

RUBBER STRIP INTRODUCING APPARATUS

Field of the Invention

5 The present invention relates to equipment for profile processing, and more specifically, relates to an apparatus for introducing a rubber strip into a profile.

Background of the Invention

10 In prior arts, some profiles should be inserted with a rubber strip so as to achieve effects such as water-proofing, sound-insulating, or the like. An example thereof is aluminum profile used for door frame or window frame. The profile is provided along a lengthwise direction thereof with a rubber strip mounting groove, in which the rubber strip can be inserted. A front end face and a rear end face of the profile are each
15 generally configured as a slope, so as to facilitate jointing of two aluminum profiles arranged in a horizontal direction and in a vertical direction respectively. In addition, the slopes of said two end faces are normally not parallel to each other, but form an angle, e.g. a right angle of 90 degrees, therebetween. Correspondingly, the rubber strip inserted in the profile should also have two end faces respectively parallel to said two
20 end faces of the profile. That is, the two end faces of the rubber strip are also configured as slopes with corresponding angles.

 Conventionally, the rubber strip is inserted in the profile and cut off there in a manner as follows. First, the aluminum profile is held by one hand of an operator, and
25 the rubber strip is held by the other hand of the operator, so that the rubber strip can be guided into the rubber strip mounting groove of the profile by hands. Then, the rubber strip is cut off along each of the sloping end faces of the profile through a pair of scissors. That is, two cutting operations with different cutting angles have to be performed for each profile. This procedure lacks efficiency and causes the operator

tedious, thus wasting labor. Moreover, the operator's hands may be injured due to contact with sharp corners of the end faces of profiles. Therefore, there exists a safety risk during operation.

5 Chinese invention patent application CN107972281A discloses an apparatus for guiding and cutting rubber strip, This apparatus is used for guiding the rubber strip in the rubber strip mounting groove of the profile and then cutting the rubber strip according to the angles of two end faces of the profile. The apparatus includes a cutting device, a profile positioning device, a rubber strip guiding and loading device,
10 a rubber strip anti-torsion device, a rubber strip pushing device, and a controlling device. The apparatus can automatically deliver and guide the rubber strip into the rubber strip mounting groove of the profile through the controlling device, and then cut off the rubber strip after it is in position. The cut rubber strip has its end faces with the same angles as the end faces of the profile. Therefore, the production efficiency is
15 greatly enhanced, the labor cost is saved, and automatic operation can be achieved. Moreover, the contact between human's hands and the end faces of the profile during cutting is avoided, thus achieving safe operation.

However, in practice, the above technical solution can still fail to prevent the
20 rubber strip from being deformed, hunched, twisted or knotted when the rubber strip is conveyed to the profile. These problems would cause abnormal conveyance of the rubber strip and interrupt the operation, and thus require manual involvement, which significantly reduces the working efficiency.

25 **Summary of the Invention**

The present invention proposes a rubber strip introducing apparatus, which is, compared with the prior arts, additionally provided with means for adjusting the conveyance of the rubber strip and means for detecting the deformation of the rubber

strip. In this manner, the rubber strip can be prevented to a large extent from being deformed, hunched, or twisted during its conveyance, thus effectively increasing the efficiency of introduction of the rubber strip.

5 The technical solution proposed by the present invention relates to a rubber strip introducing apparatus for guiding a rubber strip into a rubber strip mounting groove of a profile and cutting off the rubber strip according to angles of two end faces of the profile. The apparatus comprises a pushing device, an aligning device, a cutter device, and a control device in communication with the above devices, all the devices being
10 arranged in the above-mentioned order along a direction of conveying the rubber strip. The apparatus further comprises a rubber strip supplying table and a rubber strip twisting detection device. The rubber strip supplying table includes a fixed frame, a rotatable bracket rotatably coupled to the fixed frame, and a supplying tray rotatably and detachably coupled to the rotatable bracket. The rubber strip twisting detection
15 device is configured to detect a twisting angle of the rubber strip when the rubber strip is twisted during conveyance, and the control device is configured to control the rotatable bracket to rotate for compensation with the same angle.

 Although current rubber strip introducing apparatus also includes means for
20 keeping the direction of the rubber strip stable and preventing the deformation thereof, the technical effect thus achieved is far from satisfactory. The deformation of the rubber strip still exists in the apparatus, causing reduced working efficiency. Compared with the current technical solution, the rubber strip introducing apparatus according to the present invention can perform compensating rotation by means of the
25 control device which can control the rotatable bracket, so that the rubber strip supplying table can be adjusted in terms of angle and position thereof. In this manner, the twisted rubber strip can be restored to its normal state, thus preventing to a large extent the rubber strip from being deformed, hunched or twisted when the rubber strip is conveyed to the profile.

As a concrete implementation mode of the present invention, the rubber strip twisting detection device of the rubber strip introducing apparatus according to the present invention comprises a disc support, a rotating disc, and an angle sensor. The rotating disc is rotatably connected to the disc support, and is provided at its side with an indexing disc. The angle sensor is fixed on the disc support, and in communication link with the control device for detecting a rotating angle of the indexing disc. The control device is configured to, after the angle sensor detects that the indexing plate rotates with a certain angle, control the rotatable bracket of the rubber strip supplying table to rotate for compensation with the same angle.

According to the present invention, the rubber strip twisting detection device is additionally provided to ensure continuous operation of the rubber strip introducing apparatus without manual involvement, thus effectively improving the working efficiency.

As a concrete implementation mode of the present invention, the rotating disc is structured as a bearing, which has an outer ring fixedly connected to the disc support, and an inner ring fixedly connected to the indexing plate and rotatably connected to the outer ring. At least one pair of rotating wheels are mounted on the inner ring of said bearing, wherein the rubber strip passes between said at least one pair of rotating wheels, which are able to press toward the rubber strip from both sides.

As an optional implementation mode, the rubber strip introducing apparatus according to the present invention further includes a pressing roller device, which has an upper pressing roller and a lower wheel that cooperate with each other. The upper pressing roller and the lower wheel are each provided with an annular groove on circumferential wall surfaces respectively, so that the rubber strip can pass through a gap formed by the annular grooves that are opposite to each other. The lower wheel is

fixed while the upper pressing roller is slidable in a vertical direction through a sliding mechanism. The upper pressing roller is connected with a first pressure cylinder that is able to provide a vertical driving force, so that the upper pressing roller can press against the lower wheel under the action of the first pressure cylinder.

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As an optional implementation mode, the pushing device of the rubber strip introducing apparatus according to the present invention includes an active roller and a driven roller that cooperate with each other, wherein the active roller and the driven roller are each provided with an annular groove on circumferential wall surfaces respectively, so that the rubber strip can pass through a gap formed by the annular grooves that are opposite to each other. The driven roller is arranged to be vertically slidable by a sliding mechanism, and connected to a second pressure cylinder that is able to provide a vertical driving force, so that it can press against the driving roller under the action of the second pressing cylinder. The driving roller is connected to a pushing motor, and is rotated by the pushing motor to push the rubber strip forward.

As an optional implementation mode, the rubber strip introducing apparatus according to the present invention further includes a guiding device, which is arranged between the pushing device and the aligning device, and includes a rubber strip passer and a rubber strip guiding bridge. The rubber strip passer is provided with a through hole for allowing the rubber strip to pass through, and the rubber strip guiding bridge includes two sets of rollers opposite to each other, between which the rubber strip can pass.

By means of the pressing roller device and the guiding device, the rubber strip introducing apparatus according to the present invention can ensure the rubber strip to be conveyed to the aligning device without deformation and twisting.

As an optional implementation mode, the aligning device of the rubber strip

introducing apparatus according to the present invention includes an aligning assembly and a clamping assembly. The aligning assembly includes a power cylinder, and a rubber strip conveyor, which has a front end surface that matches a rear end surface of the profile, and a connecting groove corresponding to the rubber strip mounting groove of the profile in position, the power cylinder being configured to drive the rubber strip conveyor, either to move forward to a position where the front end surface of the rubber strip conveyor abuts with the rear end surface of the profile in its working position, or to move backward to its initial position. The clamping assembly includes a fixed rail, a horizontally slidable slider, and a spring for pressing the slider against the rail. The rubber strip passes through the rail to the rubber strip conveyor.

As an optional implementation mode, the rubber strip introducing apparatus according to the present invention further includes a pulling device arranged before the cutter device. The pulling device comprises a clamping unit for clamping the rubber strip, and a delivering unit for driving the clamping unit to move so as to advance the rubber strip forward.

As an optional implementation mode, the clamping unit includes a gripper cylinder, an upper rack driven by the gripping cylinder, a gear engaging with the upper rack, a lower rack engaging with the gear, an upper gripper connected to the upper rack, and a lower gripper connected to the lower rack. The upper rack and the lower rack are each slidably coupled to a gripper mounting plate, and the gear is coupled to the gripper mounting plate via a shaft. The upper gripper and the lower gripper cooperate with each other to form a gripper mechanism, which can perform gripping and releasing operations under the control of the gripper cylinder. The delivering unit includes a screw rod mechanism, and a motor for driving a screw rod of the screw rod mechanism into rotation, wherein the clamping unit is coupled to the screw rod so that it moves as the screw rod rotates.

Compared with current technical solution, the rubber strip insertion apparatus according to the present invention additionally includes the pulling device. The pulling device can pull the rubber strip forward through the profile, under the cooperation of a thrust provided by the pushing device. Therefore, the rubber strip can be inserted into the profile smoothly without manual assistance. Not only manpower is saved, but efficiency of the apparatus is improved.

As an optional implementation mode, the rubber strip introducing apparatus according to the present invention further includes a profile placing and conveying device, which includes two profile conveying carriages that are sequentially disposed in the direction of conveying the rubber strip, for receiving and fixing one or more profiles. Each of the profile conveying carriages is provided with a tongue, a tongue cylinder, and a profile sensor, wherein the tongue is driven by the tongue cylinder to extend out for fixing the profile when the profile sensor detects that the profile is in position.

The current rubber strip introducing apparatus has no means for fixing and pressing the profile. Therefore, when the rubber strip is being introduced, the profile would be easily displaced, thus causing the operation has to be stopped. By contrast, the rubber strip introducing apparatus according to the present invention further includes the profile placing and conveying device, which can press the profile, and detect via the sensor whether the profile is in its correct position. In this manner, the rubber strip would not be introduced until the profile is in the correct position, thus improving the working efficiency.

As an optional implementation mode, the rubber strip introducing apparatus according to the present invention further includes a water circulation device, which comprises: a water adding unit connected to a water tank, for dripping or spraying

water on the rubber strip being conveyed or the rubber strip mounting groove of the profile in its working position; and a recycling unit, which is connected to the water tank, and includes a water receiving box disposed under the water adding unit, for returning water sprayed by the water adding unit to the water tank.

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Compared with the current technical solution, the rubber strip introducing apparatus according to the present invention further includes the recycling unit for recycling water being sprayed or dripped to the rubber strip by the water adding unit, thereby recycling the water, saving the costs, and improving the working
10 environment.

As an improved mode of the present invention, each device of the rubber strip introducing apparatus according to the present invention comprises at least two sets of components, so that at least two rubber strips can be introduced into a pair of profiles
15 respectively at one time with said apparatus. Among others, the same components of at least two sets can be independent from each other, or arranged as one piece. For example, the apparatus can be provided with two cutter devices for cutting two rubber strips respectively. Alternatively, the cutter device can be formed as a whole and includes a plurality of cutters. The cutter device has two cutting positions, so that it
20 can cut off at least two rubber strips simultaneously.

Compared with the current rubber strip introducing apparatus that can perform the introduction of one rubber strip at one time only, the rubber strip introducing apparatus according to the present invention can perform the introduction of at least
25 two rubber strips at one time, thus efficiency thereof being significantly improved.

In summary, the basic implementation mode and the preferred implementation modes of the rubber strip introducing apparatus according to the present invention can achieve the following technical effects. First, a fully automated and machined rubber

strip insertion can be achieved without manual operation. Second, a rubber strip twisting detection device, a pressing roller device, a guiding device, and a profile placing and conveying device that can clamp the rubber strip and prevent it from deformation are additionally provided. Therefore, the direction of conveying the rubber strip is stabilized to a greater extent, preventing deformation and twisting of the rubber strip. Accordingly, the insertion of the rubber strip is smoother, the problem of easy deformation of the rubber strip is solved, and the work efficiency is improved. Third, a powering device for pushing and pulling the rubber strip when it passes through the profile is provided, thus no manual assistance is required. Fourth, a pair of rubber strips can be inserted at one time, thus saving time, improving efficiency, and enhancing cooperation. Fifth, a water circulation device is used for lubrication, and the water can be recycled. Sixth, a profile placing and conveying device is additionally provided for fixing the profiles, so that one or more pairs of profiles can be inserted at one time. In this manner, the problem that the rubber strip cannot be smoothly inserted in the profile due to the displacement of the profile is solved to a large extent.

Brief Description of the Drawings

In order to more clearly illustrate the technical solutions of the embodiments of the present invention, the drawings used in the embodiments will be briefly described below. It is obvious that the following drawings only show some embodiments of the present invention. One ordinarily skilled in the art can also obtain other drawings based on these drawings without creative effort.

Fig. 1 schematically shows the overall structure of a rubber strip introducing apparatus according to an embodiment of the present invention;

Fig. 2 schematically shows the structure of a rubber strip supplying table

according to an embodiment of the present invention;

Fig. 3 schematically shows the structure of a rubber strip twisting detection device according to an embodiment of the present invention;

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Fig. 4 schematically shows the combined structure of the rubber strip supplying table and the rubber strip twisting detection device according to an embodiment of the present invention;

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Fig. 5 schematically shows the structure of a pressing roller device, a rubber strip pushing device, and a guiding device according to an embodiment of the present invention;

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Fig. 6 schematically shows the structure of an aligning device according to an embodiment of the present invention;

Fig. 7 schematically shows the structure of an aligning assembly of the aligning device according to an embodiment of the present invention;

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Fig. 8 schematically shows the structure of a clamping assembly of the aligning device according to an embodiment of the present invention;

Fig. 9 schematically shows the structure of a clamping unit of a pulling device according to an embodiment of the present invention;

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Fig. 10 schematically shows the structure of a delivering unit of the pulling device according to an embodiment of the present invention;

Fig. 11 schematically shows the structure of a profile placing and conveying

device according to an embodiment of the present invention;

Fig. 12 schematically shows the structure of the profile placing and conveying device according to an embodiment of the present invention after the profile has been placed thereon; and

Fig. 13 schematically shows the structure of a water circulation device according to an embodiment of the present invention.

Detailed Description of the Embodiments

The technical solutions in the embodiments of the present invention will be clearly and completely described in the following with reference to the accompanying drawings in the embodiments of the present invention, in order to enable one skilled in the art to better understand the technical solutions of the present invention. Obviously, the embodiments as described here are only some, but not all embodiments of the present invention. All other embodiments obtained by those skilled in the art without creative efforts shall fall within the scope of the present invention.

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The terms "first", "second", "third" and the like in the specification, the claims and the drawings of the present invention are used to distinguish different objects, but not intended to describe a specific order. Moreover, the terms "comprise", "include", or the like are non-exclusive. For example, a process, method, system, product, or device that comprises a series of steps or units is not limited to comprise the steps or units as listed only, but may further include steps or units not listed, or, optionally, include other steps or units inherent to the process, method, product or equipment.

The present invention will be described in further detail with reference to the

embodiments as shown in the following.

Referring to Fig. 1, an embodiment of the present invention provides a rubber strip introducing apparatus, for inserting a rubber strip in a rubber strip mounting
5 groove of a profile and cutting off the rubber strip according to angles of two end faces of the profile.

As shown in Fig. 1, the apparatus includes a rubber strip pushing device 04, an aligning device 06, a cutter device 07, and a control device. In particular, the
10 apparatus further includes a rubber strip supplying table 01, and a rubber strip twisting detection device 02. Optionally, the apparatus may further include a pressing roller device 03, a guiding device 05, an aligning device 06, a pulling device 08, a profile placing and conveying device 09, a water circulation device 10, and a bottom table 11 if necessary.

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The rubber strip supplying table 01 can be arranged independently with respect to the bottom table 11, in which the control device is disposed. Other devices or components except the rubber strip supplying table 01 and the control device can be all installed on the bottom table 11. The control device can be a PLC (programmable
20 controller), or another device that can realize similar functions. All the sensors (i.e., detectors) and power components (such as cylinders and motors) of the rubber strip introducing apparatus are connected to and controlled by the PLC. The control device can also be connected to an external touch-control manipulator, so as to facilitate the operations of the rubber strip introducing apparatus.

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Along a direction of conveying the rubber strip, the rubber strip introducing apparatus includes the following devices/components in this order: the rubber strip supplying table 01, the rubber strip twisting detection device 02, the pressing roller device 03, the rubber strip pushing device 04, the guiding device 05, the aligning

device 06, the cutter device 07, and the profile placing and conveying device 09, above which the pulling device 08 is disposed.

Referring to Fig. 2, a special feature of the rubber strip introducing apparatus according to the present invention is that a rubber strip supplying table 01 is independently arranged. The rubber strip supplying table 01 includes a fixed frame 011, a rotatable bracket 012, and a supplying tray 013. The rotatable bracket 012 is rotatably coupled to the fixed frame 011, and the supplying tray 013 is rotatably coupled to the rotatable bracket 012. Alternatively, the rotatable bracket 012 is coupled to the fixed frame 011 via a horizontal shaft, and the supplying tray 013 is coupled to the rotatable bracket 012 through a central shaft thereof, which is perpendicular to the horizontal shaft. Optionally, the supplying tray 013 for storing the rubber strip is detachably connected to the rotatable bracket 012. After the rubber strip on a current supplying tray is used up, the current supplying tray can be replaced with a new one.

Referring to Fig. 3, in an embodiment of the present invention, the rubber strip twisting detection device 02 includes a rotating disc 022, which has an outer ring mounted on a disc support 021, and an inner ring on which at least one pair of rotating wheels 023 are mounted. The rubber strip passes between the pair of rotating wheels 023. The rotating disc 022 is provided at its side with an indexing disc 024, which is connected with the inner ring of the rotating disc 022. The disc support 021 is mounted with an angle sensor 025, for detecting the rotating angle of the indexing disc 024. The angle sensor 025 is in communication link with the control device. Among others, the rotating wheels 023 can be mounted on the inner ring of the rotating disc by screws, so that tightness between the pair of the rotating wheels 023 can be adjusted by the screws, for maintain a suitable pressure between the rotating wheels 023 and the rubber strip.

The operation of the rubber strip twisting detection device 02 would not be influenced, no matter along which direction it is mounted. As shown in Fig. 3, the indexing disc 024 of one rubber strip twisting detection device 02 is arranged anteriorly, while that of the other rubber strip twisting detection device 02 is arranged
5 posteriorly.

Referring to Fig. 4, in an embodiment of the present invention, the rubber strip twisting detection device 02 is arranged before the rubber strip supplying table 01. After supplied from the supplying tray 013, the rubber strip will pass through the
10 rotating disc 022 and then pressed tight by the rotating wheels 023. When the rubber strip between said at least one pair of rotating wheels 023 is deformed, e.g., twisted, during forward transfer, the rotating wheels 023 will drive the inner ring of the rotating disc 022 and the indexing disc 024 to rotate a certain angle, wherein the rotating angle of the rotating disc 022 indicates the twisting angle of the rubber strip.

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After the angle sensor 025 detects the rotating angle of the indexing disc 024, it sends the rotating angle detected to the control device, which will control the rotatable bracket of the rubber strip supplying table 01 to perform compensating rotation with the same angle. The compensating rotation may be a rotation in the opposite direction.

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With the rubber strip twisting detection device 02, the twisting angle of the rubber strip can be fed back to the rubber strip supplying table 01 through the indication of the indexing disc, so as to prevent the rubber strip from being twisted. How much rotating angle of the rotating disc is, the rubber strip supplying table would
25 be reversely rotated the same angle accordingly. This can greatly prevent the rubber strip from being deformed, hunched, twisted and knotted when the rubber strip is conveyed to the profile.

Referring to Fig. 5, in an embodiment of the present invention, the pressing roller

device 03 includes an upper pressing roller 031 and a lower wheel 032 that cooperate with each other. The upper pressing roller 031 and the lower wheel 032 are each provided with an annular groove on circumferential wall surfaces respectively, so that the rubber strip can pass through a gap formed between upper and lower annular
5 grooves, which are opposite to each other.

The lower wheel 032 is fixedly disposed on a pressing roller support 030. The upper pressing roller 031 is disposed on the pressing roller support 030 in a vertically slidable manner by a sliding mechanism 034. The upper pressing roller 031 is
10 connected with a first pressure cylinder 033 that can provide a vertical driving force, so that it can be pressed against the lower wheel 032 under the action of the first pressure cylinder 033.

Optionally, the pressing roller device 03 further includes a sensor 035 for
15 detecting the movement of the cylinder, the sensor being mounted on the pressing roller support 030.

The pressing roller device 03 is used to keep the advancing direction of the rubber strip stable, in order to facilitate the advancement of the rubber strip. It should
20 be noted that the first pressure cylinder 033 may be a conventional cylinder, and called as a first pressure cylinder because it functions to provide a pressing force from the upper pressing roller 031.

With reference to Fig. 5 further, in an embodiment of the present invention, the
25 rubber strip pushing device 04 includes an active roller 041 and a driven roller 042 that cooperate with each other. The active roller 041 and the driven roller 042 are each provided with an annular groove on circumferential wall surfaces respectively, so that the rubber strip can pass through a gap formed between upper and lower annular grooves, which are opposite to each other.

The driven roller 042 is arranged to be slidable in the vertical direction by a sliding mechanism, and is connected to a second pressure cylinder 043 that can provide a vertical driving force, so that it can be pressed against the driving roller 041 by the second pressure cylinder 043. The driving roller 041 is connected to a pushing motor 044, and is rotated by the pushing motor 044 to push the rubber strip forward.

Optionally, the rubber strip pushing device 04 further includes: a mounting support 045, for mounting and fixing the driving roller 041, the driven roller 042, the sliding mechanism, the second pressure cylinder 043, and the like; and a sensor disposed on the mounting support 045, for detecting the position of the rubber strip.

The rubber strip pushing device 04 is used to provide a force for advancing the rubber strip forward. It should be noted that the second pressure cylinder 043 may be a conventional cylinder, and called a second pressure cylinder because it functions to provide the pressing force for the driven roller 042.

Further, with reference to Fig. 5, in an embodiment of the present invention, the guiding device 05 is disposed between the rubber strip pushing device 04 and the aligning device 06, and includes a rubber strip passer 051 and a rubber strip guiding bridge 052. The rubber strip passer 051 is provided with a through hole for allowing the rubber strip to pass through, and the rubber strip guiding bridge 052 includes two sets of rollers, between which the rubber strip can pass. The guiding device 05 is used to guide the advancing direction of the rubber strip, and fix the position thereof.

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Referring to Figs. 6 and 7, in an embodiment of the invention, the aligning device 06 includes an aligning assembly and a clamping assembly.

As shown in Fig. 6, the aligning assembly includes a power cylinder 061 and a

rubber strip conveyor 062. The rubber strip conveyor 062 has a front end surface that matches the rear end surface of the profile, and a connecting groove corresponding to the rubber strip mounting groove of the profile in position. The power cylinder 061 drives the rubber strip conveyor 062, either to move forward to a position where the front end surface of the rubber strip conveyor cooperates with the rear end surface of the profile in its working position, or to move backward to its initial position.

Optionally, the aligning device 06 further includes a sensor 065 for detecting the position of the rubber strip conveyor 062.

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Optionally, the aligning device 06 further includes a shielding plate 066 for position restriction. The shielding plate 066 can be mounted on the rubber strip conveyor 062.

15 As shown in Fig. 7, the clamping assembly includes a fixedly disposed rail 063, a horizontally slidable slider 064, and a spring for pressing the slider 064 against the rail 063. The rubber strip passes through the rail 063 and then enters in the rubber strip conveyor 062.

20 The aligning device 06 is used to align the rubber strip with the profile, in particular with the rubber strip mounting groove, in which the rubber strip is inserted, of the profile. It should be noted that the power cylinder 061 may be a conventional cylinder, and called a power cylinder because it provides power.

25 Referring to Fig. 8, in an embodiment of the invention, a pulling device 08 is provided, which may include a clamping unit for clamping the rubber strip, and a delivering unit for moving the clamping unit so as to advance the rubber strip forward. The clamping unit may include a gripper mechanism, a driving mechanism for controlling the gripper mechanism, and a power mechanism for powering the driving

mechanism.

In the embodiment as shown in Fig. 9, the clamping unit includes a gripper cylinder 081, an upper rack 082 driven by the gripping cylinder 081, a gear 084 engaging with the upper rack 082, a lower rack 083 engaging with the gear 084, an upper gripper 085 connected to the upper rack 082, a lower gripper 086 connected to the lower rack 083, and a gripper mounting plate 080. The upper rack 082 and the lower rack 083 are each slidably coupled to the gripper mounting plate 080, and the gear 084 is coupled to the gripper mounting plate 080 via a shaft. The upper gripper 085 and the lower gripper 086 cooperate with each other to form the gripper mechanism, which can perform gripping and releasing operations under the control of the gripper cylinder 081.

The gripper mechanism consists of two components, i.e., the upper gripper 085 and the lower gripper 086. The driving mechanism includes the upper rack 082 and the lower rack 083 that are respectively connected to the upper gripper 085 and the lower gripper 086, the rotatable gear 084 that is located between the upper rack 082 and the upper rack 082 and inter-meshed therewith, and the gripper mounting plate 080 for mounting the upper rack 082, the lower rack 083, and the gear 084. The power mechanism can be an ordinary cylinder. Since the cylinder is used to drive the gripper, it is referred to herein as the gripper cylinder 081.

Optionally, the gripper cylinder 081 is provided with at least one sensor 089 for position detection. For example, said at least one sensor can detect whether a rubber strip is present in the position of the gripper mechanism, whether the clamping unit moves to a preset position, etc., and then transmit a sensing signal to the control device, so that the control device can send a control command to the gripper cylinder 081 or the like.

Referring to Fig. 10, in one embodiment of the present invention, the delivering unit includes a screw rod mechanism 088, and a motor 087 for driving a screw rod of the screw rod mechanism 088 into rotation. The clamping unit is coupled to the screw rod mechanism 088, so that it moves as the screw rod rotates.

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The pulling device 08 can pull the rubber strip forward, and under the cooperation of a thrust provided by the rubber strip pushing device 04, the rubber strip can be inserted into or pass through the rubber strip mounting groove of the profile easily and smoothly without manual assistance. Not only manpower is saved, but more importantly, efficiency of the apparatus is improved, and thus continuous and efficient operation of the apparatus can be guaranteed. In this manner, the problems that the thrust is insufficient and the rubber strip cannot be delivered smoothly when only the push rubber strip device 04 provides a pushing force can be solved.

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Referring to Fig. 11, in an embodiment of the present invention, the profile placing and conveying device 09 includes two profile conveying carriages 090, which are sequentially disposed in the advancing direction of the rubber strip. Among others, a first profile conveying carriage 091 arranged posteriorly can be fixedly disposed, while a second profile conveying carriage 092 arranged anteriorly is slidably disposed. The second profile conveying carriage 092 can be driven by a powering mechanism 093 for distance adjustment, so that it can be moved close to or away from the first profile conveying carriage 091. One or more pairs of grooves 094 are respectively arranged on said two profile conveying carriages, for receiving one or more profiles therein.

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Fig. 12 schematically shows a structural view of the profile placing and conveying device 09, on which the profile is placed.

The second profile conveying carriage 092 and its powering mechanism 093 are

configured for length adjustment, so that the profile placing and conveying device 09 can be adapted to profiles of different lengths. The powering mechanism 093 may include a motor, and a conveyor belt, which is driven by the motor for driving the second profile conveying carriage 092.

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Optionally, as shown in Figs. 11 and 12, each profile conveying carriage is further provided with a tongue 095, a tongue controlling cylinder 096, and a sensor 097. When the sensor 097 detects that the profile is in position, the tongue 095 would be driven by the tongue controlling cylinder 096 to extend out for fixing the profile.

10 The tongue controlling cylinder 096 can be a conventional cylinder.

Optionally, the inner end surface of the profile conveying carriage is formed as a sloped surface, so as to match the inclined end surface of the profile.

15 Through the grooves 094 and the tongue 095 provided on the profile conveying carriage, the profile can be fixed, and thus be prevented from being displaced during the process of insertion of the rubber strip.

20 Optionally, as shown in Fig. 12, six profiles in three pairs can be placed in the apparatus at one time, namely: a pair of profiles that are about to be inserted with a rubber strip, a pair of profiles that are being inserted with a rubber strip, and a pair of profiles that have been inserted with a rubber strip.

25 The profile placing and conveying device can press the profile tight, and monitor whether the profile is in position through the sensor. Therefore, the rubber strip would not be inserted until the profile is in a correct position, thus improving the working efficiency.

Referring to Fig. 13, in an embodiment of the present invention, the water

circulation device 10 includes: a water tank 101; a water adding unit, comprising a water adding pipe 102 connected to the water tank 101, for dripping or spraying water on the rubber strip or the rubber strip mounting groove of the profile being pushed; and a recycling unit, including a water receiving box 103 that is disposed under a water spraying portion of the water adding unit, and connected to the water tank 101 through a return pipe 104 for returning recycled water to the water tank 101.

When the rubber strip is inserted in the profile, water in the water tank will be sprayed out from the water spraying portion after flowing through the water adding pipe, for lubricating the rubber strip. Then, water flows back to the water tank through the profile and the water receiving box, thus forming a water flowing cycle.

The water circulation device 10 additionally includes the recycling unit for recycling water being added by the water adding unit, thereby recycling the water, saving water resources, ensuring that there is no excess water in the apparatus and its surrounding environment, and improving the working environment.

Referring to Fig. 1 further, in an embodiment of the present invention, each device of the rubber strip introducing apparatus is provided with two sets respectively, so that in the apparatus two rubber strips can be inserted into a pair of profiles at one time.

The operation principle of the rubber strip introducing apparatus of the present invention will be described in the following for further understanding the present invention.

When the operation of inserting the rubber strip is performed, the operator can place the supplying tray 013 on the rotatable bracket 012 of the rubber strip supply table 01. For a first insertion, the rubber strip can pass through the rubber strip

twisting detection device 02, the pressing roller device 03, the rubber strip pushing device 04, the guiding device 05, and the aligning device 06 through manual labor. After that, no manual labor is necessary, thus realizing an automatic insertion for the rubber strip.

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When the rubber strip is about to be inserted in the first operation, the operator can adjust the profile placing and conveying device 09 based on the data of the control device, so that the profile placing and conveying device 09 can be adapted to the profile in terms of length. Then, the operator can place the profile, for example a pair
10 of aluminum profiles, on the grooves of the profile conveying carriages. At this moment, the tongue cylinder 096 is extended upward, and then the profile conveying carriages convey the aluminum profiles to be inserted with the rubber strip to a position corresponding to the rubber strip. The tongue cylinder 096 controls the tongue 095 to extend out for fixing the aluminum profiles. Thus the rubber strip is
15 ready to be introduced.

In the following the steps of introducing a rubber strip is discussed. Although it is possible to insert a pair of rubber strips into a pair of aluminum profiles simultaneously, the following example is directed to insertion of one rubber strip.

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First, in the first operation, the rubber strip is passed through the rubber strip twisting detection device 02, the pressing roller device 03, the rubber strip pushing device 04, the guiding device 05, and the aligning device 06 through manual labor. After that, no manual labor is necessary, thus realizing an automatic insertion for the
25 rubber strip.

Second, if the rubber strip is twisted when passing through the rubber strip twisting detection device 02, the rotating disc 022 will drive the indexing disc 024 into rotation, and the sensor 025 will start to count when detecting the rotation of the

indexing disc 024. The rotatable bracket 012 of the rubber strip supplying table 01 begins to perform compensating rotation, such as inverse rotation, based on the value calculated by the sensor.

5 Third, after the rubber strip passes through the rubber strip twisting detection device, it will pass through the pressing roller device 03. In the first insertion of the rubber strip, the first pressure cylinder 033 is turned down at the beginning, and the sensor 035 detects whether said cylinder is retracted sufficiently. When the rubber strip passes through the pressing roller device 03, the cylinder is turned up via manual
10 labor to open the pressing roller. Then, the rubber strip, held by hands, is passed through the pressing roller device 03 and the guiding device 05 (only for the first insertion), and the pressing roller will automatically press down.

Fourth, the rubber strip then passes through the rubber strip pushing device 04.
15 Compared with the pressing roller device 03, the rubber strip pushing device 04 additionally has a motor for providing a driving force and a sensor for detecting whether or not the rubber strip passes through. After the pressing roller device 03, the rubber strip will pass through the sensor arranged before the rubber strip pushing device 04. The sensor will detect whether or not the rubber strip passes through. When
20 the rubber strip passes through, the second pressure cylinder 043 retracts to release the driven roller 042, and the sensor detects whether the cylinder is retracted sufficiently. At this time, after the bottom of the rubber strip passes through the flat groove of the driving roller 041 and the V-groove of the driven roller 042, said cylinder will be turned down, so that the driven roller 042 will press against the rubber strip. The
25 sensor detects whether the cylinder is extended out sufficiently. Then, screws of the wheels are tightened, and the motor provides power so that the active roller 041 can move the rubber strip forward.

Fifth, the motor 044 provides power so that the active roller 041 can move the

rubber strip forward. Then, the rubber strip reaches the guiding device 05, passing through the rubber strip passer 051, and then through two sets of rollers of the rubber guiding bridge 052. At this stage, the outer profiles of the two sets of rollers must pass through the grooves of the rubber strip, and at the same time, rollers arranged at one side should be adjusted to clamp the rubber strip. Subsequently, screws and nuts are tightened to prevent the rubber strip from deformation that is generated due to the gap formed when the rubber strip is pushed.

Sixth, after the rubber strip passes through the guiding device 05 to reach the aligning device 06, the power cylinder 061 will be extended out, and the sensor 065 will detect whether the cylinder is extended to the correct position, The power cylinder 061 drives the rubber strip conveyor 062 to move forward, during which, the shielding plate 066 that originally blocks the slider 064 will move forward, so as to no longer block the slider 064. Without the block of the shielding plate 066, the slider 064 will press against the rubber strip along the rail under the action of the spring 632. When the rubber strip has not passed through, the retraction of the power cylinder 061 can move the shielding plate 066 to block the slider 064, allowing the rubber strip to pass through. The sensor 065 detects whether the retraction of the power cylinder 061 is sufficient.

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Seventh, the rubber strip passes by the aligning device 06 to the position where the aluminum profile is located, and the pulling device 08 grips the rubber strip to move forward. The pulling device 08 is originally arranged not to block the rubber strip, and will clamp the rubber strip when it comes. When the rubber strip has not passed through, the gripping cylinder 081 is retracted upward, and the sensor 089 will detect whether the upward retraction of the gripping cylinder is sufficient. The upward retraction of the gripping cylinder 081 will drive the upper rack 082 to move upward, causing the upper gripper 085 to go up. The rotation of the upper rack 082 will drive the gear 084 into rotation, which, in turn, drives the lower rack 083 to rotate, and thus

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the lower gripper 086 goes down. Therefore, a free space is formed between the upper and lower grippers, allowing the rubber strip to pass through. After the rubber strip has passed through, the gripper cylinder 081 is extended downward to move the upper rack 082 downward, so that the upper gripper 085 clamps the rubber strip from above.

5 The upper gear 082 rotates to drive the gear 084 into rotation, which, in turn, drives the lower rack 083 and thus the lower gripper 086 to move upward, so that the upper and lower grippers can clamp the rubber strip passing therethrough. After the rubber strip is clamped, the motor 087 drives the screw rod to move, thereby driving the clamping unit of the pulling device to move forward, till a position where the rubber
10 strip has an appropriate length. Then, the cutter device 07 will cut off the rubber strip, and the pulling device 08 continues to pull the rubber strip, till the rubber strip passes through the aluminum profile. When the pulling device 08 pulls the rubber strip forward, the water circulation device 10 will spray water to lubricate the rubber strip, thus reducing the resistance to the forward movement of the rubber strip.

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Eighth, when the pulling device 08 pulls the rubber strip forward to a suitable position, the cutter device 07 will cut off the rubber strip. When the rubber strip has not passed through the cutter device 07, the left and right cylinders thereof will be retracted and the cutting anvil will be retracted for not blocking the rubber strip
20 passing through. Specifically, the upper cylinder will drive the panel and thus the cutter arranged on the panel to retract upward, thereby not blocking the rubber strip. The sensor will detect whether the cylinder is retracted to its desirable position. After the rubber strip is forwarded with the appropriate length, the upper cylinder will be extended downward, so that the panel and the cutter will be extended downward also.

25 In the meantime, the lower cylinder will be extended upward, and the left and right cylinders will also be extended to the middle, thus driving the anvil to clamp the rubber strip. When the sensor detects that the cylinder is extended to the desirable position, the cutter starts to cut off the rubber strip. Then, the pulling device 08 continues to pull the remaining rubber strip to move forward, till the aluminum profile

is completely inserted with the rubber strip.

Ninth, after the aluminum profile is inserted with the rubber strip, the profile conveying carriage will transport the aluminum profile to a next position. The aluminum profile having been inserted with the rubber strip will be dropped to a designated position for storage. After that, the profile conveying carriage is returned to the starting point, where it is ready to transport the aluminum profile without the rubber strip to the position where the rubber strip is about to be inserted.

The foregoing explains the complete procedure of inserting the rubber strip in the profile. The technical solution of the present invention is suitable for inserting a pair of rubber strips into a pair of profiles at one time, ensuring that two rubber strips pass through the aluminum profiles simultaneously, and also suitable for inserting one rubber strip or more rubber strips at one time.

In summary, the present invention discloses a rubber strip introducing apparatus, the basic implementation mode and the preferred implementation modes of which can achieve the following technical effects.

First, a fully automated and machined rubber strip insertion can be achieved without manual operation.

Second, a powering device for pushing and pulling the rubber strip when it passes through the profile is provided, thus no manual assistance is required.

Third, a rubber strip twisting detection device, a pressing roller device, a guiding device, and a device for clamping the rubber strip to prevent its deformation are additionally provided. Therefore, the direction of conveying the rubber strip is stabilized to a greater extent, preventing deformation and twisting of the rubber strip.

Accordingly, the insertion of the rubber strip is smoother, the problem of easy deformation of the rubber strip is solved, and the work efficiency is improved.

Fourth, a pair of rubber strips can be inserted at one time, thus saving time,
5 improving efficiency, and enhancing cooperation.

Fifth, according to the present invention, a profile placing and conveying device is additionally provided for fixing two aluminum profiles, which are arranged at the left and the right or at the front and the rear. For example, grooves are arranged on the
10 profile conveying carriages, and a tongue is used to fix the profiles after they are in position. In this manner, the problem that the rubber strip cannot be smoothly inserted in the profile due to the displacement of the profile is solved.

Sixth, a water circulation device is used for lubrication, and the water can be
15 recycled.

In the above embodiments, the descriptions of the various embodiments are different, and the parts that are not described in detail in a certain embodiment can be referred to the related description of other embodiments.

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The foregoing description is merely illustrative of preferred embodiments of the present invention, and is not intended to limit the present invention. Various changes and modifications may be made by those skilled in the art. Any modifications, equivalent substitutions, improvements, and the like within the spirit and principles of
25 the present invention are intended to be included within the scope of the present invention.

CLAIMS

1. A rubber strip introducing apparatus, for guiding a rubber strip into a rubber strip mounting groove of a profile and cutting off the rubber strip according to angles
 5 of two end faces of the profile, the apparatus comprising a pushing device (04), an aligning device (06), a cutter device (07), a profile placing and conveying device (09), and a control device in communication with the above devices, which are arranged in this order along a direction of conveying the rubber strip,

characterized in that the apparatus further comprises a rubber strip supplying
 10 table (01) and a rubber strip twisting detection device (02),

wherein the rubber strip supplying table (01) includes a fixed frame (011), a rotatable bracket (012) rotatably coupled to the fixed frame (011), and a supplying tray (013) rotatably and detachably coupled to the rotatable bracket (012), and

wherein the rubber strip twisting detection device (02) is configured to detect a
 15 twisting angle of the rubber strip when the rubber strip is twisted during conveyance, and the control device is configured to control the rotatable bracket (012) to rotate for compensation with the same angle.

2. The rubber strip introducing apparatus according to claim 1, characterized in
 20 that the rubber strip twisting detection device (02) comprises a disc support (021), a rotating disc (022), and an angle sensor (025),

wherein the rotating disc (022) is rotatably connected to the disc support (021), and is provided at its side with an indexing disc (024),

wherein the angle sensor (025) is fixed on the disc support (021), and in
 25 communication link with the control device for detecting a rotating angle of the indexing disc (024), and

wherein the control device is configured to, after the angle sensor (025) detects that the indexing plate (024) rotates with a certain angle, control the rotatable bracket (012) of the rubber strip supplying table (01) to rotate for compensation with the same

angle.

3. The rubber strip introducing apparatus according to claim 2, characterized in that the rotating disc (022) is structured as a bearing, which has an outer ring fixedly
5 connected to the disc support, and an inner ring fixedly connected to the indexing plate (024) and rotatably connected to the outer ring, and

at least one pair of rotating wheels (023) are mounted on the inner ring of said bearing, wherein the rubber strip passes between said at least one pair of rotating wheels (023), which are able to press toward the rubber strip from both sides.

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4. The rubber strip introducing apparatus according to claim 1, characterized in that the apparatus further includes a pressing roller device (03), which has an upper pressing roller (031) and a lower wheel (032) that cooperate with each other,

wherein the upper pressing roller (031) and the lower wheel (032) are each
15 provided with an annular groove on circumferential wall surfaces respectively, so that the rubber strip can pass through a gap formed by the annular grooves that are opposite to each other,

wherein the lower wheel (032) is fixed while the upper pressing roller (031) is slidable in a vertical direction through a sliding mechanism, and

20 wherein the upper pressing roller (031) is connected with a first pressure cylinder (033) that is able to provide a vertical driving force, so that the upper pressing roller (031) can press against the lower wheel (032) under the action of the first pressure cylinder (033).

25 5. The rubber strip introducing apparatus according to claim 1, characterized in that the pushing device (04) includes an active roller (041) and a driven roller (042) that cooperate with each other, wherein the active roller (041) and the driven roller (042) are each provided with an annular groove on circumferential wall surfaces respectively, so that the rubber strip can pass through a gap formed by the annular

grooves that are opposite to each other, and

the driven roller (042) is arranged to be vertically slidable by a sliding mechanism, and connected to a second pressure cylinder (043) that is able to provide a vertical driving force, so that it can press against the driving roller (041) under the
5 action of the second pressing cylinder (043), and

the driving roller (041) is connected to a pushing motor (044), and is rotated by the pushing motor (044) to push the rubber strip forward.

6. The rubber strip introducing apparatus according to claim 1, characterized in
10 that the apparatus further includes a guiding device (05), which is arranged between the pushing device (04) and the aligning device (06), and includes a rubber strip passer (051) and a rubber strip guiding bridge (052),

wherein the rubber strip passer (051) is provided with a through hole for allowing the rubber strip to pass through, and the rubber strip guiding bridge (052)
15 includes two sets of rollers opposite to each other, between which the rubber strip can pass.

7. The rubber strip introducing apparatus according to claim 1, characterized in that the aligning device (06) includes an aligning assembly and a clamping assembly,

20 wherein the aligning assembly includes a power cylinder (061), and a rubber strip conveyor (062), which has a front end surface that matches a rear end surface of the profile, and a connecting groove corresponding to the rubber strip mounting groove of the profile in position, the power cylinder (061) being configured to drive the rubber strip conveyor (062), either to move forward to a position where the front
25 end surface of the rubber strip conveyor abuts with the rear end surface of the profile in its working position, or to move backward to its initial position,

wherein the clamping assembly includes a fixed rail (063), a horizontally slidable slider (064), and a spring for pressing the slider (064) against the rail, and

wherein the rubber strip passes through the rail (063) to the rubber strip conveyor

(062).

8. The rubber strip introducing apparatus according to claim 1, characterized in that the apparatus further comprises a pulling device (08) arranged before the cutter
5 device (07),

wherein the pulling device (08) comprises a clamping unit for clamping the rubber strip, and a delivering unit for driving the clamping unit to move so as to advance the rubber strip forward.

10 9. The rubber strip introducing apparatus according to claim 8, characterized in that the clamping unit includes a gripper cylinder (081), an upper rack (082) driven by the gripping cylinder (081), a gear (084) engaging with the upper rack (082), a lower rack (083) engaging with the gear (084), an upper gripper (085) connected to the upper rack (082), and a lower gripper (086) connected to the lower rack (083),

15 wherein the upper rack (082) and the lower rack (083) are each slidably coupled to a gripper mounting plate (080), and the gear (084) is coupled to the gripper mounting plate (080) via a shaft,

wherein the upper gripper (085) and the lower gripper (086) cooperate with each other to form a gripper mechanism, which can perform gripping and releasing
20 operations under the control of the gripper cylinder (081), and

the delivering unit includes a screw rod mechanism (088), and a motor (087) for driving a screw rod of the screw rod mechanism (088) into rotation, wherein the clamping unit is coupled to the screw rod so that it moves as the screw rod rotates.

25 10. The rubber strip introducing apparatus according to claim 1, characterized in that that the profile placing and conveying device (09) includes two profile conveying carriages (090) that are sequentially disposed in the direction of conveying the rubber strip, for receiving and fixing one or more profiles, and

each of the profile conveying carriages is provided with a tongue (095), a tongue

cylinder (096), and a profile sensor (097), wherein the tongue (095) is driven by the tongue cylinder (096) to extend out for fixing the profile when the profile sensor (097) detects that the profile is in position.

5 11. The rubber strip introducing apparatus according to claim 1, characterized in that the apparatus further includes a water circulation device (10), which comprises:

 a water adding unit connected to a water tank (101), for dripping or spraying water on the rubber strip being conveyed or the rubber strip mounting groove of the profile in its working position; and

10 a recycling unit, which is connected to the water tank (101), and includes a water receiving box (103) disposed under the water adding unit, for returning water sprayed by the water adding unit to the water tank (101).

 12. The rubber strip introducing apparatus according to any one of claims 1 to 11,
15 characterized in that each device of the apparatus comprises at least two sets of components, so that at least two rubber strips can be introduced into a pair of profiles respectively at one time.