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Tension Unit

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D e s c r i p t i o n

The present invention relates to a tension unit for
tensioning at least one plated coil strip for a recoiling
15 process.

In general, an apparatus for cutting a sheet-like material
into coil strips is known, wherein the cut coil strips are
recoiled or winded by means of a corresponding recoiler,
20 respectively. The recoiler for winding a corresponding coil
strip comprises a coiling device to which the single coil
strip is fed. The recoiler coils the single coil strip around
a core member which is subsequently removed, thus providing a
sheet metal coil ready for use or for sale. The coil strips
25 are generally fed to the recoiler from a feeder mechanism.

Such an apparatus suffers from a number of disadvantages. In
particular, it is relatively difficult to match the feeding
rate of the single coil strips from the feeder mechanism with
30 the rate at which the recoiler requires the coil strip.
Obviously, this can cause considerable difficulties.
Generally, because of their relatively resilient nature of
the coil strips, if the length of the coil strip between the
feeder mechanism and the recoiler becomes sufficiently, this
35 may form a loop in the coil strip between the feeder
mechanism and the recoiler. When the coil strip between the

feeder mechanism and the recoiler is again pulled tight, the loop may cause a damage to the coil strip.

Furthermore, in certain cases, it has been found that the feeder mechanism may continue to dispense coil strip material, while the recoiler has been stopped, or the feeder mechanism may continue to dispense coil strip material at a higher rate than it is being required by the recoiler.

In both cases, it has been found that the coil strip dispensed from the feeder mechanism may become entangled and twisted prior to being fed to the recoiler, and in most such cases, the coil strips are damaged and not unusable any more.

Therefore, it is a general need to overcome this problem and to provide a tension of the coil strips for recoiling processes in order to avoid such damages.

Generally, the plated coil strips are guided through two opposite tension areas comprising a tension felt as a guiding surface for contacting the surfaces of the guided coil strips. Due to the friction provided to the surfaces of the coil strips by means of the tension felt of the tension areas, a suitable tension can be provided during the recoiling process.

A drawback of the above-mentioned prior art is due to the fact that such an arrangement is not capable of guiding plated coil strips with a suitable tension without causing scratches to both surfaces thereof caused by the friction between the tension felt and the surfaces of the coil strips.

In order to protect the surfaces of the coil strips from being scratched during tensioning, it is known to cover both surfaces with a special protection tape or foil.

One drawback according to this prior art is due to the fact that the use of such a special tape or foil results in additional process efforts, need of additional man power and high operating costs. A further drawback is due to the fact that the recoiling process is slowed down by the time necessary for attaching the special tape or foil to the surfaces of the coil strips.

Accordingly, it is an object of the present invention to provide a tension unit for tensioning plated coil strips for a recoiling process, which eliminates the afore-mentioned disadvantages and, in particular, which provides a suitable tension of the fed coil strips without damaging the surfaces thereof.

In order to solve this object, the present invention provides a tension unit comprising the features of the attached claim 1. The tension unit for tensioning at least one plated coil strip for a recoiling process according to the present invention comprises at least two rotatable rollers coupled to each other through their circumferences for guiding said at least one coil strip therethrough, wherein at least one roller thereof is connected to a motor drive for controlling the roller speed to create a predetermined tension to said at least one coil strip during their recoiling process.

Hence, the present invention provides an advantageous tension unit compared to the prior art, which obtains the suitable tension by coupling at least one roller of the guiding roller pair with a motor drive. The motor drive can control the roller speed depending on the function of the recoiler, i.e. depending on the rate with which the coil strip is recoiled.

As the two guiding rollers are carried rotatably, they can move together with the guided coil strips in order to prevent a friction damage to the surfaces thereof. Hence, a tension unit is provided, which guarantees a suitable tension of the guided coil strips without damaging their surfaces.

Further advantages and preferred embodiments are disclosed in the attached dependent claims.

It is to be understood that both the foregoing general description and the following detailed description are exemplary and explanatory only and are not restrictive of the invention as claimed. The following description as well as the practice of the invention, set forth and suggest additional advantages and purposes of the invention.

The accompanying drawings, which are incorporated in and constitute a part of this specification, illustrate embodiments of the present invention, and together with the description explain the advantages and principles of the present invention.

Fig. 1 is an elevational view of a coupled roller pair according to a preferred embodiment of the present invention.

Fig. 2 is a perspective view of a roller coupled to a motor drive according to a preferred embodiment of the present invention.

Fig. 3 is an elevational view of a roller pair comprising protection rings and spacer rings, respectively, according to a preferred embodiment of the present invention.

- Fig. 4 is a perspective view of a disassembled tension unit according to a preferred embodiment of the present invention.
- 5 Fig. 5 is a perspective view of the tension unit from the right-handed front side showing the brackets according to a preferred embodiment of the present invention.
- 10 Fig. 6 is an elevational view of a roller pair being carried by means of two opposite brackets according to a preferred embodiment of the present invention.
- 15 Fig. 7 is a perspective view from the right-handed back side showing a roller pair and two opposite brackets according to a preferred embodiment of the present invention.
- 20 Fig. 8 is a rear view of a roller pair being carried by means of two opposite brackets according to a preferred embodiment of the present invention.
- 25 Fig. 9 is an elevational view of a tension unit according to a preferred embodiment of the present invention.
- Fig. 10 is a left sided view of the tension unit according to the embodiment of Fig. 9.
- 30 Fig. 11 is a right sided view of the tension unit according to the embodiment of Figs. 9 and 10.
- Fig. 12 is a perspective view of the tension unit according to the embodiment of Figs. 9 to 11.

Reference will now be made to various embodiments according to the present invention, examples of which are shown in the accompanying drawings and will be obvious to a person skilled in the art from the description of the invention. In the drawings, the same reference numbers represent the same or similar elements in the different drawings, whenever possible.

Fig. 1 illustrates an elevational view of a roller pair according to a preferred embodiment of the present invention. The roller pair consists of an upper roller 5 and a lower roller 6. The two rollers 5 and 6 are formed as cylindrical rollers, respectively, and aligned parallel to each other with their respective axis during recoiling process. Each roller 5, 6 comprises a shaft 50, 60, at least one protection ring 51, 61, particularly formed as rubber rings or polyurethane rings, for guiding the coil strip through the two rollers 5 and 6 without damaging the surfaces of the coil strips, spacer rings and contact elements 52, 53 and 62, 63 for delimiting the protection rings 51, 61, respectively. The contact elements 52, 53 and 62, 63 are serving as locking nuts for securing the protection rings 51, 61, respectively.

According to said preferred embodiment, the upper roller 5 as well as the lower roller 6 comprises several protection rings 51, 61 being positioned adjacent to each other in axial direction.

Furthermore, one roller, according to the first preferred embodiment the upper roller 5, comprises a meshing gear 7 for meshing with a corresponding meshing gear of a motor drive for being driven with a predetermined roller speed. The meshing gear 7 is positioned adjacent to a contact element 53 of the upper roller 5.

Fig. 2 illustrates a perspective view of the upper roller 5 comprising protection rings 51 and the meshing gear 7 coupled to a corresponding motor drive system 8 according to a preferred embodiment of the present invention. As shown in Fig. 2, the meshing gear 7 of the upper roller 5 is coupled to a corresponding meshing gear 80 of the motor drive system 8. The motor drive system 8 is formed as a hydraulic motor drive system for example, or the like. In particular, the motor drive system 8 comprises a hydraulic system 81 with a hydraulic pump, a hydraulic pipe, hydraulic fittings, and so on for creating high moments of torsion. The motor drive system 8 can be fixed to an additional roller block 54.

The diameter of the shaft 50 of the roller 5 can for example be 40 mm, or the like. Hence, the roller block 54 includes a hole for the shaft 50 projecting therethrough in a rotatable manner.

The hydraulic motor drive system 8 is provided to the upper roller 5 in order to slow down the roller speed for creating a tension to the coil strips guided through the two rollers 5 and 6 during a recoiling of the coil strip. Since the two rollers 5, 6 move in opposite directions to each other and both together with the guided coil strips in feeding direction, scratches to the guided coil strips can be avoided advantageously, even during being slowed down by the motor drive system 8.

Fig. 3 illustrates an elevational view of an upper roller 5 and a lower roller 6 according to a preferred embodiment of the present invention. As shown in Fig. 3, each roller 5, 6 comprises several protection rings 51, 61 for guiding a coil strip therethrough in an undamaged manner, as mentioned above. The single protection rings 51, 61 can be provided with different widths and diameters. Furthermore, the

protection rings 51, 61 are formed as detachable rings for choosing a suitable detection ring combination for the coil strips deemed to be guided through the rollers 5, 6.

5 As can further be seen in Fig. 3, each protection ring 51, 61 is delimited by corresponding spacer rings 55, 65. The spacer rings are for example formed from a metal material, wherein for example the spacer rings 55 of the upper roller 5
10 rings 51 and wherein the spacer rings 65 of the lower roller 6 comprise a smaller diameter than the corresponding protection rings 65.

Furthermore, the width of a protection ring 51 of the upper
15 roller 5 is formed equal to the width of a corresponding protection ring 61 of the lower roller 6, as shown in Fig. 3. Hence, the two rollers 5, 6 can be moved close to each other so as to form a defined material feeding area 9 for feeding and guiding a corresponding coil strip therethrough in a
20 straight and undamaged manner.

Thus, by providing the shafts 50, 60 of the upper and lower rollers 5 and 6 with different protection rings 51, 61 and spacer rings 55, 65 of different diameters, the material
25 feeding area 9 can be adjusted to the single coil strips being guided through such an arrangement in a straight and undamaged manner. It is obvious for a person skilled in the art that the user can vary and change the rubber rings and the spacer rings in dependence on the widths and thickness of
30 the cut coil strips being guided through the rollers 5, 6.

Alternatively to the above-mentioned arrangement, the smaller spacer rings 65 can also be mounted on the roller being driven by the motor drive system 8 and the larger spacer
35 rings 55 to the remaining roller. The main issue is to guide

the cut coil strips through the rollers 5, 6 and to prevent these from being guided in a not straight manner which would cause a useless recoiling process.

5 As described above, the arrangement of the larger spacer rings 55 serves as a guiding aid to prevent the guided coil strips from running left and right during the winding process. By providing different sizes of the rubber rings 51, 61 in combination with the corresponding spacer rings 55, 65, 10 plated products of different sizes can be guided through this arrangement in a straight and undamaged manner.

For example, each rubber ring 51 comprises an inner diameter of 75 mm, an outer diameter of 100,75 mm and a thickness of 15 10 mm, 20 mm, 30 mm, etc. For example, the small spacer rings 65 comprise an inner diameter of 75 mm, an outer diameter of 83,85 mm and a thickness of 1,0 mm, 2,0 mm, 3,0 mm, etc. Contrary to this, the big spacer rings 65 have an inner diameter of 75 mm, an outer diameter of 110,60 mm and a 20 thickness of 1,0 mm, 2,0 mm, 3,0 mm, etc., or the like. It is obvious for a person skilled in the art that the geometry and the sizes of the rubber rings 51, 61, the smaller spacer rings 65 and the larger spacer rings 55 are not restricted to the above-mentioned dimensions. The main issue is to provide 25 a predetermined material feeding area 9.

Figs. 4 to 12 illustrate different views of a tension unit 1 or a part thereof according to a preferred embodiment of the present invention, wherein Fig. 4 is a perspective view of a 30 disassembled tension unit; Fig. 5 is a perspective view of the tension unit from the right-handed front side showing the brackets according to a preferred embodiment of the present invention; Fig. 6 is an elevational view of a roller pair being carried by means of two opposite brackets according to 35 a preferred embodiment of the present invention; Fig. 7 is a

perspective view from the right-handed back side showing a roller pair and two opposite brackets according to a preferred embodiment of the present invention; Fig. 8 is a rear view of a roller pair being carried by means of two
5 opposite brackets according to a preferred embodiment of the present invention; Fig. 9 is an elevational view of a tension unit according to a preferred embodiment of the present invention; Fig. 10 is a left sided view of the tension unit according to the embodiment of Fig. 9; Fig. 11 is a right
10 sided view of the tension unit according to the embodiment of Figs. 9 and 10 and Fig. 12 is a perspective view of the tension unit according to the embodiment of Figs. 9 to 11.

As can be seen in Figs. 4 to 12, the two rollers 5, 6 are
15 carried between two brackets 10 and 11. The brackets 10, 11 are positioned at both sides of the rollers 5, 6 for aligning and rotatably carrying the two rollers 5, 6 parallel to each other during the guiding process of a coil strip therethrough. As can be seen especially in Fig. 5 to 8, the
20 two rollers 5, 6 are carried between the left bracket 10 and the right bracket 11. Each bracket 10, 11 according to the present embodiment comprises an upper round ring-holding device 24 and a lower round ring-holding device 23.

25 Furthermore, the tension unit 1 according to the present embodiment comprises a separator roller guide 28 at the front upstream of the two rollers 5, 6 and a separator roller guide 29 at the back downstreams the two rollers 5 and 6.

30 A motor drive system 8, which is carried by a stand 27, is connected for example to the lower roller 6 via a meshing gear 7 attached thereto. The motor drive system 8 comprises a hydraulic system 81 including hydraulic oil tubes 82, a hydraulic oil switch 83 and a hydraulic oil tank 84 being

attached at the lower part of the stand 27 of the tension unit 1.

5 Additionally, the tension unit 1 according to a preferred embodiment, illustrated in Figs. 4 to 12, comprises the brackets 10, 11, as mentioned before, for carrying the two rollers 5 and 6 such that the upper roller 5 can be lifted up relative to the lower roller 6 by adjustment devices 18. The adjustment devices 18 consist of a plate 180 and an adjustment screw 25, respectively. The adjustment screw 25 is in threaded contact with said plate 180 and in carrying contact with the upper round ring-holding device 24 such that by rotating the adjustment screw 25, the upper ring-holding device 24 can be raised or lowered. Hence, the relative position between the two thrust bearings 16, 17, i.e. between the two rollers 5 and 6, can be adjusted by rotating the adjustment screw 182.

On the one hand, the clamping pressure between the two rollers 5, 6 can be adjusted by the adjustment device 18 and, on the other hand, the two rollers 5, 6 can be loosened in order to change the attachable roller 5.

As can be seen especially in Fig. 12, the right bracket 11 can be removed from the tension unit 1 in order to insert the respective protection rings 51, 61 comprising the required size.

30 Additionally, contact elements 52, 53 and 62, 63 are added to the upper roller 5 and the lower roller 6, respectively, after inserting the respective protection rings 51, 61, as illustrated for example in Fig. 16. Hence, the respective contact elements 52, 53 and 62, 63 serve as locking nuts for the respective protection rings.

The two shafts 50 and 60 of the upper roller 5 and the lower roller 6 are supported by the left bracket 10 comprising the machine gear 7.

5 In the following it is especially referred to Fig. 7 in order to describe the function of the tension unit 1 according to the preferred embodiment of the present invention.

10 As can be seen in Fig. 7, the upper roller 5 and the lower roller 6 are only supported by the left bracket 10. In this position the required protection rings 51 and 61 are put on the respective shaft 50 of the upper roller 5 and the shaft 60 of the lower roller 6, whereafter respective contact elements 53 and 63 are put on the respective shaft in order
15 to secure the protection rings 51 and 61.

Thereafter, the shaft 50 of the upper roller 5 is inserted into the upper bearing ring 24 of the right bracket 11 and the shaft 60 of the lower roller 6 is inserted into the lower
20 bearing ring 23 of the right bracket 11 for supporting the upper roller 5 and the lower roller 6 in a rotatable manner.

As illustrated in Fig. 7 by the arrows above the right bracket 10 and the left bracket 11, the upper roller 5 can be
25 moved in an upward and downward direction by rotating the adjustment screw 25 of each adjustment device 18 in a corresponding direction. Hence, the upper roller 5 is adjustable and can be moved up and down using the adjustment device 18. This could be necessary for introducing and
30 bypassing a material between the upper roller 5 and the lower roller 6. In the case of slitting plated coils, the upper roller 5 has to be opened, i.e. has to be moved up for a relative movement of the two rollers 5 and 6 to each other for adjusting the space, and has to be moved down again for

providing a predetermined clamping force between the two rollers 5 and 6.

5 Taking into consideration the above-mentioned evaluations, the present invention provides a tension unit for tensioning plated coil strips for a recoiling process, wherein one roller is provided with a motor drive system for controlling the roller speed in order to create a predetermined tension to the guided coil strips during the recoiling process. The
10 tension unit comprises suitable brackets for carrying and adjusting the two rollers in a suitable manner and for carrying the motor drive system.

The tension unit can therefore be formed as a stand-alone
15 unit or as a unit being attachable to an apparatus for cutting a sheet-like material into plated coil strips and/or to an apparatus for recoiling said coil strips. A controller (not shown) can be provided and connected to the motor drive system and to the recoiler in order to adjust the roller
20 speed to the winding rate of the recoiler in order to avoid damages of the guided coil strips during the recoiling process.

It will be apparent to those skilled in the art that various
25 modifications and variations can be made to the disclosed embodiments of the present invention without departing from the scope of the invention. Other embodiments of the invention will be apparent to those skilled in the art from consideration of the specification and practice of the
30 embodiments of the invention disclosed herein. The specification and examples should be considered exemplary, with the true scope of the invention being indicated by the attached claims.

P a t e n t C l a i m s

5 1. Tension unit (1) for tensioning at least one plated coil strip for a recoiling process comprising:

at least two rotatable rollers (5, 6) coupled to each other through their circumferences for guiding said at least one coil strip therethrough;

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wherein at least one roller (5) of the at least two rotatable rollers (5, 6) is connected to a motor drive system (8) for controlling the roller speed to create a predetermined tension to said at least one coil strip during the recoiling process.

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20 2. Tension unit (1) according to claim 1, characterized in that said at least two rollers (5, 6) are formed as cylindrical rollers, respectively, which are positioned parallel to each other during the tensioning process.

25 3. Tension unit (1) according to claim 1 or 2, characterized in that said motor drive system (8) is formed as a hydraulic motor drive and is controlled to rotate the corresponding roller (5; 6) with said predetermined roller speed.

30 4. Tension unit (1) according to at least one of the preceding claims, characterized in that said one roller (5; 6) being connected to said motor drive system (8) is provided with a meshing gear (7) for meshing with a corresponding meshing gear (80) of said

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motor drive system (8) for being driven with said predetermined roller speed.

5 5. Tension unit (1) according to at least one of the preceding claims,
c h a r a c t e r i z e d in that
said tension unit (1) comprises an upper roller (5) and
a lower roller (6) being rotatably carried by means of
two brackets (10, 11), one at each axial side of said
10 two rollers (5, 6).

15 6. Tension unit (1) according to claim 5,
c h a r a c t e r i z e d in that
each bracket (10, 11) comprises an adjustment device
(18) for moving the two rollers (5, 6) relative to each
other for adjusting the space and for providing a
predetermined clamping force between said two rollers
(5, 6).

20 7. Tension unit (1) according to claim 5 or 6,
c h a r a c t e r i z e d in that
each bracket (10; 11) comprises at least two ring-
holding devices (23, 24) for carrying one end of each
roller (5, 6), respectively, in a parallel and rotatable
25 manner.

8. Tension unit (1) according to claim 7,
c h a r a c t e r i z e d in that
at least one ring-holding device (24) can be lowered or
30 raised for moving the corresponding roller (5) relative
to the remaining roller (6) by means of an adjusting
screw (25).

35 9. Tension unit (1) according to at least one of the preceding claims,

characterized in that each of said at least two rollers (5, 6) comprises at least one detachable protection ring (51, 61), especially a rubber or polyurethane ring, to form a soft material feeding area (9) for guiding said at least one coil strip through said at least two rollers (5, 6) without damaging the surfaces of said at least one coil strip.

10 10. Tension unit (1) according to claim 9,
characterized in that
at least one of said at least two rollers (5, 6)
comprises at least two detachable spacer rings (55, 65)
15 delimiting a respective protection ring (51, 61) and
having a larger diameter than the respective protection
ring (51, 61) to form a defined material feeding area
(9) for guiding said at least one coil strip through
said at least two rollers (5, 6) in a straight
direction.

20 11. Tension unit (1) according to claim 9 or 10,
characterized in that
at least one of said at least two rollers (5, 6) can be
declined in and/or removed from at least one
25 corresponding bracket (10, 11) to provide the two
rollers (5, 6) with suitable protection rings (51, 61),
contact elements (52, 53; 62, 63) and/or suitable spacer
rings (55, 65).

30 12. Tension unit (1) according to at least one of the
preceding claim 9,
characterized in that
said tension unit (1) is formed as a stand-alone unit or
as a unit being attachable to an apparatus for cutting a

sheet-like material into plated coil strips and/or an apparatus for recoiling said coil strips.