

**A TWIST APPLICATION DEVICE WITH AN ADJUSTABLE DISTANCE
BETWEEN THE CONDUCTOR ENDS**

BACKGROUND OF THE INVENTION

The invention concerns a twist application device, which comprises a feed device for purposes of feeding conductor ends of at least two conductors and a twist application head, mounted such that it can rotate, for purposes of twisting the said conductors. The feed device has first clamping jaws for purposes of clamping the conductor ends, and the twist application head has second clamping jaws for purposes of clamping the conductor ends. The feed device and the twist application head can be moved relative to one another into a transfer position, in which the first clamping jaws and the second clamping jaws are located opposite one another. In a clamping position, moreover, the first clamping jaws can be moved relative to one another such that a distance between clamped conductor ends can be altered.

The invention furthermore concerns a method for purposes of twisting at least two conductors with the aid of a feed device with first clamping jaws and a twist application device with a twist application head with second clamping jaws. Conductor ends of the said conductors are thereby clamped between the first clamping jaws of the feed device, and the feed device is moved into a transfer position with the twist application head, in which the first clamping jaws of the feed device and the second clamping jaws of the twist application head are located opposite one another. The conductor ends are then clamped between the second clamping jaws of the twist application head, the first clamping jaws of the feed device are released, and the said conductors are twisted by

rotation of the twist application head.

A twist application device, together with a method for purposes of twisting two conductors of the type cited above, are in principle known from the prior art. EP 1 032 095 A2 discloses for this purpose a method and a device for purposes of processing and twisting a pair of conductors. In the said twist application device the leading conductor ends are fed from a first pivoting unit to a first automatic device for purposes of processing and fitting. An extraction carriage then accepts the leading conductor ends and pulls the conductors out to the desired length. A feed device accepts the leading conductor ends and brings these to a twist application head. The lagging conductor ends are accepted by a second pivoting unit and fed to a second automatic device for purposes of processing and fitting. A transfer module accepts the finished lagging conductor ends and transfers these to a holding module. The conductor pair located between holding module and twist application head are twisted and elongated with a controlled tensile force.

In general, the aim is to twist conductors over the total length as far as possible. The distance between the conductor ends during the twisting process has a large influence on the shortest length for the non-twisted end section that can be achieved. The larger the distance between the conductor ends, the longer is the undesired non-twisted end section as a rule. However, the distance between the conductor ends cannot be reduced in an arbitrary manner, in particular because conductor ends with fitted seals and/or contacts are also processed.

In accordance with the prior art, therefore, the feed device and the twist application head are designed to

the largest distance occurring between the conductor ends, as a result of which the non-twisted end section is only as short as possible, if the conductor ends - for example as a result of fitted seals and contacts - cannot be arranged at a smaller distance than that in the twist application head. All other twisted conductors, and this represents the majority, accordingly have a non-twisted end section that is too long.

SUMMARY OF THE INVENTION

An object of the present invention is therefore to specify an improved twist application device and an improved method for purposes of twisting conductors. In particular the non-twisted end section should be as short as possible.

The object is achieved by means of the features of the independent claims. Advantageous developments are presented in the figures and in the dependent claims.

In accordance with the invention a twist application device of the type cited in the introduction also comprises a controller, which is connected with a drive for the first clamping jaws and is equipped for the control of the latter such that the distance between clamped conductor ends is set at an adjustable value before the transfer into the twist application head.

In accordance with the invention the distance between clamped conductor ends in a method of the type cited in the introduction is brought into an adjustable value by movement of the first clamping jaws into a clamping position before the clamping of the conductor ends in the second clamping jaws of the twist application head.

Here it is advantageous if at least two different values can be selected for the distance between the clamped conductor ends. However, it is also conceivable that the conductor ends are measured (e.g. optically) and a (minimum) distance is automatically set.

The design of the twist application device and the functional sequences in the same enable the conductor ends to be twisted with a variable distance relative to one another. Thin conductors, with small (crimped) contacts and small seals as necessary, can be arranged with a smaller distance between them than conductors with a large external diameter, in particular those that are fitted with large volume (crimped) contacts and seals. In this manner the conductors can be twisted to the greatest possible length, in other words the non-twisted conductor ends can remain as short as possible. Moreover a required conductor separation, together with a required non-twisted conductor length, can be well maintained.

Further advantageous configurations and developments of the invention ensue from the subsidiary claims, and also from the description in conjunction with the figures.

It is advantageous if an intermediate space located between fully-open first clamping jaws, in a direction of movement for purposes of altering the distance between the clamped conductor ends, extends at least twice as far as in a clamping direction of the first clamping jaws for purposes of clamping the conductor ends. In particular the cited intermediate space in a direction of movement for purposes of altering the distance between the clamped conductor ends can be at least twice as large as a diameter of the conductor ends for which the feed device is specified. Finally,

it is also of advantage if the cited intermediate space in a direction of movement for purposes of altering the distance between the clamped conductor ends is at least 9 mm in size. In this manner the conductor ends can be clamped by the feed device in the first clamping process in different positions, and thus at different distances relative to one another.

It is particularly advantageous if the first clamping jaws have clamping surfaces facing towards one another, which

- a) are essentially flat, or
- b) comprise more than one, in particular more than two, half-shell shaped grooves for purposes of accommodating one conductor end in each case.

Case a) enables the clamping process to take place in an arbitrary position. The first clamping process can also be supplied with teeth for a secure grip, whereby the height of the teeth is advantageously less than 10 % of the conductor diameter, and/or is less than 3 % of the distance of the first clamping jaws in the clamping direction when the first clamping jaws are fully-open, and/or is less than 0.3 mm. The clamping surfaces are then still essentially flat. Case b) finally enables the clamping of the conductor ends at a plurality of prescribed positions.

It is also particularly advantageous if the second clamping jaws have clamping surfaces facing towards one another, which

- c) are essentially flat, or
- d) comprise more than two, in particular more than

three, half-shell shaped grooves for purposes of accommodating one conductor end in each case.

The statements made concerning the first clamping jaws apply here in an analogous manner.

It is moreover favourable if the first clamping jaws in a clamping position can be moved relative to one another such that a distance between two clamped conductor ends can be altered. In this manner twisted-pair conductors can be manufactured with conductor ends that are variously spaced apart.

It is moreover favourable, if the first clamping jaws in a clamping position can be moved relative to one another such that a distance between three clamped conductor ends can be altered. In this manner three-wire twisted conductors can be manufactured with conductor ends that are variously spaced apart.

It is moreover favourable if the first clamping jaws and/or second clamping jaws are mounted such that they can move relative to one another for purposes of clamping a conductor end. By this means precise clamping is possible, or rather the precise maintenance of a required distance between the conductor ends.

It is moreover favourable if the first clamping jaws, for purposes of altering the distance between the clamped conductor ends, are mounted such that they can be rotated relative to one another without affecting a clamping position. By this means a simple design of structure ensues for the feed device.

In the method presented it is of advantage if the conductor ends are captured and clamped by the feed device individually and in sequence, and are captured

and clamped by the twist application head jointly and simultaneously. In this manner the conductor ends can always be gripped by the feed device at the same position, as a result of which a simple design of structure of that device ensues, with which the conductors to be twisted can be transported onwards.

However, it is also advantageous if the conductor ends are captured and clamped by the feed device jointly and simultaneously, and by the twist application head jointly and simultaneously. In this manner the processing speed, i.e. the through flow, can be increased.

It is furthermore advantageous if a variable position of the first clamping jaws is set in accordance with a selected distance between the conductor ends before the clamping of the conductor ends, and if the first clamping jaws are moved into a fixed prescribed position before the clamping of the conductor ends in the second clamping jaws of the twist application head. In this variant of embodiment of the invention the conductors are therefore clamped in an adjustable position in the first clamping jaws. The set distance between the conductor ends ensues as a consequence, in that the first clamping jaws and the second clamping jaws are moved relative to one another into a fixed prescribed transfer position.

Finally, it is also advantageous if the first clamping jaws are moved into a fixed prescribed position before the clamping of the conductor ends, and a variable position of the first clamping jaws is set in accordance with a selected distance between the conductor ends before the clamping of the conductor ends in the second clamping jaws of the twist application head. In this variant of embodiment of the

invention the conductors are therefore always clamped in the same position in the first clamping jaws. The set distance between the conductor ends ensues as a consequence, in that the first clamping jaws and the second clamping jaws are moved relative to one another into an adjustable transfer position.

At this point it should be noted that the variants disclosed with respect to the twist application device and the advantages resulting therefrom relate to an equal extent to the disclosed method, and vice versa.

BRIEF DESCRIPTION OF THE DRAWINGS

Further advantages, features and details of the invention ensue from the following description, in which examples of embodiment of the invention are described with reference to the figures. Here the features mentioned in the claims and in the description can in each case, either individually or in any combination, be essential to the invention.

The reference symbol list is a component of the disclosure. The figures are described in a connected and comprehensive manner. The same reference symbols denote the same parts; reference symbols with different indices specify components with the same or similar functions.

In the figures:

Fig. 1 shows an example of a twist application device;

Fig. 2 shows a first, exemplary and schematically represented form of embodiment of flat clamping jaws of a feed device;

- Fig. 3 as Fig. 2, only with clamping jaws with teeth;
- Fig. 4 as Fig. 2, only with depressions for the accommodation of conductors;
- Fig. 5 a detailed view of first clamping jaws with clamped conductors at a small distance from one another;
- Fig. 6 a detailed view of first clamping jaws with clamped conductors at a larger distance from one another;
- Fig. 7 a detailed view of a twist application head with clamped conductors at a small distance from one another;
- Fig. 8 a detailed view of a twist application head with clamped conductors at a larger distance from one another;
- Fig. 9 the feed device from Fig. 1 in a standby position;
- Fig. 10 the feed device with the first linear gripper in position;
- Fig. 11 as Fig. 10, only with a first conductor captured;
- Fig. 12 the feed device with the first linear gripper pivoted out of position;
- Fig. 13 the feed device with the second linear gripper in position;

- Fig. 14 as Fig. 13, only with a second conductor captured;
- Fig. 15 the feed device with linear grippers adjusted in accordance with a selected conductor separation;
- Fig. 16 the feed device in a position for transfer to the twist application head;
- Fig. 17 as Fig. 16, only with the second clamping jaws of the twist application head activated;
- Fig. 18 as Fig. 17, only with the first clamping jaws of the feed device released;
- Fig. 19 shows a schematic representation of three grippers with first clamping jaws in a standby position;
- Fig. 20 shows the arrangement from Fig. 19, with a first conductor that has been captured by the first gripper;
- Fig. 21 shows the arrangement from Fig. 19, with the first gripper pivoted out of position, and a second conductor that has been captured by the second gripper;
- Fig. 22 shows the arrangement from Fig. 19, with the first and second grippers pivoted out of position, and a third conductor that has been captured by the third gripper;
- Fig. 23 the arrangement from Fig. 19, with grippers adjusted in accordance with a selected

conductor separation;

Fig. 24 as Fig. 23, only with the second clamping jaws of the twist application head, which have captured the three conductors;

Fig. 25 as Fig. 24, only with the first clamping jaws released, and

Fig. 26 as Fig. 25, only with the grippers pivoted out of position.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Fig. 1 shows an exemplary twist application device, which comprises a feed device 1 for purposes of feeding conductor ends 2a, 2b of two conductors 3a, 3b, and a twist application head 4 mounted such that it can rotate for purposes of twisting the said conductors 3a, 3b. The feed device 1 has first clamping jaws 5a .. 5d, and the twist application head 4 has second clamping jaws 6a, 6b for purposes of clamping the conductor ends 2a, 2b. (Note: in Fig. 1 the clamping jaw 5b is covered by the conductor 3a, and is therefore not visible). The feed device 1 and the twist application head 4 can be moved relative to one another into a transfer position, in which the first clamping jaws 5a .. 5d and the second clamping jaws 6a, 6b are located opposite one another, so that the conductor ends 2a, 2b can be transferred from the feed device 1 into the twist application head 4. With the aid of the twist application head 4, the conductors 3a, 3b are then twisted in a manner known per se, in order, for example, thus to manufacture a twisted-pair conductor.

The first clamping jaws 5a .. 5d in a clamping position can be moved relative to one another such that a

distance between clamped conductor ends 2a, 2b can be altered. For this purpose the twist application device has a controller 7, which is connected with a drive 8 for the first clamping jaws 5a .. 5d and is equipped for the control of the latter, such that the distance between clamped conductor ends 2a, 2b is set at an adjustable value before the transfer into the twist application head 4. How the adjustment of the distance functions in practice will be explained later in detail.

Fig. 2 shows a schematic front view of the first clamping jaws 5a, 5b, from which it can be discerned that the first clamping jaws 5a, 5b, have clamping surfaces 9a, 9b facing towards one another, which are flat. Fig. 2 shows the clamping jaws 5a, 5b in the fully-open position. From Fig. 2 it can furthermore be discerned that the width b of the intermediate space located between the fully-open first clamping jaws 5a, 5b is greater than its height h. Here the width b is measured in a direction of movement A for purposes of altering the position of the conductor end 2a, while the height h is measured in a clamping direction B for purposes of clamping the conductor end 2a. In an advantageous variant of embodiment the width b is at least twice as large as the height h. In other words, an intermediate space located between the first clamping jaws 5a, 5b when the latter are fully-open extends, in a direction of movement A for purposes of altering the distance of the clamped conductor end 2a, at least twice as far as in a clamping direction B of the first clamping jaws 5a, 5b for purposes of clamping the conductor end 2a. By means of the proposed measures the conductor 3a, or rather the conductor end 2a, can be clamped in any position between the first clamping jaws 5a, 5b.

In a further alternative form of embodiment the width b is at least twice as large as the diameter d of the conductor 3a, or rather the conductor end 2a. In other words, an intermediate space located between the fully-open first clamping jaws 5a, 5b, in a direction of movement A for purposes of altering the distance of the clamped conductor end 2a is at least twice as large as the diameter d of the conductor 3a, that is to say, the conductor end 2a, for which the feed device 1 is specified.

In another advantageous form of embodiment the width b is at least 9 mm. In other words, the intermediate space, located between the fully-open first clamping jaws 5a, 5b, is at least 9 mm in size in a direction of movement A for purposes of altering the position of the clamped conductor end 2a.

Fig. 3 now shows a form of embodiment in which the clamping surfaces 9a, 9b have teeth. Advantageously the height z of the teeth is less than 3 % of the height h , or less than 10 % of the diameter d , as a result of which the clamping surfaces 9a, 9b remain essentially flat and the conductor 3a, or rather the conductor end 2a, can be clamped at any position between the clamps 5a, 5b. However, by virtue of the teeth the clamping action is more effective than in the form of embodiment represented in Fig. 2.

An exemplary twist application device embodied in specific form is specified for the twisting of cables 3a, 3b with a cross-section from 0.35 mm^2 up to 2.5 mm^2 , and can process cables with a diameter of up to 3 mm. Here the clamping jaws have a width b of 9 mm, as a result of which the centre-to-centre distance between the conductors 3a, 3b is a maximum of 15 mm (compare also the distance a in Figures 5 and 6). The height of

the teeth is 0.2 mm. While these values are indeed advantageous, they are not mandatory. Should the twist application device be able to process larger cables 3a, 3b, the dimensions can be increased correspondingly.

Fig. 4 now shows a variant of embodiment in which the clamping surfaces 9a, 9b in each case have four half-shell shaped grooves for purposes of accommodating the conductor 3a, or rather the conductor end 2a. Here the depth t of a groove is slightly less than half the diameter d of the conductor 3a, or rather the conductor end 2a. The conductor 3a, or rather the conductor end 2a, can thus be clamped in any one of the positions prescribed by the grooves between the clamps 5a, 5b. In general the clamping surfaces 9a, 9b can also have more or less than four half-shell shaped grooves. In particular more than one, in particular more than two, half-shell shaped grooves are to be provided.

Figures 5 and 6 now show how the distance between two conductors 3a, 3b, that is to say, between two conductor ends 2a, 2b, can be varied by varying the position in which the latter are clamped in the feed device 1. In each of the upper illustrations the clamping jaws 5a .. 5d are represented with two clamped conductors 3a, 3b, while in each of the lower illustrations the twisted conductors 3a, 3b are represented.

In Fig. 5 the conductors 3a, 3b are clamped with a relatively small distance a between them, while in Fig. 6 the distance a between them is relatively large. Under the presupposition that these distances a must also be maintained during the twisting process, different lengths l of the non-twisted end sections ensue. To this end Fig. 7 shows clamping of the conductors 3a, 3b, corresponding to Fig. 5, between the

two clamps 6a, 6b of the twist application head 4, while Fig. 8 shows clamping of the conductors 3a, 3b, corresponding to Fig. 6, between the two clamps 6a, 6b of the twist application head 4. For purposes of rotating the twist application head 4 the latter has a gear 10, with which a drive pinion (not represented), or a drive belt engages. The non-twisted end section represented in Fig. 6 is now discernibly larger than the non-twisted end section represented in Fig. 5.

Thin conductors 3a, 3b, with small (crimped) contacts and small seals as necessary, can be arranged with a smaller distance a between them than conductors 3a, 3b with a large external diameter, in particular those that are fitted with large volume (crimped) contacts and seals. In this manner the conductors 3a, 3b can be twisted along the greatest possible length.

The previous illustrations show examples in which the first clamping jaws 5a .. 5d in a clamping position can be moved relative to one another such that a distance between clamped two conductor ends 3a, 3b can be altered, as a result of which twisted-pair conductors can in particular be manufactured with conductor ends 2a, 2b that are variously spaced apart.

However, this is not the only conceivable form of embodiment. It is also possible, for example, that the first clamping jaws 5a .. 5d in a clamping position can be moved relative to one another such that a distance between three clamped conductor ends can be altered (see Figures 19 to 26). In this manner three-wire twisted conductors can be manufactured with conductor ends that are variously spaced apart.

A method for purposes of twisting two conductors 3a, 3b with the aid of the feed device 1 and the twist

application head 4 is now explained in more detail with the aid of Figures 9 to 18.

Fig. 9 shows the feed device 1 from Fig. 1 in a first state in which the first conductor is already arranged in the vicinity of the first clamps 5a, 5b, but is not yet clamped. Moreover, further details are indicated in Fig. 9. A (crimped) contact 11a, is arranged on the conductor 3a, together with a seal 12a. Both project beyond the cross-section of the conductor 3a, and thus determine the smallest distance that can be achieved between a plurality of conductors 3a, 3b.

Furthermore, specifically indicated in Fig. 9 are the two linear grippers 13a, 13b, which have the clamping jaws 5a .. 5d, a pneumatic ram 14, a horizontal guide 15, a carriage 16 mounted on the latter such that it can move, a pivot bearing 17, on which the first linear gripper 13 is mounted such that it can rotate, together with a vertical guide 18, with which the second linear gripper 13b is mounted such that it can move vertically. With the aid of the drive 8 the carriage 16, and thus the linear grippers 13a, 13b that are mounted on the latter, can be traversed horizontally along the horizontal guide 15. In addition, the first linear gripper 13a can be pivoted about the pivot bearing 17 with the aid of the pneumatic ram 14. Finally, the second linear gripper can be moved vertically along the vertical guide 18 by pneumatic means. Finally, the clamping jaws 5b, 5d can also be moved relative to the clamping jaws 5a, 5c. In general, needless to say, another form of drive, for example an electrical or hydraulic drive, can be provided instead of a pneumatic drive. In the first state illustrated in Fig. 9 the first linear gripper 13a is pivoted upwards, the second linear gripper 13b is moved upwards, and the clamping jaws 5a .. 5d are open.

Fig. 10 shows the feed device 1 in a second state, in which the first linear gripper 13a is pivoted downwards, the second linear gripper 13b, as before, is moved upwards, and the clamping jaws 5a .. 5d are still open.

Fig. 11 shows the feed device 1 in a further state, in which the clamping jaws 5a, 5b are closed and have clamped the conductor 3a. Before the clamping process takes place the first linear gripper 13a is positioned horizontally in accordance with a required position of the conductor 3a with the aid of the controller 7 and the drive 8.

Fig. 12 shows the feed device 1 in a further state, in which the first linear gripper 13a, together with the clamped conductor 3a, is pivoted upwards, the second linear gripper 13b is moved downwards, and the clamping jaws 5c, 5d are still open. The conductor 3b is already arranged in the vicinity of the clamping jaws 5c, 5d.

Fig. 13 shows the feed device 1 in a further state, in which the second linear gripper 13b has been positioned horizontally in accordance with a required position of the conductor 3b with the aid of the controller 7 and the drive 8.

Fig. 14 shows the feed device 1 in a further state, in which the clamping jaws 5c, 5d have been closed, and have clamped the conductor 3b.

Fig. 15 shows the feed device 1 and the twist application head 4 in a state in which the first linear gripper 13a is pivoted downwards, and the conductors 3a, 3b are arranged at a required distance from one another.

Fig. 16 shows the feed device 1 and the twist application head 4 in a state in which the feed device 1 has been moved into a transfer position with the twist application head 4, in which the first clamping jaws 5a .. 5d of the feed device 1 and the second clamping jaws 6a, 6b of the twist application head 4 are located opposite one another.

Fig. 17 shows the feed device 1 and the twist application head 4 in a state in which the second clamping jaws 6a, 6b of the twist application head 4 have been closed, and are clamping the conductors 3a, 3b.

Fig. 18 shows the feed device 1 and the twist application head 4 in a state in which the first clamping jaws 5a .. 5d of the feed device 1 are open, and the conductors 3a, 3b have accordingly been transferred to the twist application head 4. Here the first linear gripper 13a has already been pivoted upwards, so that the feed device 1 can be moved out of the vicinity of the twist application head 4. By fixing the other conductor ends (not represented) and rotating the twist application head 4 the conductors 3a, 3b can then be twisted in a manner known per se.

The method for purposes of twisting the two conductors 3a, 3b with the aid of the feed device 1 with first clamping jaws 5a .. 5d and the twist application device 1 with the twist application head 4 with second clamping jaws 6a, 6b thus comprises the following steps:

- Clamping of the conductor ends 2a, 2b of the said conductors 3a, 3b between the first clamping jaws 5a .. 5d of the feed device 1,

- Movement of the feed device 1 into a transfer position with the twist application head 4, in which the first clamping jaws 5a .. 5d of the feed device 1 and the second clamping jaws 6a, 6b of the twist application head 4 are located opposite one another,
- Clamping of the conductor ends 2a, 2b between the second clamping jaws 6a, 6b of the twist application head 4,
- Release of the first clamping jaws 5a .. 5d of the feed device 1, and
- Twisting of the said conductors 3a, 3b by rotation of the twist application head 4.

The distance between clamped conductor ends 2a, 2b is thereby set at an adjustable value by movement of the first clamping jaws 5a .. 5d into a clamping position before the clamping of the conductor ends 2a, 2b in the second clamping jaws 6a, 6b of the twist application head 4. In particular at least two different values can be selected for the distance between the clamped conductor ends 2a, 2b.

In the example shown the conductor ends 2a, 2b are captured and clamped by the feed device 1 individually and in sequence, and are captured and clamped by the twist application head 4 jointly and simultaneously. However, it is also conceivable, needless to say, for the conductor ends 2a, 2b also to be captured and clamped by the feed device 1 jointly and simultaneously.

Furthermore a variable position of the first clamping

jaws 5a .. 5d is set in accordance with a selected distance a between the conductor ends 2a, 2b before the conductor ends 2a, 2b are clamped, and the first clamping jaws 5a .. 5d are moved into a fixed prescribed position before the clamping of the conductor ends 2a, 2b in the second clamping jaws 6a, 6b of the twist application head 4 (on this point see, in particular, Figures 2 to 6, together with the horizontal guide 15, with which the linear grippers 13a, 13b can be traversed horizontally). In concrete terms the distance a aimed for in the twist application head 4 is already defined during the clamping process by the feed device 1, in that when capturing the conductors 2a, 2b the linear grippers 13a, 13b are traversed into an appropriate (variable) position (see in particular Fig. 10 und Fig. 13). In contrast the positioning of the linear grippers 13a, 13b during the transfer to the twist application head 4 is fixed. That is to say, for the transfer of the conductors 2a, 2b to the twist application head the linear grippers 13a, 13b are always traversed to the same position.

Needless to say, this is not the only conceivable option. It is also conceivable, for example, that the first clamping jaws 5a .. 5d are moved into a fixed prescribed position before the clamping of the conductor ends 2a, 2b, and a variable position of the first clamping jaws 5a .. 5d is set in accordance with a selected distance a between the conductor ends 2a, 2b before the clamping of the conductor ends 2a, 2b in the second clamping jaws 6a, 6b of the twist application head 4. In concrete terms this means that the linear grippers 13a, 13b in Figures 10 and 13 always traverse to the same position, but in the transfer of the conductors 2a, 2b to the twist application head 4 (see Fig. 16) are traversed to a position corresponding to the selected distance a .

Generally for purposes of clamping a conductor end 2a, 2b the first clamping jaws 5a .. 5d can be mounted such that they can be moved relative to one another, and for purposes of altering the distance between clamped conductor ends 2a, 2b they can be mounted such that they can be rotated relative to one another without affecting a clamping position, as is represented in Figures 1 to 18. However, it is also conceivable for the first clamping jaws 5a .. 5d to be mounted such that they can be moved relative to one another, both for purposes of clamping a conductor end 2a, 2b, and also for purposes of altering the distance between clamped conductor ends 2a, 2b. Likewise the first clamping jaws 5a .. 5d can be mounted such that they can be rotated relative to one another, both for purposes of clamping a conductor end 2a, 2b, and also for purposes of altering the distance between clamped conductor ends 2a, 2b. Finally, it is also possible that for purposes of clamping a conductor end 2a, 2b the first clamping jaws 5a .. 5d are mounted such that they can be rotated relative to one another, and for purposes of altering the distance between clamped conductor ends 2a, 2b they are mounted such that they can moved be relative to one another without affecting a clamping position.

Furthermore, the second clamping jaws 6a, 6b can also be mounted such that they can be moved relative to one another for purposes of clamping a conductor end 2a, 2b, as represented in Figures 1 to 18, but are also mounted such that they can be rotated. Moreover it is also conceivable for the second clamping jaws 6a, 6b to be designed as represented in Figures 2 to 4. That is to say, the second clamping jaws 6a, 6b can have clamping surfaces facing towards one another, which

- c) are essentially flat, or
- d) comprise more than two, in particular more than three, half-shell shaped grooves for purposes of accommodating one conductor end 2a, 2b in each case.

Figures 19 to 26 now show schematically an exemplary sequence for purposes of clamping (and twisting) three conductors 3a..3c.

In Fig. 19 the first clamping jaws 5a .. 5f are located in an initial position for this purpose, and a first conductor 3a is located in the vicinity of the feed device 1.

Fig. 20 shows the arrangement in a state in which the clamping jaws 5a, 5b have been traversed onto the first conductor 3a, and have captured, that is to say, clamped the latter.

Fig. 21 shows the arrangement in a state in which the clamping jaws 5c, 5d have been traversed onto a second conductor 3b, brought into the vicinity of the feed device 1, and have captured, that is to say, clamped the latter. In the meantime the clamping jaws 5a, 5b, together with the clamped first conductor 3a, have been moved out of the vicinity of the conductor 3b.

Fig. 22 shows the arrangement in a state in which the clamping jaws 5e, 5f have been traversed onto a third conductor 3c, brought into the vicinity of the feed device 1, and have captured, that is to say, clamped the latter. In the meantime the clamping jaws 5c, 5d, together with the clamped second conductor 3b, have been moved out of the vicinity of the conductor 3c.

The clamping jaws 5a .. 5f are then traversed towards one another into a position in which they transfer the conductors 3a .. 3c to the twist application head 4. This state is represented in Fig. 23.

In Fig. 24 the conductors 3a .. 3c have been captured, that is to say, clamped by the second clamping jaws 6a, 6b of the twist application head 4. However, as before the conductors 3a .. 3c also continue to be held by the clamping jaws 5a .. 5f of the feed device 1. In Fig. 25, in contrast, the clamping jaws 5a .. 5d have already been released.

Fig. 26 shows finally a state in which the clamping jaws 5a .. 5f have been moved out of the vicinity of the conductors 3a .. 3c, clamped in the twist application head 4. The conductors 3a .. 3c can thus be twisted in a manner known per se.

At this point it should be noted that the variants of embodiment disclosed in Figures 1 to 18 can also be applied in an analogous manner to the variants of embodiment disclosed in Figures 19 to 26. In particular, this relates to the form and mounting of the first clamping jaws 5a .. 5f and the second clamping jaws 6a, 6b.

Finally it is also noted that the arrangements represented can in reality also comprise more components than represented. Furthermore it is noted that the above configurations and developments of the invention can be combined in any manner.

REFERENCE LIST

1	Feed device
2a, 2b	Conductor end
3a .. 3c	Conductor
4	Twist application head
5a .. 5f	First clamping jaws of the feed device 1
6a, 6b	Second clamping jaws of the twist application head 4
7	Controller
8	Drive
9a, 9b	Clamping surfaces
10	Gear
11a	(Crimped) contact
12a	Seal
13a, 13b	Linear gripper
14	Pneumatic ram
15	Horizontal guide
16	Carriage
17	Pivot bearing of the first linear gripper 13a
18	Vertical guide of the second linear gripper 13b
A	Direction of movement
B	Clamping direction
a	Distance between conductors
b	Intermediate space width
d	Conductor diameter
h	Intermediate space height
l	Non-twisted conductor length
t	Depth of the groove
z	Tooth height

CLAIMS

1. A twist application device, comprising a feed device (1) for purposes of feeding conductor ends (2a .. 2c) of at least two conductors (3a .. 3c), and a twist application head (4) mounted such that it can rotate for purposes of twisting the said conductors (3a .. 3c), wherein

- the feed device (1) has first clamping jaws (5a .. 5f) for purposes of clamping the conductor ends (2a .. 2c),
- the twist application device (4) has second clamping jaws (6a, 6b) for purposes of clamping the conductor ends (2a .. 2c),
- the feed device (1) and the twist application head (4) can be moved relative to one another into a transfer position, in which the first clamping jaws (5a .. 5f) and the second clamping jaws (6a, 6b) are located opposite one another, and
- the first clamping jaws (5a .. 5f) in a clamping position can be moved relative to one another such that a distance (a) between clamped conductor ends (2a .. 2c) can be altered,

characterised by

a controller (7), which is connected with a drive (8) for the first clamping jaws (5a .. 5f) and is equipped for the control of the latter, such that the distance (a) between clamped conductor ends (2a .. 2c) is set at an adjustable value before

the transfer into the twist application head (4).

2. The feed device (1) according to claim 1, characterised in that an intermediate space located between fully-open first clamping jaws (5a .. 5f) extends, in a direction of movement (A) for purposes of altering the distance between the clamped conductor ends (2a .. 2c), at least twice as far as in a clamping direction (B) of the first clamping jaws (5a .. 5f) for purposes of clamping the conductor ends (2a .. 2c).
3. The feed device (1) according to claim 1 or 2, characterised in that an intermediate space, located between fully-open first clamping jaws (5a .. 5f) in a direction of movement (A) for purposes of altering the distance between the clamped conductor ends (2a .. 2c), is at least twice as large as a diameter (d) of the conductor ends (2a .. 2c), for which the feed device (1) is specified.
4. The feed device (1) according to any one of the claims 1 to 3, characterised in that an intermediate space, located between fully-open first clamping jaws (5a .. 5f), is at least 9 mm in size in a direction of movement (A) for purposes of altering the distance between the clamped conductor ends (2a .. 2c).
5. The feed device (1) according to any one of the claims 1 to 4, characterised in that the first clamping jaws (5a .. 5f) have clamping surfaces (9a, 9b) facing towards one another, which
 - a) are essentially flat, or

- b) comprise more than one half-shell shaped groove for purposes of accommodating one conductor end (2a .. 2c) in each case.
6. The feed device (1) according to any one of the claims 1 to 5, characterised in that the first clamping jaws (5a .. 5d) in a clamping position can be moved relative to one another such that a distance (a) between two clamped conductor ends (2a, 2b) can be altered.
 7. The feed device (1) according to any one of the claims 1 to 5, characterised in that the first clamping jaws (5a .. 5f) in a clamping position can be moved relative to one another such that a distance (a) between three clamped conductor ends (2a .. 2c) can be altered.
 8. The feed device (1) according to any one of the claims 1 to 7, characterised in that the first clamping jaws (5a .. 5f) are mounted such that they can be moved relative to one another for purposes of clamping a conductor end (2a .. 2c).
 9. The feed device (1) according to any one of the claims 1 to 8, characterised in that the first clamping jaws (5a .. 5f) are mounted such that they can be rotated relative to one another for purposes of altering the distance (a) between clamped conductor ends (2a .. 2c) without affecting a clamping position.
 10. A twist application device (1) for purposes of twisting at least two conductors (3a .. 3c), characterised by a twist application head (4), mounted such that it can rotate, together with a feed device (1) according to any one of the claims

1 to 9.

11. The twist application device (1) according to claim 10, characterised in that

the second clamping jaws (6a, 6b) have clamping surfaces facing towards one another, which

c) are essentially flat, or

d) comprise more than two half-shell shaped grooves for purposes of accommodating one conductor end (2a .. 2c) in each case.

12. The twist application device (1) according to claim 10 or 11, characterised in that the second clamping jaws (6a, 6b) are mounted such that they can be moved relative to one another for purposes of clamping a conductor end (2a .. 2c).

13. A method for purposes of twisting at least two conductors (3a .. 3c) with the aid of a feed device (1) with first clamping jaws (5a .. 5f), and a twist application device (1) with a twist application head (4) with second clamping jaws (6a, 6b), comprising the steps:

- Clamping of conductor ends (2a .. 2c) of the said conductors (3a .. 3c) between the first clamping jaws (5a .. 5f) of the feed device (1),

- Movement of the feed device (1) into a transfer position with the twist application head (4), in which the first clamping jaws (5a .. 5f) of the feed device (1) and the second clamping jaws (6a, 6b) of the twist

application head (4) are located opposite one another,

- Clamping of the conductor ends (2a .. 2c) between the second clamping jaws (6a, 6b) of the twist application head (4),
- Release of the first clamping jaws (5a .. 5f) of the feed device (1), and
- Twisting of the said conductors (3a .. 3c) by rotation of the twist application head (4),

characterised in that

the distance (a) between clamped conductor ends (2a .. 2c) is set at an adjustable value by movement of the first clamping jaws (5a .. 5f) in a clamping position, before the clamping of the conductor ends (2a .. 2c) in the second clamping jaws (6a, 6b) of the twist application head (4).

14. The method according to claim 13, characterised in that at least two different values can be selected for the distance (a) between clamped conductor ends (2a .. 2c).
15. The method according to claim 13 or 14, characterised in that the conductor ends (2a .. 2c) are captured and clamped by the feed device (1) individually and in sequence, and are captured and clamped by the twist application head (4) jointly and simultaneously.
16. The method according to claim 13 or 14, characterised in that the conductor ends (2a .. 2c) are captured and clamped by the feed device

(1) jointly and simultaneously, and are captured and clamped by the twist application head (4) jointly and simultaneously.

17. The method according to any one of the claims 13 to 16, characterised in that a variable position of the first clamping jaws (5a .. 5f) is adjusted in accordance with a selected distance (a) between the conductor ends (2a .. 2c) before the clamping of the conductor ends (2a .. 2c), and the first clamping jaws (5a .. 5f) are moved into a fixed prescribed position before the clamping of the conductor ends (2a .. 2c) in the second clamping jaws (6a, 6b) of the twist application head (4).
18. The method according to any one of the claims 13 to 16, characterised in that before the clamping of the conductor ends (2a .. 2c) the first clamping jaws (5a .. 5f) are moved into a fixed prescribed position, and a variable position of the first clamping jaws (5a .. 5f) is adjusted in accordance with a selected distance (a) between the conductor ends (2a .. 2c) before the clamping of the conductor ends (2a .. 2c) in the second clamping jaws (6a, 6b) of the twist application head (4).