum. Gripper jaws affected by wear can thereby be exchanged simply and independently of the other elements of the twisting head. The hard material particles improve still further the very good fixing holding of the lines to be twisted as a result of the aforesaid features.

According to an advantageous variant of this embodiment of the twisting head, an elastic support, preferably a textile, is fastened on the base body. The support itself is preferably fastened on the elastic material and hard material particles which are present in any case are located on the support. As a result, with optimal holding effect and low-wear structure due to the elastic support, in a cost-saving manner only the uppermost layer coming in contact with the line ends can be covered with the adhesion-promoting layer.

The initially mentioned object is also achieved by a twisting apparatus which is characterised according to the invention in that the twisting head is designed according to at least one of the preceding paragraphs relating to the twisting head, wherein a second drive is a rotary drive which transfers the drive moment via a preferably annular drive means to a shaft of the twisting head. The second drive is used for the rotating movement of the twisting head whereas the first drive effects the movement of the gripper jaws.

It is preferably provided in this case that the output shaft of the second drive is disposed laterally at a distance and parallel to the axis of rotation of the twisting head. The same applies in a preferred further variant for the motor shaft.

Overall, as a result of the individual features, a very compact structure of the gripper, therefore also of the twisting head and the entire twisting apparatus can be achieved. The small number of parts and/or the low moving mass enables highly dynamic processes, where as a result of the largely rotationally symmetrical structure of the rotating parts, these can be simply balanced for low-vibration operation. In addition, the preferably cylindrical structure of the rotating assembly of gripper and twisting head without outwardly projecting components considerably reduces the risk of collision with neighbouring components and also reduces the control expenditure which would be required otherwise to eliminate risks of collision. Also there are no components mounted externally in the rotating assembly which at high rotational speeds and centrifugal forces could produce a hazard by slinging away.

The very compact structure with a preferably tubular housing of the twisting head allows a very large amount of space for the automatic insertion or ejection of the line ends from or in a substantially cylindrically constructed twisting chamber which has a large receiving chamber volume for the line ends equipped with seal and contacts.

The gripper jaws can be exchanged very easily and preferably a large capturing region for lines is integrated at the end plate of the twisting rotor. In this case, the edges of the capturing region on the twisting head, in particular on the front-side end plate of the twisting head can act as stripper edges in order to strip line ends safely from the gripper jaws.

Further advantages, features and details of the invention are obtained from the following description in which exemplary embodiments of the invention are described with reference to the drawings. In this case, the features men-

tioned in the claims and in the description can in each case be essential to the invention individually by themselves or in any combination.

The reference list is part of the disclosure. The figures are described cohesively and in an overlapping manner. The same reference numbers denote the same components, reference numbers with different indices specify functionally the same or similar components.

In the figures:

Fig. 1 shows a twisting head according to the invention in a perspective overall view with opened insertion or injection region,

Fig. 2 shows the twisting head of Fig. 1 in a partially cutaway overall view in longitudinal section,

Fig. 3 shows a longitudinal section through the twisting head of Fig. 1 and 2 in a plane turned about the longitudinal axis with respect to Fig. 2 and

Fig. 4 shows the twisting head of Fig. 1 to 3 with downwardly directed but closed insertion or ejection region.

A twisting apparatus according to the invention in the depicted exemplary embodiment of Figs. 1 to 4 consists of a base frame 1, to which at least one drive motor 2, which is preferably a servo drive, for the twisting head 4 is attached. Via for example a drive belt 3, preferably a toothed belt, the drive motor 2 drives the twisting head 4 with the actual gripper 11, 15, 16, 17, 19, 19', 20, 20', 22, 22' comprising a plurality of assemblies (see on this matter in particular Fig. 2). Within the framework of the invention other drives or other transmission elements can also be provided between drive motor 2 and twisting head 4. Alternatively a second twisting head can additionally be provided and preferably actuated by the same drive motor 2.

A first toothed disk 9 fastened to the drive shaft (not visible) of the drive motor 2 transmits, via the toothed drive belt 3, the rotational movement via a second toothed disk 10 to the rotatably mounted twisting head 4 preferably positioned parallel to the drive motor 2, which also comprises the rotatably mounted twisting head housing 8. Also visible in Fig. 1 are one gripper jaw 22 of the two gripper jaws 22, 22' provided and also two lines 24, 24' to be twisted having free excess lengths 32, 33 of various length. Alternatively a coaxial arrangement of the drive motor 2 and the twisting head 4 is also possible. The torque transmission from the drive motor 2 to the twisting head 4 is then preferably accomplished by means of a coupling have a stable rotational angle.

The second gripper jaw 22' cannot be identified in Fig. 1 since, concealed by a front-side end plate 25, it is located - as can be seen for example in Fig, 2 - opposite the first gripper jaw 22 in relation to the lines 24, 24'. The lines 24, 24' are clamped between the two gripper jaws 22 and 22' for the twisting. The stroke of the gripper jaws 22, 22' is sufficient for clamping and holding the entire line cross-sectional region for which the twisting apparatus is designed.

The gripper jaws 22, 22' are guided in linear guides 23, 23' in the front region of the twisting head housing 8. For changing the gripper jaws 22, 22' the front-side end plate 25 of the twisting head 4 can be dismounted very simply by loosening the screws 35. The end plate 25 also contains along at least a part of its circumference, circumferential guide grooves 36 for a tubular sleeve 26 which over a part of the circumference of the twisting head housing 8 surrounds this on the outside. Also shown is a locking ring 27 of the tubular sleeve 26 on its side facing the base frame 1 and one of two locking tappets 28 attached in a fixed position relative to the base frame 1. These locking tappets 28 provided on the circumference can be shifted automatically, preferably actuated pneumatically and in a locking position engage in structures of the locking ring 27 and in such a manner fix the tubular sleeve 26 in its position from twisting relative to the base frame 1. In the withdrawn position

of the locking tappets 26 the tubular sleeve 26 can be rotated freely with the twisting head housing 8.

Figure 2 shows the twisting head 4 in a partially cutaway overall view along the axis of rotation which coincides with an axis 5 fixed to the frame. Here it can be seen how the twisting head housing is mounted as a pot-like supporting structure 8 by means of a first roller bearing 6 and a second roller bearing 7 on the axis 5 fixed to the frame. By means of the holder 18 a pneumatic cylinder 17 as a drive for the assemblies forming the grippers 11, 15, 16, 17, 19, 19‘, 20, 20‘, 22, 22‘ of the twisting head 4 is preferably also fixed in a manner fixed to the frame. The piston rod of this pneumatic cylinder 17 actuates via the pivot bearing 16 a fork-shaped lever 15 which is pivotally mounted on a pivot axis 14. Bolts 30 and 30’ (not shown in Fig. 2, see Fig. 3 on this matter) are fastened to the fork ends of the lever 15.

As can be seen in the enlarged longitudinal section of Fig. 3, the bolts 30, 30’ dip into the region between an axial roller bearing 13 and a ring 31. This axial roller bearing 13 is mounted on one side on a pressure ring 11. The opposite side of the axial roller bearing 13 on which side the bolts 30, 30’ can act is freely rotatable. The pressure ring 11 is mounted axially displaceably by means of a plain bearing 12 on a tubularly lengthened region of the twisting head housing 8.

As can again be seen in Fig. 2, the pressure ring 11 is located in engagement with two rods 19, 19’ which are mounted axially displaceably in the twisting head housing 8, which extend along the length of the twisting head housing 8 and which, on the side of the twisting head housing 8 opposite the pressure ring 11, are located in engagement with forming pins of angle levers 20, 20’. The angle levers 20, 20’ are mounted pivotably on pivot axes 21, 21’ and at their second end in turn engage with forming pins in the gripper jaws 22, 22’.

The gripper jaws 22, 22’ are guided in their longitudinal direction in linear guides 23, 23’ of the twisting head housing 8. The gripper jaws 22, 22’ grip

and hold the line 24, 24' when the piston rod of the pneumatic cylinder 17 is extended and via the pivot bearing 16 of the fork-shaped lever 15 mounted on the pivot axis 14 presses via the bolts 30, 30' fastened to the fork ends on the axial roller bearing 13 and therefore on the pressure ring 11. The pressure ring 11 exerts a compressive force on the rods 19, 19' mounted displaceably in the twisting head housing 8 which, via the angle levers 20, 20' mounted pivotally on the pivot axes 21, 21' transfer a corresponding force to the gripper jaws 22, 22' in the longitudinal direction thereof, i.e. substantially radially to the lines 24, 24'. Consequently the lines 24, 24' are clamped between the gripper jaws 22, 22'. In this case, the gripper force is approximately the same over the entire gripping range of the pair of gripper jaws 22, 22' since this is determined by the pressure of the pneumatic cylinder 17. As a result it is relatively easy to set up the twisting process before the parameters for the twisting process are stored.

Figure 3 shows in section the bolts 30, 30' fastened to the fork ends of the lever 15 in their position between the axial roller bearing 13 and a ring 31 fastened to the pressure ring 11. For closing the gripper jaws 22, 22', the lever 15 presses via the bolts 30, 30' on the freely rotatable ring of the axial roller bearing 13. The twisting head 4 is only set in rotation when the gripper jaws 22, 22' are closed, which is ensured by means of a corresponding control/sensor system.

For opening the gripper jaws 22, 22', the bolts 30, 30' press against the ring 31 of the pressure ring 11 mounted displaceably on the twisting head housing 8. This movement is also effected by the pneumatic cylinder 17. The working strokes thereof in at least one direction can also be supported by an elastic element, for example, a spring element. In this position the gripper jaws 22, 22' are open and no twisting process takes place. In addition, Figure 3 shows the spring-mounted pressure bolts 29, 29' which secure the tubular sleeve 26 against twisting in the two rotational angle positions with respect to the twisting head housing 8 laterally open or closed.

Figure 4 again shows the twisting head 4 in a perspective overall view with a downwardly directed insertion or ejection region 34 of the end plate 25 and with lines 24, 24'. In this position the tubular sleeve 26 closes the interior of the twisting head housing 8 at its circumference. This closed position of the twisting head 4 is approached before the twisting process. The locking tappets 28 are then withdrawn and the twisting process is carried out with the twisting head housing 8 closed. For ejection of the lines 24, 24' after the twisting process, the twisting head 4 is stopped at an angle of 90° before the ejection position. The tubular sleeve 26 is then fixed by means of the locking tappets 28 and the locking ring 27 and the twisting head 4 is then turned further by 90°. As a result of this process the tubular sleeve 26 is also twisted by 90° with respect to the twisting head housing 8 so that the side openings of the twisting head housing 8 are now open again. Now after the opening of the gripper jaws 22, 22', the, for example, pairwise twisted lines 24, 24' can drop downwards from the twisting head housing 8, e.g. onto a collecting surface due to gravity.

Advantageously, clamping surfaces of the gripper jaws 22, 22' can be withdrawn behind the edges of the insertion region 34 during opening so that these edges act as forcible ejectors of the ends of the lines 24, 24'. Lines 24, 24' possibly adhering to the gripper jaws 22, 22' with their insulation are thereby reliably stripped for ejection and any disturbances in the process can thereby be prevented. The drive mechanism of the gripper jaws 22, 22' is designed so that during opening these are reliably withdrawn behind the edges of the line collecting region, in particular the end plate 25 and the lines 24, 24' are thereby safely raised from the gripper jaws 22, 22' for removal/ejection. Experience shows that some line insulating materials can sporadically remain adhering to the gripper jaws. This then results in disturbances in the sequence.

The preferably exchangeable gripper jaws 22, 22' preferably consist of an elastomer and are covered on the surface or also homogeneously in the material with hard material particles (e.g. corundum) to increase the frictional

force. The hard material particles can be applied directly to the elastomer, e.g. by fusing or dissolving the elastomer; or they are glued on directly; or they are located on an elastic intermediate support (textile) which in turn is glued to the elastomer.

The invention is not restricted to the exemplary embodiment shown. The various drives of the moving parts can be implemented in various ways, for example, by means of pneumatic or hydraulic working cylinders, by means of electric motors, magnetic drives or the like. Also the transmission of force can be accomplished by means of various endless and closed force transmission means such as belts, toothed belts, chains etc.

Reference list

1	Base frame	23,23‘	Linear guide
2	Drive motor	24,24‘	Line
3	Toothed drive belt	25	Front-side end plate
4	Twisting head	26	Tubular sleeve
5	Axis fixed to frame	27	Locking ring
6	First roller bearing	28,28‘	Locking tappet
7	Second roller bearing	29,29‘	Spring-mounted pressure bolt
8	Pot-like twisting head housing	30,30‘	Bolt
8‘	Tubular extension	31	Ring
9	First toothed disk	32	Line end
10	Second toothed disk	33	Line end
11	Pressure ring	34	Insertion and ejection region
12	Plain bearing	35	Screws
13	Axial roller bearing	36	Guide grooves
14	Pivot axis		
15	Lever		
16	Pivot bearing		
17	Pneumatic cylinder		
18	Holder		
19,19‘	Pressure rod		
20, 20‘	Angle lever		
21, 21‘	Second pivot axis		
22, 22‘	Gripper jaws		

What is claimed is:

1. Gripper for electrical or optical lines (24, 24‘), such as wires, cables, line bundles, optical fibres having at least one gripper jaw which can be moved relative to a counterbearing by means of a drive arrangement (22, 22‘), wherein the drive arrangement comprises at least one drive (17) with adjustable force, which acts via a link chain (15, 19, 19‘, 20, 20‘) on the or each gripper jaw (22, 22‘) characterised in that the link chain (15, 19, 19‘, 20, 20‘) comprises a section (19, 19’) which can be moved parallel to the drive (17) but in the opposite direction of movement of the drive (17), and the link chain (15, 19, 19‘, 20, 20‘) comprises a deflecting lever which is positionally fixed to the drive (17), preferably a fork lever (15) via which the drive (17) acts on the section (19, 19’) of the link chain (15, 19, 19‘, 20, 20’) which can be moved parallel to the drive (17) but in the opposite direction of movement of the drive (17), preferably with an interposed axial roller bearing (13) and/or a pressure ring (11) which can be positioned coaxially to the line.

2. The gripper according to claim 1, characterised in that the drive with adjustable force is a fluid working cylinder with programmable supply pressure.

3. The gripper according to claim 1 or 2, characterised in that the direction of movement of the gripper jaws (22, 22’) has a dominant component radially in relation to the line (24, 24’).

4. The gripper according to at least one of claims 1 to 3, characterised in that the direction of action of the drive (17) is accomplished predominantly parallel in relation to the line (24, 24’), wherein via the link chain (15, 19, 19‘, 20, 20‘) a force deflection is provided in a direction of action in the direction of movement of the gripper jaws (22, 22’).

5. Twisting head (4) for the twisting of electrical or optical lines (24, 24') such as wires, cables, line bundles, optical fibres comprising a gripper which can be rotated about the axis of the lines (24, 24'), wherein the drive (17) is disposed in a fixed position and the link chain (15, 19, 19', 20, 20') comprises at least one section (19, 19'. 20, 20') co-rotating with the twisting head (4), characterised in that the gripper is designed according to one of claims 1 to 4 and the co-rotating section (19, 19', 20, 20') of the link chain (15, 19, 19', 20, 20') is formed by elements (19, 19') which can be moved parallel to the drive (17) and opposite to the direction of movement of the drive and by the or each gripper jaw (22, 22').

6. The twisting head according to claim 5, characterised in that the movable elements (19, 19') and the or each gripper jaw (22, 22') are mounted on a co-rotating, preferably pot-shaped supporting structure (8) which has at least one recess extending parallel to the direction of the lines (24, 24') in a dimension and shape such that the lines (24, 24') can be removed

7. The twisting head according to claim 6, characterised in that a tubular sleeve (26) is provided as a cover coaxially to the supporting structure (8), which has at least one recess extending parallel to the direction of the line (24, 24') for removal of the lines (24, 24') and which either co-rotates with the twisting head (4) or is locked in a non-rotatable position.

8. The twisting head according to one of claims 5 to 7, characterised in that the gripper jaws (22, 22') are formed from a metallic material, preferably hard-anodised aluminium with a fluting or roughening of the gripper surfaces, at best of a plasma-coated surface or other surface structures or at least partially of an elastic material, particularly preferably of an elastomer, wherein preferably at least the surfaces coming

in contact with the lines (24, 24') to be gripped are covered by hard material particles such as, for example, corundum.

9. The twisting head according to claim 8, characterised in that an elastic support, preferably a textile, is fastened to a base body of the gripper jaws (22, 22'), wherein the support is preferably fastened on the elastic material and when hard material particles are present, these are located on the support.

10. A twisting apparatus for twisting electrical or optical lines (24, 24') such as wires, cables, line bundles, optical fibres etc. having at least one twisting head (4) which can be rotated by a second drive (2), characterised in that the twisting head (4) is designed according to at least one of claims 5 to 9, wherein the second drive (2) is a rotary drive which transmits the drive moment preferably via an annular drive means (3) to a shaft (5) of the twisting head (4).

11. The twisting apparatus according to claim 10, characterised in that the output shaft, preferably also the motor shaft, of the second drive (2) is or are disposed laterally at a distance and parallel to the axis of rotation (5) of the twisting head (4).