

APPARATUS FOR GUIDING AND CUTTING RUBBER STRIP

Field of the Invention

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The present invention relates to a combined device for guiding and cutting material, in particular to an apparatus for guiding a rubber strip into an inserting groove of a profile and cutting off the rubber strip.

Background of the Invention

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In prior arts, some profiles should be inserted with a rubber strip so as to achieve effects such as water-proofing, sound-proofing, or the like. For example, aluminum profile used for door frame or window frame, as shown in Fig. 24, is provided with a rubber strip mounting groove 103, in which the rubber strip can be mounted, along a lengthwise direction thereof. A front end face 101 and a rear end face 102 of the aluminum profile are each generally configured as a slope, so as to facilitate jointing of aluminum profiles arranged in a horizontal direction and in a vertical direction respectively. In addition, the slopes of said two end faces 101 and 102 are normally not parallel to each other, but form an angle of 90 degrees therebetween. Corresponding, the rubber strip inserted in the aluminum profile also has two end faces respectively parallel to said two end faces of the aluminum profile. That is, the two end faces of the rubber strip are also configured as slopes with corresponding angles.

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Conventionally, the rubber strip is inserted in the profile and cut there as follows. First, the aluminum profile is held by one hand of an operator, and the rubber strip is held by the other hand of the operator, so that the rubber strip is guided into the rubber strip 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

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different cutting angles will 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.

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Summary of the Invention

The technical problem to be solved by the present invention is to provide an apparatus for guiding and cutting rubber strip, by means of which the rubber strip can
10 be efficiently and rapidly guided and cut off with a high safety.

In order to solve the above technical problem, the present invention proposes an apparatus for guiding and cutting rubber strip, which is used for guiding a rubber strip into a rubber strip mounting groove of a profile, and cutting off the rubber strip based
15 on the angles of two end faces of the profile. The apparatus includes a cutting device for cutting off the rubber strip, and a profile positioning device for fixing the profile in a working position. The apparatus for guiding and cutting rubber strip according to the present invention further includes a rubber strip guiding and loading device located behind the profile, and a controlling device which is connected with a
20 powering device or powering components and used for controlling operations thereof.

The rubber strip guiding and loading device includes an abutment element, which has a front end face that can be in engagement with a rear end face of the profile and a connecting groove corresponding to the rubber strip mounting groove of
25 the profile in position, and a first powering member, which is configured to drive the abutment element to move forwardly to a jointing position, where the front end face of the abutment element engages with the rear end face of the profile in the working position and the connecting groove engages with the rubber strip mounting groove, or to move rearwardly to its initial position.

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The cutting device is arranged between the abutment element in the initial position and the rear end face of the profile in the working position, and includes an upper cutter, a lower cutter, and a second powering member for controlling vertical movements of the upper cutter. The upper cutter and the lower cutter are configured to perform cutting operation through offset movements toward each other. The upper cutter includes a cutter rest, and two blades fixed on two side faces of a lower portion of the cutter rest respectively, wherein an angle of a front blade is identical to that of the rear end face of the profile while an angle of a rear blade is identical to that of a front end face of the profile.

The apparatus for guiding and cutting rubber strip according to the present invention further includes a rubber strip introducing device for advancing the rubber strip. The rubber strip introducing device is arranged behind the abutment element in the initial position, and includes a rubber strip anti-twisting device and a rubber strip pushing device for providing a forward driving force.

The rubber strip anti-twisting device includes at least one first anti-twisting wheel, which has a vertical axis of rotation and is adjustable in its position, and at least one second anti-twisting wheel having a fixed vertical axis of rotation. The first anti-twisting wheel and the second anti-twisting wheel are arranged at two sides of a rubber strip transfer path and opposite to each other, and both provided with respective annular grooves, opposite to each other, in the circumferential walls thereof, so that the rubber strip can pass through a space defined between the annular grooves.

The rubber strip pushing device includes a driving roller, a driven roller located above the driving roller, a motor for providing a rotating force for the driving roller, a guide rail assembly which is connected with the driven roller in such a manner that the driven roller can move along the vertical direction only, and a pressing element which presses the driven roller to the driving roller. The driving roller and the driven roller each have a horizontal rotating axle vertical to the rubber strip transfer path, and

are respectively provided with respective annular recesses, opposite to each other, on their circumferential wall surfaces, so that the rubber strip can pass through a gap defined between the annular recesses.

5 The first anti-twisting wheel is arranged between an upper clamping plate and a lower clamping plate, with a side plate being fixed to the upper clamping plate and the lower clamping plate from outside. Outside the upper clamping plate and the side plate is there provided with an inverted L-shaped fixing bracket, which has a top plate including a slot extending along a direction vertical to the rubber strip transfer path, 10 whereby screws extending from the upper clamping plate protrude into the slot. The lower clamping plate is arranged within a sliding groove, and configured to be moveable along the sliding groove in the direction vertical to the rubber strip transfer path. A bolt passes through a nut and the inverted L-shaped fixing bracket from outside to abut against the side plate, so that the movement range of the first 15 anti-twisting wheel can be adjusted.

 The rotating axle of the driving roller is mounted on two main supports at both ends respectively. The guide rail assembly includes two upper brackets located over the driving roller, a base plate located under the driving roller, a vertical guiding post 20 connecting between the upper brackets and the base plate, and a shaft sleeve arranged at each of the two main supports. The rotating axle of the driving roller is mounted on the two upper brackets at both ends respectively. The guiding post passes through the shaft sleeve. The pressing element is a tension spring that is connected with the base plate and thus can exert a downward pull force thereon.

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 The rubber strip introducing device further includes a first rubber strip guiding bridge arranged between the rubber strip anti-twisting device and the rubber strip pushing device, and a second rubber strip guiding bridge arranged between the rubber strip pushing device and the abutment element.

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The first rubber strip guiding bridge includes a first base plate, and a plurality of first rubber strip guiding wheels each having a vertical axis and mounted on the first base plate. The plurality of first rubber strip guiding wheels is arranged in two rows at two sides of the rubber strip transfer path respectively, so that the rubber strip can be transferred forwardly with a correct angle between the two rows of the first rubber strip guiding wheels.

The second rubber strip guiding bridge includes a second base plate, and a plurality of second rubber strip guiding wheels each having a vertical axis and mounted on the second base plate. The plurality of second rubber strip guiding wheels is arranged in two rows at two sides of the rubber strip transfer path respectively, with a guiding plate being securingly provided between two second rubber strip guiding wheels adjacent to each other along the rubber strip transfer path, so that the rubber strip can be transferred forwardly with a correct angle between the two rows of the second rubber strip guiding wheels and the guiding plates.

The first base plate of the first rubber strip guiding bridge is provided with a sensor through-hole in the rubber strip transfer path, in which a first sensor is arranged for sensing the existence of the rubber strip. In an area corresponding to a middle portion of the profile in the working position provided is a second sensor for sensing whether the profile is in place, and in an area corresponding to the front end of the profile in the working position provided is a third sensor for sensing whether the rubber strip is in place. The first sensor, the second sensor and the third sensor are all in communication with the controlling device.

The rubber strip introducing device further includes a rubber strip guiding bracket, which is located behind the rubber strip anti-twisting device, and provided with a through-hole through which the rubber strip passes. The rubber strip anti-twisting device further includes two guiding elements both located in the rubber strip transfer path one before another, each guiding element having a through-hole

through which the rubber strip passes. Between the recesses of the driving roller and the driven roller a rubber strip guiding tube), through which the rubber strip can exactly pass, is arranged in a position for outputting the leading end of the rubber strip.

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The profile positioning device includes lateral fixing elements arranged at two sides of the profile in the working position, and a front fixing element arranged at the front end face of the profile in the working position, an angle of a rear end face of the front fixing element corresponding to that of the front end face of the profile.

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The apparatus for guiding and cutting rubber strip according to the present invention further includes a profile outputting device, which includes a front bearing element, a rear bearing element, a third powering member, a fourth powering member, and a profile outputting plate. The third powering member is configured to drive the front bearing element to move forwardly, so as to support a bottom of the front end of the profile in the working position, or move rearwardly, while the fourth powering member is configured to drive the rear bearing element to move forwardly, so as to support a bottom of the rear end of the profile in the working position, or move rearwardly. The profile outputting plate is located inclinedly under the profile in the working position.

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Each of the first powering member, the second powering member, the third powering member, and the fourth powering member is a cylinder.

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The apparatus for guiding and cutting rubber strip according to the present invention further includes a water adding device, which is used to drip or spray water to the rubber strip being transferred or the rubber strip mounting groove of the profile in the working position.

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The lower cutter of the cutting device includes a cutter seat, which has a notch at

a position directly under the upper cutter, and two side faces of the notch form two sharp edges with a top surface of the cutter seat, the sharp edges being cooperated with the two blades for achieving cutting function.

5 The cutter rest is provided with a guiding shaft, which extends downwardly along a vertical direction, at the lower portion thereof in the region where two blades connect with each other. The cutter seat is provided with a concave, vertical guiding groove at a corner of the notch, so that the guiding shaft is able to be inserted in the vertical guiding groove and slide along the vertical guiding groove up and down.

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The cutter rest is provided with an indentation in a bottom portion thereof, for providing clearance for the rubber strip during cutting.

15 A cutting edge of each blade forms an angle of 20 to 40 degrees with a horizontal direction.

20 A front side face and a rear side face of the cutter rest each have an inwardly concave area, on which two blades are mounted and fixed respectively, and the outer surfaces of two blades are flush with the front and rear side faces of the cutter rest, respectively.

25 The cutting device further includes an upper cutter guiding mechanism for restricting moving direction of the upper cutter, the upper cutter guiding mechanism comprising at least two vertical guiding columns, and a cutter mounting plate through which the vertical guiding columns pass, wherein the cutter rest is fixed on the cutter mounting plate at its upper portion.

Two side faces of the cutter rest are fixedly connected with a bottom portion of the cutter mounting plate through angles and screws.

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Compared with the prior arts, the apparatus for guiding and cutting rubber strip according to the present invention can automatically transfer and guide the rubber strip into the rubber strip mounting groove of the profile through the controlling device, and cut off the rubber strip after it is in position. The cut rubber strip has its
5 end faces with the same angles with the end faces of the profile. Therefore, the production efficiency is greatly enhanced and the labor cost is saved with automatic operation. Moreover, the contact between human's hands and the end faces of the profile during cutting is avoided, thus achieving safer operations.

10 **Brief Description of the Drawings**

Fig. 1 is a front view schematically showing the structure of an apparatus for guiding and cutting rubber strip according to the present invention;

15 Fig. 2 is a rear view schematically showing the structure of the apparatus for guiding and cutting rubber strip according to the present invention;

Fig. 3 schematically shows the structure of a rubber strip guiding and loading device;

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Fig. 4 schematically shows a water adding device;

Fig. 5 schematically shows the structure of a rubber strip introducing device;

25 Fig. 6 schematically shows the structure of a rubber strip anti-twisting device;

Fig. 7 schematically shows the structure above a rubber strip pushing device;

Fig. 8 schematically shows the structure below the rubber strip pushing device;

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Fig. 9 schematically shows the structure of a first rubber strip guiding bridge;

Fig. 10 schematically shows the structure of a second rubber strip guiding bridge;

Fig. 11 schematically shows the structure of a bottom of the first rubber strip guiding bridge;

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Fig. 12 schematically shows the structures of a profile positioning device and a profile outputting device;

Fig. 13 schematically shows the structures of a front bearing element and a third
10 powering member;

Fig. 14 schematically shows the structure of a front fixing element;

Fig. 15 is a cross-sectional view of a rubber strip;

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Fig. 16 schematically shows the structure of a cutting device;

Fig. 17 schematically shows the structure of a cutter rest;

20 Fig. 18 schematically shows the structure of a lower cutter;

Fig. 19 schematically shows the structure of the cutter rest from below;

Fig. 20 schematically shows an upper cutter from a side of a guiding shaft
25 thereof;

Fig. 21 schematically shows a side view of the upper cutter;

Fig. 22 is a horizontal cross section view of a bottom portion of the upper cutter;

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Fig. 23 schematically shows a top fixing structure of the upper cutter; and

Fig. 24 schematically shows the structure of a profile.

Detailed Description of the Embodiments

The present invention will be described in further detail with reference to the embodiments as shown in the accompanying drawings.

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An apparatus for guiding and cutting rubber strip according to the present invention is used for guiding a rubber strip 20 into a rubber strip mounting groove 103 of a profile 10, and cutting off the rubber strip based on the angles of two end faces 101, 102 of the profile 10. As shown in Figs. 1 and 2, the apparatus includes a cutting
10 device 1 for cutting off the rubber strip, a rubber strip introducing device 2 for advancing the rubber strip, a rubber strip guiding and loading device 3 located behind the profile 10, a profile positioning device 4 for fixing the profile 10 in a working position, where the profile is ready to be inserted with the rubber strip, a controlling device 5 which is connected with a powering device or powering components and
15 used for controlling operation thereof, a water adding device 6, and a profile outputting device 7 for outputting the profile with the rubber strip inserted.

In the following each of the above devices will be illustrated in details.

20 As shown in Fig. 1, the rubber strip introducing device 2 is located rearmost of the whole apparatus. The rubber strip 20 is fed out of a rubber strip supply frame 30 to the rubber strip introducing device 2, from which it is forwarded to a position where the profile is located. Since the rubber strip 20 is elongated, it will be easily twisted during transfer so that it cannot be smoothly inserted into the profile. Therefore,
25 besides the function of transferring the rubber strip, the rubber strip introducing device 2 can also have functions of preventing the rubber strip from twisting and keeping the rubber strip with a correct moving direction during transfer. Fig. 15 shows a cross sectional view of the rubber strip 20 according to the present embodiment, wherein the rubber strip 20 has a generally O-shaped ring portion 201 at an upper
30 portion thereof, and an inverted T-shaped lower portion, the base side 202 of which

forms two recessions 203, a right one and a left one, with the ring portion 201. As shown in Fig. 5, the rubber strip introducing device 2 is mounted on a workbench 91, on which along a direction from rear to front, a rubber strip guiding bracket 25, a rubber strip anti-twisting device 21, a first rubber strip guiding bridge 23, a rubber strip pushing device 22, and a second rubber strip guiding bridge 24 are mounted in sequence.

The rubber strip guiding bracket 25 is fixed on the workbench 91 by means of an L-shaped angle element, and provided with a through-hole 251, through which the rubber strip 20 can pass. The through-hole 251 can provide a primary guiding effect for the rubber strip 20, and define an input position of the rubber strip 20.

As shown in Fig. 6, the rubber strip anti-twisting device 21 includes a base plate 215 fixed to the workbench 91, a lifting table 214, which is connected with the base plate 215 through four bolts 216 so that the lifting table 214 can be adjusted along the vertical direction, a first anti-twisting wheel 211 and a second anti-twisting wheel 212 both mounted on the lifting table 214, and two guiding elements 217 fixed on the front and rear portions of the lifting table 214 respectively.

The first anti-twisting wheel 211 and the second anti-twisting wheel 212 are located at two sides of a rubber strip transfer path respectively, and opposite to each other. Each of the wheels has a vertical axis of rotation.

The first anti-twisting wheel 211 is provided with a bearing 2112 therein, in a manner of close fit. A bearing top cover 2113 and a bearing base seat 2114 are respectively provided on the top and bottom of the bearing 2112, and fit with the bearing 2112 through screws. The first anti-twisting wheel 211 is mounted on an adjusting bracket, so that its position can be adjusted to the right or to the left. The anti-twisting wheel 211 has a horizontal annular groove 2111 in the circumferential wall thereof.

The adjusting bracket mainly consists of an upper clamping plate 2131, a lower clamping plate 2132, and a side plate 2133 fixed to the upper clamping plate 2131 and the lower clamping plate 2132 from outside. Outside the upper clamping plate 2131 and the side plate 2133 there is an inverted L-shaped fixing bracket 2134, which is fixed to the lifting table 214. The fixing bracket 2134 has a top plate including a slot 2135, which is vertical to the rubber strip transfer path. Screws extending from the top of the upper clamping plate 2131 protrude into the slot 2135. The lower clamping plate 2132 is arranged within a sliding groove 2136 of the lifting table 214, and can move to the right and to the left along the sliding groove 2136 in a direction vertical to the rubber strip transfer path. The first anti-twisting wheel 211 is sandwiched between the upper clamping plate 2131 and the lower clamping plate 2132, so that it can move to the right and to the left along the slot 2135 and the sliding groove 2136. A bolt 2137 passes through a nut 2138 and a vertical portion of the inverted L-shaped fixing bracket 2134 from outside to abut with the side plate 2133, so that the moving range of the first anti-twisting wheel 211 can be adjusted thereby.

The second anti-twisting wheel 212 has the same internal structure as the first anti-twisting wheel 211, but with a fixed axis of rotation. The second anti-twisting wheel 212 also has a horizontal annular groove 2121 in the circumferential wall thereof. The annular groove 2111 and the annular groove 2121 of two anti-twisting wheels are opposite to each other in terms of position. The rubber strip 20 passes through a space defined by the annular groove 2111 and the annular groove 2121, and two ends of a base side 202 of the rubber strip 20 are inserted into the annular groove 2111 and the annular groove 2121, respectively. In this manner, the rubber strip 20 can be kept with a correct moving angle, thus a twist thereof can be avoided.

The front and rear guiding elements 217 are located in the rubber strip transfer path, and provided with through-holes respectively, through which the rubber strip can pass. The front and rear guiding elements 217 are used to define the position where

the rubber strip moves in or out of the rubber strip anti-twisting device 21.

The rubber strip pushing device 22 can provide a driving force for pushing forward the rubber strip. As shown in Figs. 7 and 8, the rubber strip pushing device 22 includes a driving roller 221, a driven roller 222 located above the driving roller 221, a motor 223 for providing a rotating force for the driving roller 221, a guide rail assembly, and a pressing element 225. The driving roller 221 and the driven roller 222 each have a horizontal rotating axle vertical to the rubber strip transfer path, and are respectively provided with an annular recess 2212 and an annular recess 2222 on their circumferential wall surfaces, the two recesses being opposite to each other. Of course, the cross sectional shape of each of the annular recess 2212 and the annular recess 2222 is preferably matched with that of the rubber strip 20, so that the contact surface between the rubber strip and the corresponding roller can be increased, the friction force can be enhanced, and the transfer efficiency can be improved. In the present embodiment, the recess 2212 is a flat recess with a flat bottom, while the recess 2222 is a V-shaped recess. In addition, between the recesses 2212 and 2222 a rubber strip guiding tube 227, through which the rubber strip can just pass, is arranged in a position for outputting the leading end of the rubber strip. In this manner, the rubber strip can be better restricted in position.

The rotating axle 2211 of the driving roller 221 is mounted on two main supports 226 at both ends respectively. The two main supports 226 are connected with each other with a connecting plate 228 at the front sides thereof. The guide rail assembly includes: two upper brackets 2241 located over the driving roller 221, a base plate 2242 located under the driving roller 221, a vertical guiding post 2243 connecting between the upper brackets 2241 and the base plate 2242, and a shaft sleeve 2244 arranged at an inner side of each of the two main supports 226. The rotating axle 2211 of the driven roller 222 is mounted on the two upper brackets 2241 at both ends respectively. The guiding post 2242 passes through the shaft sleeve 2244. In this manner, the driven roller 222 can move along the vertical direction only due to the

guide rail assembly.

The pressing element 225 functions to press the driven roller 222 to the driving roller 221, so that the two rollers are kept in a state of being pressed toward each other.

5 Therefore, when the motor 223 drives the driving roller 221 in rotation, the driven roller 222 will be in reverse rotation, so that the rubber strip 20 held therebetween will be pushed forward continuously. The pressing element 225 can be a cylinder, a gravity device, a spring device, or the like. In the present embodiment, the pressing element 225 is a tension spring, which is connected with the base plate 2242 at its upper
10 portion, and with a fixed base seat 229 at its lower portion. Therefore, the base plate 2242 will be exerted with a downward force, thus driving the driven roller 222 to press downwardly.

To keep the rubber strip 20 to be transferred forwardly with a correct angle, the
15 rubber strip introducing device 2 further includes, as shown in Fig. 5, a first rubber strip guiding bridge 23 arranged between the rubber strip anti-twisting device 21 and the rubber strip pushing device 22, and a second rubber strip guiding bridge 24 located before the rubber strip pushing device 22.

20 As shown in Figs. 9 and 11, the first rubber strip guiding bridge 23 includes a first base plate 231, and a plurality of first rubber strip guiding wheels 232 each having a vertical axis and mounted on the first base plate 231. Each of the first rubber strip guiding wheels 232 is provided with a bearing 234 therein through close fit. A washer 236 is arranged under the bearing 234, while a special screw 235 can pass
25 through a hole 237 provided in the first base plate 231 from above, and then is fixed by means a nut 238. The plurality of first rubber strip guiding wheels 232 are arranged in two rows at two sides of the rubber strip transfer path respectively, with a first rubber strip guiding wheel 232 at the right side of the rubber strip transfer path corresponding to a first rubber strip guiding wheel 232 at the left side thereof. The
30 rubber strip 20 passes in between the two rows of first rubber strip guiding wheels 232,

the edges thereof being inserted into two recesses 203 of the rubber strip 20, so that the rubber strip 20 can be transferred forwardly with a correct angle. In addition, the holes 237 associated with one row of the first rubber strip guiding wheels 232 are each configured as an elongated hole, the longitudinal direction thereof being perpendicular to the rubber strip transfer direction. In this manner, the distance between two rows of the first rubber strip guiding wheels 232 can be adjusted. Moreover, in the first base plate 232, a sensor through-hole 233 is provided in the rubber strip transfer path. A first sensor 81 in communication with the controlling device 5 is arranged in the sensor through-hole 233, for sensing the existence of the rubber strip. If no rubber strip is detected, the controlling device 5 will deactivate the operation of the apparatus and send an alarm to the operator.

As shown in Fig. 10, the second rubber strip guiding bridge 24 includes a second base plate 241, and a plurality of second rubber strip guiding wheels 242 each having a vertical axis and mounted on the second base plate 241. The second rubber strip guiding wheels 242 have the same structure and arrangement as the first rubber strip guiding wheels 232; however, a guiding plate 243 is further provided between two of second rubber strip guiding wheels 242 adjacent to each other along the rubber strip transfer path. Accordingly, the rubber strip 20 will pass in between the two rows of the second rubber strip guiding wheels 242 and between two rows of the guiding plates 243, thus can be output with a correct angle.

As shown in Fig. 3, the rubber strip guiding and loading device 3 includes an abutment element 31 and a first powering member 32. The abutment element 31 has a front end face that can be in engagement with the rear end face of the profile 10, and a connecting groove 311 corresponding to the rubber strip mounting groove 103 of the profile 10 in position. During actual operation, the abutment element 31 can be formed by a part of the front end of the profile 10. The first powering member 32 can drive the abutment element 31 to move forwardly to a jointing position, or move rearwardly to its initial position. In the present embodiment, the first powering

member 32 is a cylinder. When the abutment element 31 moves forwardly to the jointing position, the front end face thereof will engage and joint with the rear end face of the profile 10 in the working position, with the connecting groove 311 being in a line with the rubber strip mounting groove 103. When the abutment element 31
5 moves rearwardly to the initial position, the connecting groove 311 thereof faces exactly to the rubber strip output position at the front end of the second rubber strip guiding bridge 24.

The cutting device 1 is arranged between the abutment element 31 in the initial
10 position and the rear end face of the profile 10 in the working position, and can cut off a rubber strip in such a manner that both end faces of the cut rubber strip have respective angles corresponding to the angles of two end faces of profile. As shown in Fig. 24, a front end face 101 of the profile 10 forms an angle A1 with the lengthwise direction of the profile 10, and a rear end face 102 thereof forms an angle A2 with the
15 lengthwise direction of the profile 10. Of course, the angles of two end faces of the profile 10 means those of end faces of the profile at a position where the rubber strip mounting groove is located. In this manner, the end faces of the cut rubber strip can be flush with the end faces of the profile at a position where the rubber strip is embedded, respectively.

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As shown in Fig. 16, the cutting device 1 mainly includes an upper cutter 11, a lower cutter 12, an upper cutter guiding mechanism, and a second powering member 13. The upper cutter 11 and the lower cutter 12 are opposed to each other, and can perform cutting through offset movements thereof toward each other. The upper cutter
25 guiding mechanism is used to restrict the moving direction of the upper cutter 1.

As shown in Figs. 20 and 21, the upper cutter 11 includes a cutter rest 111, and two blades 112 fixed on a lower portion of the cutter rest 111. The cutter rest 111 is generally shaped as a triangular prism arranged uprightly, and as shown in Fig. 22, it
30 has a cross-sectional shape of isosceles triangle. As shown in Fig. 17, a front side face

and a rear side face of the cutter rest 111, i.e., the two side faces corresponding to two equal sides of the isosceles triangle in Fig. 22, each have an inwardly concave area 116, which is provided with a threaded hole 118. The two blades 112 are mounted on two concave areas 116 respectively, and each fixed thereon with a screw 163 passing
5 through the threaded hole 118. In this case, the outer surfaces of two blades 112 are flush with the front and rear side faces of the cutter rest 111, respectively, thus providing a clean and aesthetics outer appearance for the upper cutter 11.

As shown in Fig. 22, when the blades 112 are fixed, the angle formed by a front
10 blade 112 and the lengthwise direction of the rubber strip to be cut is A2, which is identical to that formed by the rear end face 102 of the profile 10 and the lengthwise direction of the rubber strip to be cut, and the angle formed by a rear blade 112 and the lengthwise direction of the rubber strip to be cut is A1, which is identical to that formed by the front end face 101 of the profile 10 and the lengthwise direction of the
15 rubber strip to be cut. That is, the angle B formed by the two blades 112 is equal to that formed by the front end face and the rear end face of the profile 10. If the front end face and the rear end face of the profile 10 each have a slope with 45 degrees as conventionally, the angle B formed by the two blades 112 is 90 degrees.

As shown in Fig. 18, the lower cutter 12 includes a cutter seat 121 that can be
20 fixed on a workbench 92. The cutter seat 121 has a V-shape notch 122 directly facing the upper cutter 11 from below. The two side faces 124 of the V-shape notch 122 of the cutter seat 121 form two sharp edges respectively with a top surface of the cutter seat 121. When the upper cutter 11 moves downwardly to the notch 122, the two sharp
25 edges will be in close engagement with the two blades 112 respectively for cutting operation. In this manner, the rubber strip can be smoothly cut off.

During cutting, the rubber strip to be cut is placed on the top surface of the lower
cutter 12, under the upper cutter 11. Then, the blades 112 of the upper cutter 11 are
30 moved downwardly to the notch 122 of the lower cutter 12, thus cutting off the rubber

strip into two sections. A front section cut from the rubber strip has a slope angle the same as the rear end face 102 of a previous profile 10, while a rear section cut therefrom has a slope angle the same as the front end face 101 of a next profile 10. Therefore, two cutting actions can be performed with one operation.

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In order to prevent the upper cutter 11 from deviation during movement to negatively influence on the cutting quality, the cutter rest 111 is provided with a guiding shaft 113, which extends downwardly along the vertical direction, at the lower portion thereof in the region where two blades connect with each other, as shown in Fig. 17. Accordingly, the cutter seat 121 is provided with a vertical guiding groove 123 at a corner of the notch 122. The guiding groove 123 is concave relative to the notch 122. Such being the case, the guiding shaft 113 can be exactly inserted in the vertical guiding groove 123 and slide along the vertical guiding groove 123 up and down. With this structure, the moving direction of the upper cutter 11 can be effectively guided and restricted.

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As shown in Fig. 19, the cutter rest 111 is provided with an indentation 115, for providing clearance for the rubber strip during cutting. In the embodiment, the indentation 115 is configured as having a right angle.

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As shown in Fig. 21, in order to cut the rubber strip easily, an angle α formed by the cutting edge of each blade 112 and the horizontal direction ranges from 20 to 40 degrees, and is 30 degrees in the present embodiment. As shown in Fig. 20, the nose of the cutting edge of each blade 112 is far away from the guiding shaft 113, so that two blades 112 can cut off the rubber strip at the same time during cutting.

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As shown in Figs. 16 and 23, in the present embodiment, the powering member is a cylinder 13, which is mounted on a cylinder mounting plate 131. The cylinder 13 is connected with a cutter mounting plate 152 through a cutter rest connector 132 located under the cylinder mounting plate 131.

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The upper cutter guiding mechanism includes at least two vertical guiding columns 151, the cutter mounting plate 152, and shaft sleeves 153. The shaft sleeve 153 is fixed in a shaft hole of the cutter mounting plate 152, and movably mounted
5 around a respective vertical guiding column 151. The two side faces of the cutter rest 111 are fixedly connected with the bottom of the cutter mounting plate 152 through angles 161 and screws 162. The engagement between the guiding shaft 113 and the vertical guiding groove 123 can be controlled through adjustment on the screws 162. The top portion and the bottom portion of the vertical guiding column 151 are fixedly
10 connected with the cylinder mounting plate 1 and the workbench 92 respectively. In this manner, the upper cutter 11 can, driven by the cylinder 13, move only along the vertical guiding column 151 up and down.

As shown in Fig. 2 and 12, the profile positioning device 4 includes a plurality of
15 lateral fixing elements 41, a front fixing element 42, a left supporting member 43 and a right supporting member 44. The left supporting member 43 and the right supporting member 44 are arranged at two sides of the rubber strip 20 in the working position. At least two pairs of the lateral fixing elements 41 are provided, each being fixed to the left supporting member 43 and the right supporting member 44
20 respectively. The profile 10 is sandwiched by the left supporting member 43, the right supporting member 44 and the lateral fixing elements 41. As shown in Fig. 14, the front fixing element 42 is fixed on the front end face of the rubber strip 20 in the working position, with the angle of its rear end face 421 corresponding to that of the front end face 101 of the profile 10, thus defining the position of the front end of the
25 profile 10.

The water adding device 6 is arranged at one side of the profile 10 in the working position, as shown in Fig. 4. The water adding device 6 is provided with a water tank therein, and can drip or spray water to the rubber strip mounting groove 103 of the
30 profile 10 in transfer through a water tube 61. In this manner, the friction force

generated between the profile and the rubber strip can be reduced, thus rendering the rubber strip can be inserted into the profile easily.

As shown in Figs. 12 and 13, the profile outputting device 7 includes a front bearing element 71, a rear bearing element 72, a third powering member 73, a fourth powering member 74, and a profile outputting plate 75. The front bearing element 71 is arranged under the front fixing element 42, and can be driven by the third powering member 73 to move forwardly or rearwardly. When the front bearing element 71 moves forwardly and thus extrudes, it supports the bottom face of the front end of the profile 10 in the working position. When the front bearing element 71 moves rearwardly, it moves away from the profile 10. The rear bearing element 72 is located at the rear side of the profile 10, and shaped as a shaft with a longitudinal direction thereof perpendicular to the lengthwise direction of the profile 10. The rear bearing element 72 can be driven by the fourth powering member 74 to move forwardly or rearwardly. When the rear bearing element 72 moves forwardly and thus extrudes, it supports the bottom face of the rear end of the profile 10 in the working position. When the rear bearing element 72 moves rearwardly, it moves away from the profile 10. In the present embodiment, the third powering member 73 and the fourth powering member 74 both are cylinder. As shown in Fig. 2, the profile outputting plate 75 is located inclinedly under the profile 10 in the working position. When the cylinders 73 and 74 drive the front bearing element 71 and the rear bearing element 72 to retreat, the profile 10 will be out of support and then fall down on the inclined profile outputting plate 75, thus being guided to a collection position for the finished profile.

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As shown in Fig. 12, in an area corresponding to a middle portion of the profile 10 in the working position a second sensor 82 is provided for sensing whether the profile 10 is in place, and in an area corresponding to the front end of the profile 10 in the working position a third sensor 83 is provided for sensing whether the rubber strip 20 is in place. The second sensor 82 and the third sensor 83 are also in communication

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with the controlling device 5, which can be a PLC. All the sensors and the powering device or powering components are in communication with the PLC and controlled thereby. As shown in Fig. 1, the controlling device 5 is further connected externally a touch controller 51, with which the operations can be conveniently performed.

5

Before the apparatus according to the present invention starts to operate, the rubber strip 20 should be provided thereto through the following steps.

Firstly, the whole rubber strip is placed on the rubber strip supply frame 30. The rubber strip 20 is pulled out to pass through the rubber strip guiding bracket 25 and the rear guiding element 217 of the rubber strip anti-twisting device 21 respectively. Then, the rubber strip 20 passes through a space formed between the recesses of the first anti-twisting wheel 211 and the second anti-twisting wheel 212, with the bottom side 202 of the rubber strip 20 being inserted into the recesses 2111 and 2121. Subsequently, the bolt 2137 is adjusted so that the first anti-twisting wheel 211 is moved to clamp the rubber strip 20 therein, and the nut 2138 is used for fixing. If the rubber strip 20 used next is the same type as that used previously, no further adjustment for the bolt 2137 is necessary. Finally, the rubber strip 20 is guided to pass through the through-hole of the rear fixing element 217.

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Secondly, the rubber strip 20 is guided to pass in between the two rows of the first rubber strip guiding wheels 232 of the first rubber strip guiding bridge 23. The outer edges of the first rubber strip guiding wheels 232 pass through the recesses 203 at both sides the rubber strip 20. The positions of the first rubber strip guiding wheels 232 in one of the rows are adjusted, so that the first rubber strip guiding wheels 232 in both rows can clamp the rubber strip 20 therebetween. Then, the screw 235 and the nut 238 are fastened. The rubber strip 20 is guided to pass through the first rubber strip guiding bridge 23 in such a manner that the rubber strip 20 can pass through a sensing light source, which can be achieved by adjusting the sensor 81.

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Thirdly, the rubber strip 20 is guided to pass through a notch formed between the recess 2212 of the driving roller 221 and the recess 2222 of the driven roller 222. In this manner, the shift of the rubber strip to the left or right during transfer can be avoided, and the contact surface between the rubber strip 20 and the recesses can be increased, thus enhancing the friction force. Then, the rubber strip 20 will reach the second rubber strip guiding bridge 24 from the rubber strip guiding tube 227, which is used to prevent the rubber strip 20 from deformation due to existence of free space generated when the rubber strip 20 is forwarded.

Fourthly, the rubber strip 20 is guided to pass through the second rubber strip guiding bridge 24, with the same procedure as mentioned above.

Lastly, the rubber strip 20 is placed in the connecting groove 311 of the abutment element 31 of the rubber strip guiding and loading device, with part of the rubber strip 20 being extruded out of the abutment element 31.

After the rubber strip 20 is in position, the apparatus for guiding and cutting rubber strip according to the present invention can be operated as follows.

Firstly, the rubber strip 20 is placed in its working position. At this stage, the left side, the right side and the front end of the profile 10 are restricted by the lateral fixing elements 41 at two sides and the front fixing element 42, respectively.

Secondly, when the sensor 82 detects the profile 10 is in place, the controlling device 5 activates the cylinder 32 of the rubber strip guiding and loading device 3 to move the abutment element 31 forwardly, passing in between the upper cutter 11 and the lower cutter 12 of the cutting device 1, until the front end face 312 of the abutment element 31 just engages with the rear end face 102 of the profile 10. Then, the profile 10 is moved forwardly to abut against the rear end face 421 of the front fixing element 42, so that the profile 10 will be pressed in the working position, wherein the rubber

strip mounting groove 103 of the profile 10 is exactly in a line with the connecting groove 311 of the abutment element 31. At this stage, the rubber strip 20 inserted before is still located in the connecting groove 311 of the abutment element 31.

5 Thirdly, the controlling device 5 activates the motor 223 of the rubber strip pushing device 22, so that the ready rubber strip 20 will be forwarded to the rubber strip mounting groove 103 of the profile 10 in the working position by means of the abutment element 31 of the rubber strip guiding and loading device 3, until the sensor 83 located at the front end of the profile 10 detects the rubber strip 20. At this stage,
10 the rubber strip 20 is substantially located at the front end of the profile 10. During transfer of the rubber strip, the water adding device 6 will provide water to the rubber strip 20 being transferred, so as to reduce the friction force between the rubber strip 20 and the rubber strip mounting groove 103.

15 Fourthly, when the sensor 83 detects the rubber strip 20 is in position, the controlling device 5 deactivates the motor 223. The cylinder 32 of the rubber strip guiding and loading device 3 drives the abutment element 31 to move back to the initial position. At this stage, the rubber strip 20 between the abutment element 31 and the rear end face of the profile 10 is located between the upper cutter 11 and the lower
20 cutter 12 of the cutting device 1. The cylinder 13 of the cutting device 1 moves the upper cutter 11 downwardly, while the lower cutter 12 supports the bottom of the rubber strip 20. The two blades 112 of the upper cutter 11 cut the rubber strip 20 into two sections, wherein the angle of the rear end of the front section of the rubber strip is equal to that of the rear end face 102 of the profile 10, while the angle of the front
25 end of the rear section of the rubber strip is equal to that of the front end face 101 of the next profile 10. After that, the cylinder 13 moves the upper cutter 11 upwardly to its original position.

 Lastly, the front bearing element 71 and the rear bearing element 72 will be
30 retreated by the cylinders 73 and 74. The profile 10 pushes away the bearing elements

and then falls down on the profile guiding plate 75, and finally to the collection position for finished profiles.

5 With repeating the above steps, it can be achieved by the controlling device 5 that multiple rubber strips can be cut off and inserted in position. When the sensor 81 detects no signal, it indicates that the rubber strips in the rubber strip supply frame 30 are used out, and a refill is necessary.

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. An apparatus for guiding and cutting rubber strip, which is used for guiding a rubber strip into a rubber strip mounting groove (103) of a profile (10), and cutting off
5 the rubber strip based on the angles of two end faces of the profile (10), the apparatus including a cutting device (1) for cutting off the rubber strip and a profile positioning device (4) for fixing the profile (10) in a working position,

characterized in that the apparatus further includes a rubber strip guiding and loading device (3) located behind the profile (10), and a controlling device (5) which
10 is connected with a powering device or powering components and used for controlling operations thereof,

wherein the rubber strip guiding and loading device (3) includes an abutment element (31), which has a front end face that can be in engagement with a rear end face of the profile (10) and a connecting groove (311) corresponding to the rubber
15 strip mounting groove (103) of the profile (10) in position, and a first powering member (32), which is configured to drive the abutment element (31) to move forwardly to a jointing position, where the front end face of the abutment element (31) engages with the rear end face of the profile (10) in the working position and the connecting groove (311) engages with the rubber strip mounting groove (103), or to
20 move rearwardly to its initial position;

and wherein the cutting device (1) is arranged between the abutment element (31) in the initial position and the rear end face of the profile (10) in the working position, and includes an upper cutter (11), a lower cutter (12), and a second powering member (13) for controlling vertical movements of the upper cutter (11), the upper cutter (11)
25 and the lower cutter (12) being configured to perform cutting operation through offset movements toward each other, the upper cutter (11) including a cutter rest (111), and two blades (112) fixed on two side faces of a lower portion of the cutter rest (111) respectively, whereby an angle of a front blade is identical to that of the rear end face of the profile (10) while an angle of a rear blade is identical to that of a front end face
30 of the profile (10).

2. The apparatus for guiding and cutting rubber strip according to claim 1, characterized in that the apparatus further includes a rubber strip introducing device (2) for advancing the rubber strip, the rubber strip introducing device (2) being arranged
5 behind the abutment element (31) in the initial position, and including a rubber strip anti-twisting device (21) and a rubber strip pushing device (22) for providing a forward driving force,

wherein the rubber strip anti-twisting device (21) includes at least one first anti-twisting wheel (211), which has a vertical axis of rotation and is adjustable in its
10 position, and at least one second anti-twisting wheel (212) having a fixed vertical axis of rotation, the first anti-twisting wheel (211) and the second anti-twisting wheel (212) being arranged at two sides of a rubber strip transfer path and opposite to each other, and both provided with respective annular grooves, opposite to each other, in the circumferential walls thereof, so that the rubber strip can pass through a space defined
15 between the annular grooves; and

wherein the rubber strip pushing device (22) includes a driving roller (221), a driven roller (222) located above the driving roller (221), a motor (223) for providing a rotating force for the driving roller (221), a guide rail assembly which is connected with the driven roller (222) in such a manner that the driven roller (222) can move
20 along the vertical direction only, and a pressing element (225) which presses the driven roller (222) to the driving roller (221), whereby the driving roller (221) and the driven roller (222) each have a horizontal rotating axle vertical to the rubber strip transfer path, and are respectively provided with respective annular recesses, opposite to each other, on their circumferential wall surfaces, so that the rubber strip can pass
25 through a gap defined between the annular recesses.

3. The apparatus for guiding and cutting rubber strip according to claim 2, characterized in that the first anti-twisting wheel (211) is arranged between an upper clamping plate (2131) and a lower clamping plate (2132), with a side plate (2133)
30 being fixed to the upper clamping plate (2131) and the lower clamping plate (2132)

from outside;

outside the upper clamping plate (2131) and the side plate (2133) is there provided with an inverted L-shaped fixing bracket (2134), which has a top plate including a slot (2135) extending along a direction vertical to the rubber strip transfer path, whereby screws extending from the upper clamping plate (2131) protrude into the slot (2135);

the lower clamping plate (2132) is arranged within a sliding groove (2136), and configured to be moveable along the sliding groove (2136) in the direction vertical to the rubber strip transfer path; and

10 a bolt (2137) passes through a nut (2138) and the inverted L-shaped fixing bracket (2134) from outside to abut against the side plate (2133), so that the movement range of the first anti-twisting wheel (211) can be adjusted.

4. The apparatus for guiding and cutting rubber strip according to claim 2, characterized in that the rotating axle of the driving roller (221) is mounted on two main supports (226) at both ends respectively;

the guide rail assembly includes two upper brackets (2241) located over the driving roller (221), a base plate (2242) located under the driving roller (221), a vertical guiding post (2243) connecting between the upper brackets (2241) and the base plate (2242), and a shaft sleeve (2244) arranged at each of the two main supports (226);

the rotating axle of the driving roller (222) is mounted on the two upper brackets (2241) at both ends respectively;

the guiding post (2242) passes through the shaft sleeve (2244); and

25 the pressing element (225) is a tension spring that is connected with the base plate (2242) and thus can exert a downward pull force thereon.

5. The apparatus for guiding and cutting rubber strip according to claim 2, characterized in that the rubber strip introducing device (2) further includes a first rubber strip guiding bridge (23) arranged between the rubber strip anti-twisting device

(21) and the rubber strip pushing device (22), and a second rubber strip guiding bridge (24) arranged between the rubber strip pushing device (22) and the abutment element (31),

wherein the first rubber strip guiding bridge (23) includes a first base plate (231),
5 and a plurality of first rubber strip guiding wheels (232) each having a vertical axis and mounted on the first base plate (231), the plurality of first rubber strip guiding wheels (232) being arranged in two rows at two sides of the rubber strip transfer path respectively, so that the rubber strip can be transferred forwardly with a correct angle between the two rows of the first rubber strip guiding wheels (232); and

10 wherein the second rubber strip guiding bridge (24) includes a second base plate (241), and a plurality of second rubber strip guiding wheels (242) each having a vertical axis and mounted on the second base plate (241), the plurality of second rubber strip guiding wheels (242) being arranged in two rows at two sides of the rubber strip transfer path respectively, with a guiding plate (243) being securingly
15 provided between two second rubber strip guiding wheels (242) adjacent to each other along the rubber strip transfer path, so that the rubber strip can be transferred forwardly with a correct angle between the two rows of the second rubber strip guiding wheels (242) and the guiding plates (243).

20 6. The apparatus for guiding and cutting rubber strip according to claim 5, characterized in that the first base plate (232) of the first rubber strip guiding bridge (23) is provided with a sensor through-hole (233) in the rubber strip transfer path, in which a first sensor (81) is arranged for sensing the existence of the rubber strip;

in an area corresponding to a middle portion of the profile (10) in the working
25 position provided is a second sensor (82) for sensing whether the profile (10) is in place, and in an area corresponding to the front end of the profile (10) in the working position provided is a third sensor (83) for sensing whether the rubber strip is in place;
and

the first sensor (81), the second sensor (82) and the third sensor (83) are all in
30 communication with the controlling device (5).

7. The apparatus for guiding and cutting rubber strip according to claim 5, characterized in that the rubber strip introducing device (2) further includes a rubber strip guiding bracket (25), which is located behind the rubber strip anti-twisting device (21), and provided with a through-hole through which the rubber strip passes;

the rubber strip anti-twisting device (21) further includes two guiding elements (217) both located in the rubber strip transfer path one before another, each guiding element (217) having a through-hole through which the rubber strip passes; and

between the recesses of the driving roller (221) and the driven roller (222) a rubber strip guiding tube (227), through which the rubber strip can exactly pass, is arranged in a position for outputting the leading end of the rubber strip.

8. The apparatus for guiding and cutting rubber strip according to any one of claims 1 to 7, characterized in that the profile positioning device (4) includes lateral fixing elements (41) arranged at two sides of the profile (10) in the working position, and a front fixing element (42) arranged at the front end face of the profile (10) in the working position, an angle of a rear end face of the front fixing element (42) corresponding to that of the front end face of the profile (10).

9. The apparatus for guiding and cutting rubber strip according to claim 8, characterized in that the apparatus further includes a profile outputting device (7), which includes a front bearing element (71), a rear bearing element (72), a third powering member (73), a fourth powering member (74), and a profile outputting plate (75),

wherein the third powering member (73) is configured to drive the front bearing element (71) to move forwardly, so as to support a bottom of the front end of the profile (10) in the working position, or move rearwardly, while the fourth powering member (74) is configured to drive the rear bearing element (72) to move forwardly, so as to support a bottom of the rear end of the profile (10) in the working position, or move rearwardly;

and wherein the profile outputting plate (75) is located inclinedly under the profile (10) in the working position.

10. The apparatus for guiding and cutting rubber strip according to claim 9,
5 characterized in that each of the first powering member (32), the second powering member (13), the third powering member (73), and the fourth powering member (74) is a cylinder.

11. The apparatus for guiding and cutting rubber strip according to any one of
10 claims 1 to 7, characterized in that the apparatus further includes a water adding device (6), which is used to drip or spray water to the rubber strip (1) being transferred or the rubber strip mounting groove (103) of the profile (10) in the working position.

15 12. The apparatus for guiding and cutting rubber strip according to any one of claims 1 to 7, characterized in that the lower cutter (12) of the cutting device (1) includes a cutter seat (121), which has a notch (122) at a position directly under the upper cutter (11), and two side faces of the notch (122) form two sharp edges with a top surface of the cutter seat (121), the sharp edges being cooperated with the two
20 blades (112) for achieving cutting function.

13. The apparatus for guiding and cutting rubber strip according to claim 12, characterized in that the cutter rest (111) is provided with a guiding shaft (113), which extends downwardly along a vertical direction, at the lower portion thereof in the
25 region where two blades (112) connect with each other, and the cutter seat (121) is provided with a concave, vertical guiding groove (123) at a corner of the notch (122), so that the guiding shaft (113) is able to be inserted in the vertical guiding groove (123) and slide along the vertical guiding groove (123) up and down.

30 14. The apparatus for guiding and cutting rubber strip according to claim 12,

characterized in that the cutter rest (111) is provided with an indentation (115) in a bottom portion thereof, for providing clearance for the rubber strip during cutting.

15. The apparatus for guiding and cutting rubber strip according to claim 12,
5 characterized in that a cutting edge of each blade (112) forms an angle of 20 to 40 degrees with a horizontal direction.

16. The apparatus for guiding and cutting rubber strip according to claim 12,
characterized in that a front side face and a rear side face of the cutter rest (111) each
10 have an inwardly concave area, on which two blades (112) are mounted and fixed respectively, and the outer surfaces of two blades (112) are flush with the front and rear side faces of the cutter rest (111), respectively.

17. The apparatus for guiding and cutting rubber strip according to claim 12,
15 characterized in that the cutting device (1) further includes a upper cutter guiding mechanism for restricting moving direction of the upper cutter (11), the upper cutter guiding mechanism comprising at least two vertical guiding columns (151), and a cutter mounting plate (152) through which the vertical guiding columns (151) pass, wherein the cutter rest (111) is fixed on the cutter mounting plate (152) at its upper
20 portion.

18. The apparatus for guiding and cutting rubber strip according to claim 17,
characterized in that two side faces of the cutter rest (111) are fixedly connected with
a bottom portion of the cutter mounting plate (152) through angles (161) and screws
25 (162).