

RUBBER STRIP INSERTION APPARATUS

Field of the Invention

5 The present invention belongs to the technical field of mechanical equipment, and specifically relates to a rubber strip insertion apparatus.

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. of 90 degrees, therebetween. Correspondingly, the rubber strip inserted in the profile should also have two end faces respectively parallel to said two end faces
20 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. 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
30 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.

Chinese invention patent application CN107972281A discloses an apparatus for
5 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,
a rubber strip anti-torsion device, a rubber strip pushing device, and a controlling
10 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
greatly enhanced, the labor cost is saved, and automatic operation can be achieved.
15 Moreover, the contact between human hands and the end faces of the profile during
cutting is avoided, thus achieving safe operation.

However, in practice it has been found that the rubber strip pushing device of this
apparatus can provide a pushing force only, which cannot push the rubber strip
20 forward with sufficient driving power. Therefore, the rubber strip insertion procedure
cannot be performed smoothly, and often needs manually pulling operations, thus
resulting in inefficiency and wasted manpower.

Summary of the Invention

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The present invention aims to provide a rubber strip insertion apparatus with
improved efficiency. In this rubber strip insertion apparatus, a pulling device is
provided to pull the rubber strip forward, so that the rubber strip can be smoothly
inserted in the profile. In this manner, no manual operation is necessary for pulling the
30 rubber strip, thus saving the labor costs and increasing the efficiency.

The technical solution proposed by the present invention relates to a rubber strip insertion apparatus, for inserting 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, in sequence along a direction transferring the rubber strip, a rubber strip pushing device, an aligning device, a cutter device, and a controlling device for controlling the above devices. In particular, the apparatus further comprises a pulling device arranged before the cutter device, the pulling device comprising 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. The pulling device arranged anteriorly can clamp the rubber strip that has been inserted in the profile and pull it forward, while the rubber strip pushing device arranged posteriorly can push the rubber strip forward.

Compared with current apparatus for guiding and cutting rubber strip, the rubber strip insertion apparatus according to the present invention further includes a pulling device, in addition to the rubber strip pushing device. The pulling device can pull the rubber strip forward, and under the cooperation of a thrust provided by the rubber strip pushing device, 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 is guaranteed.

In a possible implementation mode, the clamping unit may include 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, a lower gripper connected to the lower rack, and a gripper mounting plate. The upper rack and the lower rack are each slidably coupled to the 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.

In other words, the clamping unit includes a gripper mechanism consisting of the
5 upper gripper and the lower gripper, a driving mechanism for controlling the gripper
mechanism, and a power mechanism for powering the driving mechanism. The
driving mechanism includes the upper rack and the lower rack that are respectively
connected to the upper gripper and the lower gripper, the rotatable gear that is located
between the upper rack and the upper rack and inter-meshed therewith, and the
10 gripper mounting plate for mounting the upper rack, the lower rack, and the gear. The
power mechanism can be a gripper cylinder.

The delivering unit may include a screw rod mechanism, and a motor for driving
a screw rod of the screw rod mechanism into rotation, the clamping unit being
15 coupled to the screw rod mechanism so that it moves as the screw rod rotates.

In a possible implementation mode, the rubber strip insertion apparatus further
includes a rubber strip supplying table, which has a fixed frame, a rotatable bracket,
and a supplying tray, wherein the rotatable bracket is rotatably coupled to the fixed
20 frame, and the supplying tray is rotatably and detachably coupled to the rotatable
bracket. Optionally, the rotatable bracket is coupled to the fixed frame via a horizontal
shaft, and the supplying tray is coupled to the rotatable bracket through a central shaft
thereof, which is perpendicular to the horizontal shaft.

25 In a preferred embodiment, the rubber strip insertion apparatus further includes a
rubber strip twisting detection device, comprising a bearing, which has an outer ring
mounted on a bearing seat, and an inner ring on which at least one pair of rotating
wheels are mounted, so that the rubber strip passes between the pair of rotating wheels.
The bearing is provided at its side with an indexing disc, which is connected with the
30 inner ring of the bearing, and the bearing seat is mounted thereon with an angle sensor

for detecting a rotating angle of the indexing disc. When the rubber strip located between said at least one pair of rotating wheels is deformed, such as twisted, the inner ring of the bear and thus the indexing disc would be rotated accordingly, the rotating angle of the indexing disc indicating the twisting angle of the rubber strip.

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Optionally, 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.

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The implementation mode as mentioned above can effectively prevent the rubber strip from being deformed or twisted, compared with the current apparatus for guiding and cutting rubber strip. Although the current apparatus for guiding and cutting rubber strip also includes means for 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. By contrast, the rubber strip insertion apparatus according to the present invention is further provided with the rubber strip twisting detection device, which can prevent to a large extent the rubber strip from being deformed, hunched or twisted when the rubber strip is conveyed to the profile.

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In a possible implementation mode, the rubber strip insertion apparatus further includes a water circulation device, which comprises: a water tank; a water adding unit, comprising a water adding pipe connected to the water tank, for dripping or spraying water on the rubber strip being conveyed or the rubber strip mounting groove of the profile; and a recycling unit, including a water receiving box, which is disposed under a water spraying portion of the water adding unit, and connected to the water tank through a return pipe for returning recycled water to the water tank.

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The current apparatus for guiding and cutting rubber strip has a water adding unit for spraying water to the rubber strip for lubrication. On this basis, the rubber strip

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insertion apparatus further includes the water circulation device, which 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
5 environment.

In a possible implementation mode, the rubber strip insertion apparatus further includes a profile placing and conveying device, which includes two profile conveying carriages that are sequentially disposed in an advancing direction of the
10 rubber strip, wherein the relative distance between said two profile conveying carriages can be adjustable. One or more pairs of grooves are respectively arranged on said two profile conveying frames, for receiving one or more profiles therein.

Optionally, each of the profile conveying carriages is further provided with a
15 tongue, a cylinder, and a sensor. The tongue can be driven by the cylinder to extend outward for fixing the profile, when the sensor detects that the profile is in position.

The current apparatus for guiding and cutting rubber strip has no means for fixing and pressing the profile, such as aluminum window frame. Therefore, when the
20 rubber strip is being inserted, the profile would be easily displaced to cause the operation has to be stopped. By contrast, the rubber strip insertion apparatus further includes the profile placing and conveying device, which can press the profile, and detect via the sensor whether the profile is in the correct position. In this manner, the rubber strip would not be inserted until the profile is in the correct position, thus
25 improving the working efficiency.

In a possible implementation mode, the rubber strip insertion apparatus 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
30 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 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 pressure cylinder.

A guiding device is arranged between the rubber strip 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, between which the rubber strip can pass.

Compared with the current apparatus for guiding and cutting rubber strip, the rubber strip insertion apparatus according to the present invention can ensure the rubber strip to be smoothly delivered to the aligning device without deformation or twist by means of the pressing roller device and the guiding device.

In a possible implementation mode, each device of the rubber strip insertion apparatus comprises at least two sets of components, so that at least two rubber strips can be inserted into a pair of profiles respectively at one time with said apparatus. Among others, the same component of at least two sets can be independent from each other, or arranged into 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 can cut off at least two rubber strips simultaneously.

The current apparatus for guiding and cutting rubber strip can perform the insertion of one rubber strip at one time, thus efficiency thereof cannot be satisfactory.

By contrast, the rubber strip insertion apparatus according to the present invention can perform the insertion of at least two rubber strips at one time, thus efficiency thereof being improved.

5 In summary, the present invention discloses a rubber strip insertion 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,
10 thus no manual assistance is required. Third, 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 the rubber strip is stabilized to a greater extent, preventing deformation and twisting of the rubber strip. Accordingly, the insertion of
15 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, 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
20 at the left and the right or at the front and the rear. For example, grooves are arranged on the 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 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 recycled.

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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
30 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 insertion
5 apparatus according to an embodiment of the present invention;

Fig. 2 schematically shows the structure of a clamping unit of a pulling device according to an embodiment of the present invention;

10 Fig. 3 schematically shows the structure of a delivering unit of the pulling device according to an embodiment of the present invention;

Fig. 4 schematically shows the structure of a rubber strip supplying table according to an embodiment of the present invention;

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Fig. 5 schematically shows the structure of a rubber strip twisting detection device according to an embodiment of the present invention;

Fig. 6 schematically shows the structure of a water circulation device according
20 to an embodiment of the present invention;

Fig. 7 schematically shows the structure of a profile placing and conveying device according to an embodiment of the present invention;

25 Fig. 8 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;

Fig. 9 schematically shows the structure of a pressing roller device, a rubber strip
30 pushing device, and a guiding device according to an embodiment of the present

invention;

Fig. 10 schematically shows the structure of an aligning device according to an embodiment of the present invention;

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Fig. 11 schematically shows the structure of an aligning assembly of the aligning device according to an embodiment of the present invention; and

Fig. 12 schematically shows the structure of a clamping assembly of the aligning device according to an embodiment of the present invention.

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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.

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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 insertion apparatus, for inserting a rubber strip in a rubber strip mounting 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 apparatus includes a pulling device 08. Optionally, the apparatus may further include a rubber strip supplying table 01, a rubber strip twisting detection device 02, a pressing roller device 03, a guiding device 05, a profile placing and conveying device 09, a water circulation device 10, and a bottom table 11 if necessary.

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 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 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 insertion apparatus.

Along a conveying direction of the rubber strip, the 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 insertion apparatus according to the present invention is that 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. 2, 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 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
5 081 or the like.

Referring to Fig. 3, in one embodiment, 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
10 that it moves as the screw rod rotates.

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 grove of the profile
15 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. 4, in some embodiments of the present invention, 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.
25 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
30 up, the current supplying tray can be replaced with a new one.

Referring to Fig. 5, in some embodiments of the present invention, the rubber strip twisting detection device 02 includes a bearing 022, which has an outer ring mounted on a bearing seat 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 bearing 022 is provided at its side with an indexing disc 024, which is connected with the inner ring of the bearing 022. The bearing seat 021 is mounted with an angle sensor 025, for detecting the rotating angle of the indexing disc 024. When the rubber strip located between the at least one pair of rotating wheels 023 is deformed, say, twisted or the like, the inner ring of the bearing 022 and thus the indexing disc 024 will be driven to rotate correspondingly, so that the rotating angle of the indexing disc 024 indicates the twisting angle of the rubber strip. Among others, the rotating wheels 023 can be mounted on the inner ring of the bearing by screws, so that tightness between the pair of the rotating wheels 023 can be adjusted by the screws.

After the angle sensor 025 detects that the indexing disc 024 is rotated by a certain angle, the control device 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, for example, a rotation in the opposite direction.

The rubber strip twisting detection device 02 aims to prevent the rubber strip from being twisted and to feed back the reading on the indexing disc to the rubber strip supplying table 01. How much the indexing disc is rotated, the supplying table would be reversely rotated 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. 6, in some embodiments 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
5 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
10 the profile and the water receiving box, thus forming a water flowing cycle.

The water circulation device 10 additionally includes a 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
15 surrounding environment, and improving the working environment.

Referring to Figs. 7 and Fig. 8, in some embodiments 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.
20 The relative distance between two profile conveying carriages 090 can be adjustable. One or more pairs of grooves 094 are respectively arranged on said two profile conveying carriages, for receiving one or more profiles therein. In Fig. 8, a structural view of the profile placing and conveying device 09, on which the profile is placed, is schematically shown.

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Optionally, 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
30 away from the first profile conveying carriage 091.

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
5 include a motor, and a conveyor belt, which is driven by the motor for driving the second profile conveying carriage 092.

Optionally, 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
10 the profile is in position, the tongue 095 would be driven by the tongue controlling cylinder 096 to extend out for fixing the profile. The tongue controlling cylinder 096 can be a conventional cylinder.

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

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.

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Optionally, each profile conveying carriage 090 is mainly composed of a main body portion 090a, and a movable portion 090b that is disposed on the main body portion 090a through a powering mechanism (such as a cylinder) and a connecting assembly. The movable portion 090b can move up-and-down or left-and-right relative
25 to the main body portion 090a. The grooves 094 are disposed in pairs on the movable portion 090b, and the profiles disposed in the grooves 094 can be moved up-and-down or left-and-right along with the movable portion 090b. The tongue 095 is disposed on the body portion 090a, which has an inner end surface that is formed as a slope matching the end surface of the profile. After the movable portion 090b
30 together with the profile thereon is moved to a designated position, the tongue 095 is

extended out so that one or a pair of profiles are fixed between the main body portions 090a of two profile conveying carriages, whereby the rubber strip can be inserted. After the one or a pair of profiles are inserted with the rubber strip, the tongue 095 is retracted, so that the movable portion 090b drives the profile to move downward and
5 then move left-and-right. In this case, another one or another pair of profiles can be conveyed to the designated position for insertion of the rubber strip.

Optionally, 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
10 profiles that are being inserted with a rubber strip, and a pair of profiles that have been inserted with a rubber strip.

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
15 not be inserted until the profile is in a correct position, thus improving the working efficiency.

Referring to Fig. 9, in some embodiments of the present invention, the pressing roller device 03 includes an upper pressing roller 031 and a lower wheel 032 that
20 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 grooves.

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
25 slidable manner by a sliding mechanism 034. The upper pressing roller 031 is connected with a 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 pressure
30 cylinder 033.

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

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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 be noted that the pressure cylinder 033 may be a conventional cylinder, and called as a pressure cylinder because it functions to provide a pressing force from the upper pressing roller 031.

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With reference to Fig. 9 further, in some embodiments of the present invention, the 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.

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The driven roller 042 is arranged to be slidable in the vertical direction by a sliding mechanism, and is connected to a pressure cylinder 043 that can provide a vertical driving force, so that it can be pressed against the driving roller 041 by the 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.

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

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The rubber strip pushing device 04 is used to provide a force for advancing the

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rubber strip forward. It should be noted that the pressure cylinder 043 may be a conventional cylinder, and called a pressure cylinder because it functions to provide the pressing force for the driven roller 042.

5 Further, with reference to Fig. 9, in some embodiments 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
10 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.

Referring to Figs. 10 to 12, in some embodiments of the invention, the aligning device 06 includes an aligning assembly and a clamping assembly.

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As shown in Fig. 11, 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
20 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.

As shown in Fig. 12, the clamping assembly includes a fixedly disposed rail 063,
25 a horizontally slidable slider 064, and a spring 067 for pressing the slider 064 against the rail 063.

The rubber strip passes between the track 063 and the slider 064 to the rubber strip conveyor 062.

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

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

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,
10 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.

Referring to Fig. 1 further, in some embodiments of the present invention, each device of the rubber strip insertion apparatus is provided with two sets respectively, so
15 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 insertion apparatus of the present invention will be described in the following for further understanding the present
20 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
25 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.

30 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 controlling 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 of aluminum profiles, on the grooves of the profile conveying carriages. At this moment, the tongue controlling 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 controlling cylinder 096 controls the tongue 095 to extend outward for fixing the aluminum profiles. Thus the rubber strip is ready to be inserted.

In the following the steps of inserting 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.

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 rubber strip.

Second, if the rubber strip is twisted when passing through the rubber strip twisting detection device 02, the bearing 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.

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 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 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
5 insertion), and the pressing roller will automatically press down.

Fourth, the rubber strip then passes through the rubber strip pushing device 04. 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
10 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 the rubber strip passes through, the pressure cylinder 043 retracts to release the driven roller 042, and the sensor detects whether the cylinder is retracted sufficiently. At this
15 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 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
20 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
25 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 generated due to the gap formed when the rubber strip is pushed.

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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
 5 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
 10 pass through. The sensor 065 detects whether the retraction of the power cylinder 061 is sufficient.

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
 15 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,
 20 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 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
 25 rack 082 downward, so that the upper gripper 085 clamps the rubber strip from above. 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
 30 clamping unit of the pulling device to move forward, till a position where the rubber

strip has an appropriate length. Then, the cutter device 07 will cut off the rubber strip, and the pulling device 08 continues to drive 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.

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 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. 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.

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

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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.

15

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 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.

20

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

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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 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 inserted in the

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profile due to the displacement of the profile is solved.

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

5

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.

10

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 the present invention are intended to be included within the scope of the present invention.

15

CLAIMS

1. A rubber strip insertion apparatus, for inserting 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 rubber strip pushing device (04), an aligning device (06), a cutter device (07), a profile placing and conveying device (09), and a controlling device,

characterized in that the apparatus further comprises a pulling device (08), which comprises a clamping unit for clamping the rubber strip, and a delivering unit for
10 driving the clamping unit to move so as to advance the rubber strip forward,

wherein 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
15 gripper mounting plate (080),

wherein 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,

wherein the upper gripper (085) and the lower gripper (086) cooperate with each
20 other to form a gripper mechanism, which can perform gripping and releasing 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, the clamping unit being coupled to the screw rod mechanism (088) so that it moves as the screw rod
25 rotates.

2. The apparatus according to claim 1, characterized in that the apparatus further includes a rubber strip supplying table (01), which has a fixed frame (011), a rotatable bracket (012), and a supplying tray (013), wherein the rotatable bracket (012) is
30 rotatably coupled to the fixed frame (011), and the supplying tray (013) is rotatably

coupled to the rotatable bracket (012).

3. The apparatus according to claim 2, characterized in that the apparatus further includes a rubber strip twisting detection device (02) comprising a bearing (022),
5 which has an outer ring mounted on a bearing seat (021), and an inner ring on which at least one pair of rotating wheels (023) are mounted,

wherein the rubber strip passes between the pair of rotating wheels (023), and the bearing (022) is provided at its side with an indexing disc (024), which is connected with the inner ring of the bearing (022), and

10 the bearing seat (021) is mounted thereon with an angle sensor (025) for detecting a rotating angle of the indexing disc (024).

4. The apparatus according to claim 3, characterized in that the control device is configured to, after the angle sensor (025) detects that the indexing plate (024) rotates
15 with a certain angle, control the rotatable bracket (012) of the rubber strip supplying table (01) to rotate for compensation with the same angle.

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

20 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 being conveyed or the rubber strip mounting groove of the profile; and

a recycling unit, including a water receiving box (103), which is disposed under a
25 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).

6. The apparatus according to claim 1, characterized in that that the profile placing and conveying device (09) includes two profile conveying carriages (090) that
30 are sequentially disposed in a direction of conveying the rubber strip, wherein the

relative distance between said two profile conveying carriages (090) can be adjustable, and

one or more pairs of grooves (094) are respectively arranged on said two profile conveying frames, for receiving one or more profiles therein.

5

7. The apparatus according to claim 6, characterized in that each of the profile conveying carriages is provided with a tongue (095), a cylinder (096), and a sensor (097), wherein the tongue (095) is driven by the cylinder (096) to extend out for fixing the profile when the sensor (097) detects that the profile is in position.

10

8. The 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 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

wherein the upper pressing roller (031) is connected with a 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 pressure cylinder (033).

9. The apparatus according to claim 1, characterized in that the rubber strip 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 pressure cylinder (043) that is able to provide a vertical driving force, so that it can be pressed against the driving roller (041) under the action of the pressing cylinder (043), and

5 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.

10 10. The apparatus according to claim 1, characterized in that the apparatus further includes a guiding device (05), which is arranged 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),

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) includes two sets of rollers, between which the rubber strip can pass.

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

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 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,

25 wherein the clamping assembly includes a fixed rail (063), a horizontally slidable slider (064), and a spring (067) for pressing the slider (064) against the rail (063), and

wherein the rubber strip passes between the rail (063) and the slider (064) to the rubber strip conveyor (062).

30 12. The apparatus according to any one of claims 1 to 11, characterized in that

each device of the apparatus comprises at least two sets of components, so that at least two rubber strips can be inserted into a pair of profiles respectively at one time.