(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 3 947 165 B1**

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
**13.09.2023 Bulletin 2023/37**

(21) Application number: **20723915.3**

(22) Date of filing: **26.03.2020**

(51) International Patent Classification (IPC):
***B65B 25/14*** *(2006.01)*

(52) Cooperative Patent Classification (CPC):
**B65B 25/148; B65B 13/181; B65B 25/146; B65B 27/06**

(86) International application number:
**PCT/FI2020/050197**

(87) International publication number:
**WO 2020/193868 (01.10.2020 Gazette 2020/40)**

# (54) METHOD FOR PACKING A COIL OR ROLL, COIL OR ROLL PACKING ARRANGEMENT, AND COIL OR ROLL PACKING SYSTEM

VERFAHREN, VORRICHTUNG UND SYSTEM ZUR VERPAKCUNG VON EINER SPULE ODER ROLLE

PROCÉDÉ, APPAREIL ET SYSTÈME POUR L'EMBALLAGE D'UNE BOBINE OU D'UN ROULEAU

(84) Designated Contracting States:
**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR**

(30) Priority: **26.03.2019 FI 20195227**

(43) Date of publication of application:
**09.02.2022 Bulletin 2022/06**

(73) Proprietor: **Pesmel OY**
**61801 Kauhajoki (FI)**

(72) Inventors:
- **MANNILA, Rami**
  **61470 KITINOJA (FI)**
- **LUHTALA, Juha**
  **60320 SEINÄJOKI (FI)**

(74) Representative: **Berggren Oy**
**P.O. Box 16**
**Eteläinen Rautatiekatu 10A**
**00101 Helsinki (FI)**

(56) References cited:
**AU-A1- 2008 221 599**
**JP-A- H07 291 218**
**KR-A- 20100 110 184**
**KR-A- 20180 051 769**



EP 3 947 165 B1

## Description

### FIELD OF THE INVENTION

**[0001]** The present invention relates in general to methods, arrangements and systems for packing coils or rolls, such as metal coils or paper rolls. In particular, however not exclusively, the present invention concerns methods, arrangements and systems for providing protection for the inner edge of the coil or roll.

### BACKGROUND

**[0002]** There are some known methods for packing metal coils which utilize different packaging material layers to protect the metal coil from outside moisture and dust. Generally, metal coils are packed in order to be protected from the environment when being transported, for example, by a vehicle, ship, or the like.

**[0003]** Packaging of metal coils can include, for example, arranging waterproof vinyl, moisture absorbing paper and a scratch-resistant thin metal foil to protect the coil. It is known to provide packaging material on both the outer surface of the coils as well as on the inner surface of the coil.

**[0004]** In known solutions, the packing of the coil is performed by operators who arrange the different packaging materials on the coil. Furthermore, different parts of the packaging, such as the inner edge protector, are typically manually attached to the coil by using adhesive, such as adhesive tape, glue or silicone. The packing thus requires much manual labor which causes high costs. Furthermore, utilization of adhesives is undesirable in the packaging due to unwanted health related issues, such as the adhesives being toxic. Furthermore, adhesives tend to be messy. The adhesives also cause the packaging to become hard to unpack because the packaging material has been attached to the coil by the adhesive.

**[0005]** Document AU 2008221599 A1 presents a device for protecting a bore at its open end and for protecting adjacent edges of a rolled material, comprising a retaining portion to be positioned within the open end and against an inner wall of the bore; and a protecting portion extending from the retaining portion outside of the open end and over the edges of the rolled material; wherein the retaining portion has segments joined together at one or more hinges such that the device is convertible between an inoperative opened out configuration and an operative configuration that has a substantially closed shape for positioning at the open end of the bore.

**[0006]** Document KR 20180051769 A presents an apparatus for adhering an inner circumferential protective plate for a wrapping coil. The apparatus for adhering an inner circumferential protective plate for a wrapping coil according to the present invention comprises: a band having a length greater than the inner circumferential length of a coil and having a superposed portion inserted into an inner diameter portion of the coil and partially overlapping one end and the other end; a first holder installed at one end of the band; a second holder installed at the other end of the band; and a cylinder supported by the first holder and the second holder and having the total length expanded and contracted to expand and contract the outer diameter of the band.

**[0007]** Document JP H07291218 A presents an apparatus is composed of a coil skids for carrying a coil, a pair of articulated robots arranged so that the placed coil comes within the limits of turning thereof and each having a robot hand for holding corner protectors at the front end of its arm, and a pair of supply racks for storing corner protectors arranged on positions within the limits of turning of each of the articulated robots and not conflicting with the coil.

**[0008]** Document KR 20100110184 A presents a taping device for coil packing comprises a press roller, a roller support, and a roller transfer part. The press roller is arranged on a side of a coil and presses a tape provided to the side of the coil. The roller support is arranged on a lateral side of the coil and supports the press roller to rotate. The roller transfer part supports the roller support so that the press roller rotates on the side of the coil and rolls along the interior surface of the coil to draw out the tape, and transfers the roller support part so that the tape is attached to the side and inner perimeter of the coil.

### SUMMARY

**[0009]** An objective of the present invention is to provide a method for packing a coil or roll, a coil or roll packing arrangement, and a coil or roll packing system. Another objective of the present invention is that the method, the arrangement, and the system at least alleviate some of drawbacks in the known solutions, such as related to the utilization of manual labor and adhesives.

**[0010]** The objectives of the invention are reached by a method for packing a coil or roll, a coil or roll packing arrangement, and a coil or roll packing system as defined by the respective independent claims.

**[0011]** According to a first aspect of the present invention, a method for packing a coil or roll is provided.

**[0012]** The method comprises:

- providing the coil or roll comprising an inner edge defined by an inner surface of the coil or roll, wherein the inner edge defines an inner diameter of the coil or roll and the inner surface defines an inner space (or an eye or a hole or a through-hole or an inner volume) of the coil or roll,

- providing an inner edge protecting element comprising a first end and a second end, wherein said ends are opposite ends with respect to each other in a longitudinal direction of the inner edge protecting element,

- adapting the inner edge protecting element to overlap at two portions of the inner edge protecting element, thereby forming substantially a closed shape having a first diameter,

- arranging, by a coil or roll packing machine, a portion of the adapted inner edge protecting element into the inner space at the end of the inner surface,

- increasing, by the coil or roll packing machine, the first diameter so that at least part of the portion becomes in contact with the inner surface, and

- mechanically securing, by the coil or roll packing machine, the inner edge protecting element at the two portions to provide an inner edge protector secured into the inner space and arranged along and in contact with the inner edge, wherein the mechanically securing comprises attaching the two portions to each other by the coil or roll packing machine, thereby, preferably, fixing the increased first diameter.

**[0013]** The coil or roll may, preferably, be a metal coil, for example, of steel or aluminum. Alternatively, the coil or roll may be a paper roll.

**[0014]** In various embodiments, the method may comprise maintaining by the coil or roll packing machine the force used to increase the first diameter during the securing. This further improves the coupling between the inner edge protector and the inner surface of the coil or roll.

**[0015]** In various embodiments, the inner edge protecting element may include at least two portions, the first portion and the second portion, separated by a bend in a longitudinal direction of the element. Thus, the inner edge protecting element may have a cross-section having L-shape or the like, in case of a right angle at the bend. The angle may differ from the right angle, however, be in the range of 60 to 120 degrees, advantageously 70 to 110 degrees or more advantageously 80 to 100 degrees, or the even more advantageously 85 to 95 degrees.

**[0016]** In some embodiments, the cross-section of the first portion of the inner edge protecting element may, preferably, be straight in order to conform with the inner surface of the coil or roll when being arranged in contact with the inner surface. However, the shape of the cross-section of the second portion may vary.

**[0017]** In various embodiments, the portion of the adapted inner edge protecting element arranged into the inner space may be the first portion in which case the second portion may become in contact with a side surface of the coil or roll.

**[0018]** In various embodiments, the method may comprise arranging the first diameter to be less than the inner diameter so that the portion of the inner edge protecting element fits into the inner space.

**[0019]** In various embodiments, a securing device comprised in the coil or roll packing machine may comprise a welding device, such as a spot welding device. In these embodiments, the method may comprise welding, such as spot welding, by the welding device, the two portions of the inner edge protecting element to each other, thereby mechanically securing the inner edge protecting element.

**[0020]** In various embodiments, the securing device may comprise a riveting device. In these embodiments, the method may comprise securing, by the riveting device, the two portions of the inner edge protecting element to each other, thereby mechanically securing the inner edge protecting element.

**[0021]** In some embodiments, the securing device may comprise a puncher or punching device. The mechanical securing may, thus, be implemented by punching at the two overlapping portions such that the penetration of the punch through the portions or at least causing deformation of the portions, if not penetrated through, provide the mechanical securing when the two portions stick to each other due to the deformation at the corresponding positions relative to each other.

**[0022]** In some embodiments, the securing device may comprise a cutting or a bending device. The mechanical securing may, thus, be implemented by cutting or bending the inner edge protecting element at the overlapping portions such that the portions become attached to each other. This may be done, for example, at the outer edge of the inner edge protecting element, such as at the second portion thereof.

**[0023]** In a further embodiment, the inner edge protecting element may comprise at the overlapping portions a ratcheting mechanism, such as having a protrusion or protrusions in one of the overlapping portions, and a hole or cavity or holes or cavities in the other one of the overlapping portions at corresponding positions. The protrusion(s) and the hole(s) may, advantageously, be arranged such that when coupled to each other, the inner edge protecting element locks, or mechanically secures, into the desired position to protect the inner edge, and thus forms the inner edge protector.

**[0024]** In some embodiments, the method may comprise gripping the inner edge protecting element by gripping elements, such as claws, comprised in the coil or roll packing machine, wherein the gripping elements may be configured to support the inner edge protecting element during moving of the element.

**[0025]** In various embodiments, the increasing of the first diameter may comprise pushing the inner edge protecting element at a plurality of different positions towards the inner surface by spreading elements comprised in the coil or roll packing machine.

**[0026]** In various embodiments, the method may comprise arranging the inner edge protecting element to a squeezing device and reducing the first diameter to be less than the inner diameter by the squeezing device by pushing the inner edge protecting element from outside with respect to the closed shape.

**[0027]** In various embodiments, the method may comprise arranging the two portions of the inner edge protecting element to a first position in the squeezing device. Furthermore, the method may comprise gripping the inner edge protecting element by the gripping elements comprised in the coil or roll packing machine such that the first position corresponds to a position of the securing device.

**[0028]** In some embodiments, the method may comprise, after the mechanical securing, pushing, by the coil or roll packing machine, the inner edge protector to be in contact with a side surface of the coil or roll.

**[0029]** In various embodiments, the method may comprise arranging a header or a side cover around the adapted inner edge protecting element and arranging the header or the side cover onto a side surface of the coil or roll.

**[0030]** According to a second aspect of the present invention, a coil or roll packing arrangement is provided.

**[0031]** The coil or roll packing arrangement comprises a coil or roll packing machine comprising a robot or manipulator and a securing device, wherein the robot or manipulator is configured to arrange a portion of an inner edge protecting element into an inner space at an end of an inner surface of a coil or roll, wherein the inner edge protecting element comprises two overlapping portions, thereby forming substantially a closed shape having a first diameter, to increase the first diameter so that at least part of the portion becomes in contact with the inner surface. The securing device is configured to mechanically secure the inner edge protecting element at the two overlapping portions to provide an inner edge protector secured into the inner space and arranged along and in contact with an inner edge of the coil or roll, wherein the mechanically securing comprises attaching the two overlapping portions to each other by the coil or roll packing machine, thereby, preferably, fixing the increased first diameter.

**[0032]** The robot or manipulator may refer to any kind of a device or machine which may be configured, such as programmed, to perform the steps in accordance with the present invention. Thus, the robot or manipulator may be configured to move or being moved in one, two, or three dimensions. Furthermore, with respect to the movement, the robot or manipulator may have any number of degrees of freedom, such as from five to seven, for instance. The robot or manipulator may in some embodiments have one or several robot or manipulating arms.

**[0033]** In some embodiments, the securing device may be a welding or a riveting device configured to mechanically secure the inner edge protecting element.

**[0034]** In various embodiments, the coil or roll packing arrangement may comprise a squeezing device configured to reduce the first diameter to be less than an inner diameter of the coil or roll by pushing the inner edge protecting element outside the closed shape.

**[0035]** In various embodiments, the robot may comprise spreading elements, such as plugs or pegs, and the robot may be configured to increase the first diameter by pushing the inner edge protecting element at a plurality of different positions towards the inner surface by the spreading elements.

**[0036]** In one preferable embodiment, the spreading elements may be elastic or comprise elastic coupling with respect to the robot, such as by a spring or spring-like element.

**[0037]** According to a third aspect of the present invention, a coil or roll packing system is provided.

**[0038]** The coil or roll packing system comprises a plurality of stations, wherein at least one of the stations comprise a coil or roll packing arrangement according to the second aspect or any embodiment thereof.

**[0039]** In some embodiments, other one of the plurality of stations may comprise providing other packaging material to the coil or roll, such as providing packaging material for protecting the coil against corrosion. This may include utilizing plastic and/or paper packaging material arranged on the surfaces of the coil, such as on the outer and the inner surfaces.

**[0040]** In various embodiments, the coil or roll may be arranged to be moved by a coil car along a coil car track. The track may, preferably, extend through the plurality of stations such that the coil or roll may be moved through all of the stations by the coil car, preferably, in automated or at least remote controlled manner.

**[0041]** The present invention provides a method for packing a coil or roll, a coil or roll packing arrangement, and a coil or roll packing system. The present invention provides advantages over known solutions in that the inner edge protector may be provided to the coil or roll without need to use adhesives, such as glue or silicone. In known solutions, having pre-manufactured inner edge protectors which are pushed by force into the inner space of the coil or roll, the protectors tend to fall off from the inner space due to having elastic energy stored in them due to being constricted when pushed by force into the inner space. In the present invention, the inner space protecting element has been, on the contrary, expanded against the inner surface of the coil or roll to form the inner edge protector, thus the elastic energy is minimized. The present invention has the advantage that the diameter of the inner edge protecting element, and therefore of the inner edge protector, can be adjusted in stepless manner or at least practically continuously. The invention also allows providing an automatic coil or roll packing arrangement in which the provision of the inner edge protector to the coil or roll does not require manual work from the operator. Furthermore, the coil or roll packing arrangement and/or the equipment, such as the machines and/or the devices, thereof may form part of the coil or roll packing system which, thus, can be fully automated or at least automated with respect to the station including the equipment configured to provide the inner edge protector to the coil or roll.

**[0042]** Various other advantages will become clear to a skilled person based on the following detailed descrip-

tion.

**[0043]** The expression "a number of" may herein refer to any positive integer starting from one (1).

**[0044]** The expression "a plurality of" may refer to any positive integer starting from two (2), respectively.

**[0045]** The terms "first" and "second" are herein used to distinguish one element from other element, and not to specially prioritize or order them, if not otherwise explicitly stated.

**[0046]** The exemplary embodiments of the present invention presented herein are not to be interpreted to pose limitations to the applicability of the appended claims. The verb "to comprise" is used herein as an open limitation that does not exclude the existence of also unrecited features. The features recited in depending claims are mutually freely combinable unless otherwise explicitly stated.

**[0047]** The novel features which are considered as characteristic of the present invention are set forth in particular in the appended claims. The present invention itself, however, both as to its construction and its method of operation, together with additional objectives and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawings.

## BRIEF DESCRIPTION OF FIGURES

**[0048]** Some embodiments of the invention are illustrated by way of example, and not by way of limitation, in the figures of the accompanying drawings.

Figure 1 illustrates schematically a coil or roll in accordance with an embodiment of the present invention.

Figure 2 illustrates schematically a coil or roll and coil packaging material in accordance with an embodiment of the present invention.

Figure 3 illustrates schematically an inner edge protecting element according to an embodiment of the present invention.

Figure 4 illustrates schematically an inner edge protector according to an embodiment of the present invention.

Figure 5 illustrates schematically a coil or roll packing arrangement according to an embodiment of the present invention.

Figure 6 illustrates schematically a coil or roll packing arrangement according to an embodiment of the present invention.

Figure 7 illustrates schematically a coil or roll packing machine according to an embodiment of the present invention.

Figure 8 illustrates schematically a coil or roll packing machine of Fig. 7 by a cutaway view.

Figure 9 illustrates schematically a coil or roll packing machine by a cross-sectional view according to an embodiment of the present invention.

Figure 10 illustrates schematically a coil or roll packing machine by a cross-sectional view according to an embodiment of the present invention.

Figure 11 illustrates schematically a coil or roll packing machine by a cutaway view according to an embodiment of the present invention.

Figure 12 illustrates schematically a coil or roll packing machine of Fig. 11 from a perspective.

Figure 13 illustrates schematically a coil or roll packing machine according to an embodiment of the present invention.

Figure 14 illustrates schematically a securing device according to an embodiment of the present invention.

Figure 15 illustrates schematically the securing device of Fig. 14 by a cross-sectional view.

Figure 16 illustrates schematically a coil or roll packing system according to an embodiment of the present invention.

Figure 17 illustrates a flow diagram of a method according to an embodiment of the present invention.

## DETAILED DESCRIPTION OF SOME EMBODIMENTS

**[0049]** Figure 1 illustrates schematically a coil or roll (hereinafter "coil") 10 in accordance with an embodiment of the present invention. The coil 10 may be, for example, a metal coil or roll, such as of stainless steel. The coil 10 may, alternatively, be a paper roll (or coil). As shown in Fig. 1, the coil 10, preferably, includes an outer surface OS, an inner surface IS, and two side surfaces SS1, SS2. Furthermore, the inner surface IS defines an inner space ISP of the coil 10. Inner edges of the side surfaces SS1, SS2 have an inner diameter or diameters D1. Furthermore, the coil 10 comprises an inner edge or edges IE1, IE2 defined by side end(s) of the inner surface IS. Still further, the coil 10 comprises an outer edge or edges OE1, OE2 defined by side ends of the outer surface OS.

**[0050]** The coil 10 has a width Wand an outer diameter D2 as shown in Fig. 1. The coil 10 may, for example, have dimensions such as follows: the width W 1200 mm, the outer diameter D2 1200 mm or the like. However,

coils 10 of various sizes may be protected by utilizing an embodiment in accordance with the present invention. The width W may be in the range from 200 mm to 4000 mm, and the outer diameter D2 in the range from 500 mm to 2000 mm, for instance.

**[0051]** Figure 2 illustrates schematically a coil 10 and coil 10 packaging material in accordance with an embodiment of the present invention. The coil 10 packaging material may include an outer edge protector 18 or protectors 18, such as of plastic material. The outer edge protector(s) 18 protect the plastic film and/or paper sheet material used to provide protection against corrosion from tearing when being wound through the inner space ISP of the coil 10 and around the coil 10. There may also be arranged further outer edge protector(s), such as preferably of metal, for example, steel, arranged on the outer edge protector(s) after winding the protection material against corrosion.

**[0052]** The coil 10 may further be protected by using mechanical protecting elements, such as metal, plastic, paper, hardboard, and/or cardboard film or sheet. There may be an outer mechanical protecting element arranged on the outer surface OS of the coil 10 (not shown in Fig. 2). There may also be inner mechanical protecting elements, such as inner body material 16, and/or side protecting elements, such as headers or side covers 14, arranged on the inner IS and side surface(s) SS1, SS2 of the coil 10, respectively.

**[0053]** According to various embodiments, such as shown in Fig. 2, the coil 10 packaging material may, preferably, include one or two inner edge protectors 13 to be arranged to protect the inner edge(s) IE1, IE2 of the coil 10. The inner edge protectors 13 may, preferably, be of metal, such as steel.

**[0054]** Finally, the packaging may also include arranging band strips of metal (not shown) around the coil 10 through the inner space ISP. There may also be band strips (not shown) arranged around the outer surface OS of the coil 10. The band strips then tightly hold the package material covering the coil 10. The packaged coil 10 may further be provided with identification information, such as labels, tags, etc.

**[0055]** Figure 3 illustrates schematically an inner edge protecting element 11 according to an embodiment of the present invention. The inner edge protecting element 11 comprises a first end 11A and a second end 11B. The ends 11A, 11B are opposite ends with respect to each other in a longitudinal direction of the inner edge protecting element 11.

**[0056]** Fig. 3 illustrates at 101 an inner edge protecting element 11, such as a planar metal sheet or strip. At 102, an inner edge protecting element 11 is shown which includes a bend 11C in the longitudinal direction of the element 11. The bend 11C may define two portions, that is the first 12A and the second 12B portion, of the element 11. The inner edge protecting elements 11 shown at 101 and 102 are optional and may merely show two stages of producing the inner edge protecting element 11. This is illustrated by the arrows between the stages pointing from left to right. However, at 103 is shown a preferable embodiment of the inner edge protecting element 11. As can be seen, the inner edge protecting element 11 has been arranged to conform or to have a corresponding shape with respect to the shape of the inner edge IE1, IE2 of the coil 10.

**[0057]** Figure 4 illustrates schematically an inner edge protector 13 according to an embodiment of the present invention. Fig. 4 illustrates, at 111, an inner edge protecting element 11 according to an embodiment having two portions 12C, 12D to be arranged overlapped with respect to each other as shown at 112. At 112, the inner edge protecting element 11 has substantially a closed shape having a first diameter D, such as defined by the first portion 12A of the inner edge protecting element 11. Furthermore, Fig. 4 illustrates, at 113, the inner edge protector 13. The inner edge protector 13 has been provided by mechanically securing at the overlapping portions 12C, 12D of the inner edge protecting element 11 by, for example, welding, such as spot welding, or riveting the overlapping portions to each other at position 13A. However, instead of riveting, the overlapping portions may be coupled or secured by a nut and bolt, or by other mechanical securing means. Furthermore, instead of welding at the position 13A, the securing may alternatively or in addition be performed at position 13B, for instance.

**[0058]** In some embodiments, the securing device 30 may comprise a puncher or punching device. The mechanical securing may, thus, be implemented by punching at the two overlapping portions such that the penetration of the punch through the portions or at least causing deformation of the portions, if not penetrated through, provide the mechanical securing when the two portions stick to each other due to the deformation at the corresponding positions relative to each other.

**[0059]** In some embodiments, the securing device 30 may comprise a cutting or a bending device. The mechanical securing may, thus, be implemented by cutting or bending the inner edge protecting element at the overlapping portions such that the portions become attached to each other. This may be done, for example, at the outer edge of the inner edge protecting element, such as at the second portion thereof.

**[0060]** In a further embodiment, the inner edge protecting element 11 may comprise at the overlapping portions a ratcheting mechanism, such as having a protrusion or protrusions in one of the overlapping portions, and a hole or cavity or holes or cavities in the other one of the overlapping portions at corresponding positions. The protrusion(s) and the hole(s) may, advantageously, be arranged such that when coupled to each other, the inner edge protecting element 11 locks, or mechanically secures, into the desired position to protect the inner edge IE1, IE2, and thus forms the inner edge protector 13.

**[0061]** Figure 5 illustrates schematically a coil or roll packing arrangement 100 according to an embodiment

of the present invention. The coil packing arrangement 100 may comprise a coil or roll packing machine 40. The coil or roll packing machine 40 may comprise a robot 42 and a securing device 44. The robot 42 may be configured at least to arrange a portion, such as the first portion 12A, of an inner edge protecting element 11 into an inner space ISP at an end of an inner surface IS of a coil 10. The robot 42 may further be configured to increase the first diameter D so that at least part of the portion, such as the first portion 12A, becomes in contact with the inner surface IS of the coil 10. Furthermore, the securing device may be configured at least to mechanically secure the inner edge protecting element 11 to provide an inner edge protector 13 secured into the inner space ISP and arranged along and in contact with an inner edge IE1, IE2 of the coil 10.

**[0062]** Furthermore, the arrangement 100 may comprise a control unit 150 configured to control the operation of the arrangement 100, such as the arranging of the inner edge protecting element 11 into the inner space ISP of the coil 10. The control unit 150 may, preferably, be in communication connection with various devices of the arrangement 100.

**[0063]** The control unit 150 may comprise one or more processors, one or more memories being volatile or non-volatile for storing portions of computer program code and any data values and possibly one or more user interface units. The mentioned elements may be communicatively coupled to each other with e.g. an internal bus.

**[0064]** The processor of the control unit 150 may at least be configured to implement at least some operational steps as described herein with respect to the arrangement and methods. The implementation of the methods may be achieved by arranging the processor to execute at least some portion of computer program code stored in the memory causing the processor, and thus the control unit 150, to implement one or more method steps to be described hereinlater. The processor may thus be arranged to access the memory and retrieve and store any information therefrom and thereto. For sake of clarity, the processor herein refers to any unit suitable for processing information and control the operation of the control unit 150, among other tasks. The operations may also be implemented with a microcontroller solution with embedded software. Similarly, the memory is not limited to a certain type of memory only, but any memory type suitable for storing the described pieces of information may be applied in the context of the present invention.

**[0065]** The control unit 150 may comprise a communication interface to which external units may be connected to. External unit may comprise wireless connection or a connection by a wired manner. The communication interface may provide interface for communication with external units such as the elevator car, the electric motor, the doors of the landing floors, or the electrical drive to the elevator control unit. There may also be connecting to the external system, such as a laptop or a handheld device. There may also be a connection to a database of the elevator or an external database including information used in controlling the operation of the elevator.

**[0066]** Optionally, the coil or roll packing arrangement 100 may comprise a squeezing device 30 configured to reduce the first diameter D to be less than an inner diameter D1 of the coil 10 by pushing the inner edge protecting element 11 from outside with respect to the closed shape. The robot 42 may additionally be configured to fetch and grab the inner edge protecting element 11 from the squeezing device 30. The squeezing device 30 may further be configured to bend the inner edge protecting element 11 to include two portions 12A, 12B, and to form the edge protecting element 11 to conform or to have a corresponding shape with respect to the shape of the inner edge IE1, IE2 of the coil 10, such as shown at 103 in Fig. 3.

**[0067]** Optionally, the coil or roll packing arrangement 100 may comprise an inner edge protecting element manufacturing device 20. The inner edge protecting element manufacturing device 20 may be configured to manufacture an inner edge protecting element 11 such as shown at 101 in Fig. 3, such as, a planar metal sheet or strip. The inner edge protecting element manufacturing device 20 may also be arranged to provide the inner edge protecting element 11 to the squeezing device 30.

**[0068]** In some embodiments, the robot 42 may be further configured to fetch a header 14 from a header storage 60. The header 14 may be configured to be fetch such that it is arranged around the inner edge protecting element 11 held by the robot 42. Therefore, the inner edge protecting element 11 and the header 14 may be substantially simultaneously arranged on the coil 10.

**[0069]** Optionally, the coil or roll packing arrangement 100 may comprise an adhesion machine 50. The adhesion machine 50 may comprise an adhesion head 52 and a main unit 51, such as including the adhesive. The robot 42 may be further configured to move the header 14 in contact with the adhesion head 52 for applying adhesive on the header 14. The header 14 may, thus, be adhered to the side surface SS1, SS2 of the coil 10.

**[0070]** The inner edge protecting element manufacturing device 20 may further be arranged to form the planar inner edge protecting element 11 to substantially conform or to have a corresponding shape with respect to the shape of the inner edge IE1, IE2 of the coil 10 prior to being bend. This is shown in Fig. 5 in which the planar strip has a spiral-like shape at the inner edge protecting element manufacturing device 20. The inner edge protecting element manufacturing device 20 may further be configured to cut the inner edge protecting element 11 to desired length.

**[0071]** Figure 6 illustrates schematically a coil or roll packing arrangement 40 according to an embodiment of the present invention. As can be seen, the coil or roll packing machine 40 may be configured to fetch the inner edge protecting element 11 from the squeezing device

30.

**[0072]** Figure 7 illustrates schematically a coil or roll packing machine 40 according to an embodiment of the present invention. The robot 42 may comprise spreading elements 46, and the robot 42 may be configured to increase the first diameter D of the inner edge protecting element 11 by pushing the inner edge protecting element 11 at a plurality of different positions towards the inner surface IS (not shown in Fig. 6) by the spreading elements 46. The robot may also comprise gripping elements 48, such as claws. In one preferable embodiment, the spreading elements 46 may be elastic or comprise elastic coupling with respect to the robot 42, such as by a spring or spring-like element. The coil or roll packing machine 40 may also comprise a securing device 44, such as a welding, preferably a spot welding, machine.

**[0073]** In some embodiments, the inner edge protecting element 11 may be gripped by the gripping elements 48, such as claws, comprised in the robot 42. The gripping elements 48 may be configured to support the inner edge protecting element 11 during moving of the element and maintaining the inner edge protecting element 11 in its adapted shape, such as, having a smaller first diameter D than the inner diameter D1 of the coil 10.

**[0074]** Figure 8 illustrates schematically a coil or roll packing machine 40 of Fig. 7 by a cutaway view.

**[0075]** Figure 9 illustrates schematically a coil or roll packing machine 40 by a cross-sectional view according to an embodiment of the present invention. As can be seen, the coil or roll packing machine 40 may be configured to arrange at least a portion of the adapted inner edge protecting element 11, that is having smaller diameter than the inner diameter D1 of the coil 10, into the inner space ISP at the end of the inner surface IS.

**[0076]** In the embodiment of Fig. 9, the adapted inner edge protecting element 11 is not be arranged into the inner space ISP completely in order have space for one of the electrodes 49 of the welding machine between the machine 40 and the coil 10.

**[0077]** As can further be seen from Fig. 9, a part of the adapted inner edge protecting element 11, that is the part including the overlapping portions 12C, 12D, may be arranged between the electrodes 49 for mechanical securing after increasing, by the coil or roll packing machine 40, particularly the spreading elements 46 thereof, the first diameter D so that at least part of said portion, such as the first portion 12A, of the adapted inner edge protecting 11 in the inner space ISP becomes in contact with the inner surface IS. In Fig. 10, which illustrates schematically a coil or roll packing machine by a cross-sectional view according to an embodiment of the present invention, the inner edge protecting element 11 has been shown with increased diameter D so as to become in contact with the inner surface IS.

**[0078]** In various embodiments, the coil or roll packing machine 40 is configured to maintain the force used to increase the first diameter D during the securing. This further improves the coupling between the inner edge protector 13 and the inner surface IS of the coil 10.

**[0079]** After mechanical securing, the inner edge protecting element 11 is an inner edge protector 13 being secured into the inner space ISP and arranged along and in contact with the inner edge IE1, IE2.

**[0080]** Said portion inner edge protector 13, such as the first portion 12A, may then, after the securing device 44 has been removed, pushed completely into the inner space ISP. In some embodiments, the second portion 12B may then become in contact with the side surface SS1, SS2 of the coil 10.

**[0081]** Figure 11 illustrates schematically a coil or roll packing machine 40 by a cutaway view according to an embodiment of the present invention. In Fig. 11, the mechanisms for moving the spreading elements 46 according to some embodiments are shown. The mechanisms may utilize, for example, hydraulics for moving the spreading elements 46. Furthermore, Fig. 11 illustrates pushing elements 47 arranged to push the inner edge protector 13 into the inner space ISP. There may be plurality of pushing elements 47 in the coil or roll packing machine 40. In an embodiment, the securing device 44 also includes a pushing element 47.

**[0082]** In various embodiments, there may be inner body packaging material 16 inside the inner space ISP. The first diameter D of the inner edge protecting element 11 may be configured to be increased such that the inner body packaging material 16 becomes trapped between the inner edge protecting element 11 and the inner surface IS of the coil 10.

**[0083]** Figure 12 illustrates schematically a coil or roll packing machine 40 of Fig. 11 from a perspective. In Fig. 12, the inner edge protector 13 has been provided after increasing its diameter by the robot 42 and securing it by the securing device 44.

**[0084]** Figure 13 illustrates schematically a coil or roll packing machine 40 according to an embodiment of the present invention. The coil or roll packing machine 40 has been arranged to insert the inner edge protector 13 into the inner space ISP of the coil 10. There may or may not be a header 14 attached to the side surface SS1, SS2 of the coil 10.

**[0085]** Figure 14 illustrates schematically a securing device 44 according to an embodiment of the present invention. Figure 15 illustrates schematically the securing device 44 of Fig. 14 by a cross-sectional view. The securing device 44 in Figs. 14 and 15 is a spot welding device. The spot welding device may comprise hydraulics means, such as including hydraulic cylinders 81 for moving the electrodes and pushing element 47 towards the coil 10 when inserting the inner edge protecting element 11 and/or the inner edge protector 13 into the inner space ISP. There may further be other hydraulics means, such as including other hydraulic cylinders 82, arranged to move the welding device, or at least part thereof including the electrodes 49, in the vertical direction or parallel to the side surface SS1, SS2 of the coil 10. Still further, the securing device 44 may comprise powering

means 83 for providing electrical power or hydraulic oil, for instance.

**[0086]** Figure 16 illustrates schematically a coil or roll packing system 300 according to an embodiment of the present invention. The coil packing system 300 may, preferably, be at least partly automatic or even fully automatic.

**[0087]** According to various embodiments, a coil or roll packing system 300 may comprise at least one or a plurality of stations 200-205. At least one 200 of the stations 200-205 may, preferably, comprise a coil or roll packing arrangement 100 according to some embodiment of the present invention, for example, as shown in Fig. 5.

**[0088]** In an embodiment, there may be at least two stations 200, 204. Other one 204 of the stations may comprise an inner body machine which is configured to arranged inner body packaging material 16 into the inner space ISP of the coil 10 defined by the inner surface IS.

**[0089]** The plurality of station 200-205 may be connected to each other by a coil car track 215. The track 215 may, preferably, extend through the plurality of stations 200-205 such that the coil or roll 10 may be moved through all of the stations 200-205 by the coil car 210, preferably, in automated or at least remote controlled manner.

**[0090]** The plurality of stations 200-205 may include, for example, in the first station 201, an entry sand and a measuring gate. In the entry sand and measuring gate, the coil 10 may be measured, such as its weight and dimensions. The second station 202 may include a plastic inner surface protecting machine in which a plastic inner surface protector may be arranged onto the inner surface IS. The third station 203 may comprise an eye wrapper machine which provides protective layer against corrosion such as by winding the material through the inner space ISP. This may include using plastic and paper sheet or films. Furthermore, at the third station the outer edge OE1, OE2 of the coil 10 may be protected by a edge protector 18, such as of plastic. At the fourth station 204, mechanical protectors may be arranged onto the outer surface OS of the coil 10.

**[0091]** Then the system 300 may comprise the station including the arrangement 100 according to some embodiment of the present invention as described hereinbefore.

**[0092]** Still further, the system 300 may comprise, at the fifth station 205, a bodystrap-per machine which may provide band strips through the inner space IS and around the coil 10, and/or around the outer surface OS.

**[0093]** According to various embodiments, the system 300 may further comprise stations in which packaging material is provided to protect the coil 10. These may be such as known to a person skilled in the art.

**[0094]** Figure 17 illustrates a flow diagram of a method according to an embodiment of the present invention. The method may be implemented by utilizing the control unit 150 and/or the arrangements 100, such as the devices and/or machines, described hereinbefore.

**[0095]** Item 1000 in Fig. 16 may refer to a start-up phase of the method. Suitable equipment, devices, and/or machines, such as a coil or roll packing machine, and components and subsystems are obtained, and systems assembled and configured for operation.

**[0096]** Item 1010 may refer to providing the coil 10 comprising an inner edge IE1, IE2 defined by an inner surface IS of the coil 10, wherein the inner edge IE1, IE2 defines an inner diameter D1 of the coil 10 and the inner surface IS defines an inner space ISP of the coil 10.

**[0097]** Item 1020 may refer to providing an inner edge protecting element 11 comprising a first end 11A and a second end 11B, wherein said ends are opposite ends with respect to each other in a longitudinal direction of the inner edge protecting element 11.

**[0098]** In various embodiments, the inner edge protecting element 11 may include at least two portions 12A, 12B, the first portion and the second portion, separated by a bend 11C in a longitudinal direction of the element 11. Thus, the inner edge protecting element 11 may have a cross-section having L-shape or the like, in case of a right angle at the bend 11C. The angle may differ from the right angle, however, be in the range of 60 to 120 degrees, advantageously 70 to 110 degrees or more advantageously 80 to 100 degrees, or the even more advantageously 85 to 95 degrees.

**[0099]** In some embodiments, the cross-section of the first portion 12A of the inner edge protecting element 11 may, preferably, be straight in order to conform with the inner surface IS of the coil 10 when being arranged in contact with the inner surface IS. However, the shape of the cross-section of the second portion 12B may vary.

**[0100]** In various embodiments, the method may comprise arranging the inner edge protecting element 11 to a squeezing device 30 and reducing the first diameter D to be less than the inner diameter D1 by the squeezing device 30 by pushing the inner edge protecting element 11 from outside with respect to the closed shape.

**[0101]** In some embodiments, the method may comprise gripping the inner edge protecting element 11 by gripping elements 48, such as claws, comprised in the coil or roll packing machine 40, wherein the gripping elements 48 may be configured to support the inner edge protecting element 11 during moving of the element 11.

**[0102]** Item 1030 may refer to adapting the inner edge protecting element 11 to overlap at two portions 12C, 12D of the inner edge protecting element 11, thereby forming substantially a closed shape having a first diameter D.

**[0103]** In various embodiments, the method may comprise arranging the first diameter D to be less than the inner diameter D1 so that the portion, such as the first portion 12A, of the inner edge protecting element 11 fits into the inner space ISP.

**[0104]** In various embodiments, the method may comprise arranging the two portions 12C, 12D of the inner edge protecting element 11 to a first position in the squeezing device 30. Furthermore, the method may com-

prise gripping the inner edge protecting element 11 by the gripping elements 48 comprised in the coil or roll packing machine 40 such that the first position corresponds to a position of the securing device 44.

**[0105]** Item 1040 may refer to arranging, by a coil or roll packing machine 40, a portion, such as the first portion 12A, of the adapted inner edge protecting element 11 into the inner space ISP at the end of the inner surface IS.

**[0106]** In various embodiments, the portion of the adapted inner edge protecting element 11 arranged into the inner space ISP may be the first portion 12A in which case the second portion 12B may become in contact with a side surface SS1, Ss2 of the coil 10.

**[0107]** Item 1050 may refer to increasing, by the coil or roll packing machine 40, the first diameter D so that at least part of the portion, such as the first portion 12A, of the adapted inner edge protecting 11 becomes in contact with the inner surface IS.

**[0108]** In various embodiments, the increasing of the first diameter D may comprise pushing the inner edge protecting element 11 at a plurality of different positions towards the inner surface IS by spreading elements 46 comprised in the coil or roll packing machine 40, such as in the robot 42.

**[0109]** In various embodiments, the method may comprise maintaining by the coil or roll packing machine 40 the force used to increase the first diameter D during securing 1060. This further improves the coupling between the inner edge protector 13 and the inner surface IS of the coil 10.

**[0110]** Item 1060 may refer to mechanically securing, by the coil or roll packing machine 40, the inner edge protecting element 11 at the two portions 12C, 12D to provide an inner edge protector 13 secured into the inner space IS and arranged along and in contact with the inner edge IE1, IE2.

**[0111]** In various embodiments, the securing device 44 may comprise a welding device, such as a spot welding device. In these embodiments, the method may comprise welding, such as spot welding, by the welding device, the two portions 12C, 12D of the inner edge protecting element 11 to each other, thereby mechanically securing the inner edge protecting element 11.

**[0112]** In various other embodiments, the securing device 44 may comprise a riveting device. In these embodiments, the method may comprise securing, by the riveting device, the two portions 12C, 12D of the inner edge protecting element 11 to each other, thereby mechanically securing the inner edge protecting element 11.

**[0113]** In some embodiments, the method may comprise, after the mechanical securing 1060, pushing, by the coil or roll packing machine 40, the inner edge protector 13 to be in contact with a side surface SS1, SS2 of the coil 10.

**[0114]** In various embodiments, the method may comprise arranging a header 14 around the adapted inner edge protecting element 11 and arranging the header 14 onto a side surface SS1, SS2 of the coil 10.

**[0115]** Method execution is stopped at item 1099. The inner edge protector 13 has been arranged to protect the inner edge IE1, IE2 of the coil 10.

**[0116]** The specific examples provided in the description given above should not be construed as limiting the applicability and/or the interpretation of the appended claims. Lists and groups of examples provided in the description given above are not exhaustive unless otherwise explicitly stated.

## Claims

**1.** A method for packing a coil or roll (10), the method comprising:

providing (1010) the coil or roll (10) comprising an inner edge (IE1, IE2) defined by an inner surface (IS) of the coil or roll (10), wherein the inner edge (IE1, IE2) defines an inner diameter (D1) of the coil or roll (10) and the inner surface (IS) defines an inner space (ISP) of the coil or roll (10);

providing (1020) an inner edge protecting element (11) comprising a first end (11A) and a second end (11B), wherein said ends (11A, 11B) are opposite ends with respect to each other in a longitudinal direction of the inner edge protecting element (11);

adapting (1030) the inner edge protecting element (11) to overlap at two portions (12C, 12D) of the inner edge protecting element (11), thereby forming substantially a closed shape having a first diameter (D);

arranging (1040), by a coil or roll packing machine (40), a portion of the adapted inner edge protecting element (11) into the inner space (ISP) at the end of the inner surface (IS);

increasing (1050), by the coil or roll packing machine (40), the first diameter (D) so that at least part of the portion of the adapted inner edge protecting element (11) becomes in contact with the inner surface (IS);

**characterized in that** the method further comprises mechanically securing (1060), by the coil or roll packing machine (40), the inner edge protecting element (11) at the two portions to provide an inner edge protector (13) secured into the inner space (ISP) and arranged along and in contact with the inner edge (IE1, IE2), wherein the mechanically securing comprises attaching the two portions (12C, 12D) to each other by the coil or roll packing machine (40), thereby fixing the increased first diameter (D).

**2.** The method according to claim 1, comprising: arranging the first diameter (D) to be less than the inner

diameter (D1) so that the portion of the inner edge protecting element (11) fits into the inner space (ISP).

**3.** The method according to claim 1 or 2, wherein a securing device (44) of the coil or roll packing machine (40) comprises a welding device, and wherein the method comprises:
welding, by the welding device, the two portions (12C, of the inner edge protecting element (11) to each other, thereby mechanically securing the inner edge protecting element (11).

**4.** The method according to any one of the preceding claims, wherein the securing device comprises a riveting device, and wherein the method comprises:
securing, by the riveting device, the two portions (12C, 12D) of the inner edge protecting element (11) to each other, thereby mechanically securing the inner edge protecting element (11).

**5.** The method according to any one of the preceding claims, the method comprising
gripping the inner edge protecting element (11) by gripping elements (48) comprised in the coil or roll packing machine (40), wherein the gripping elements (48) are configured to support the inner edge protecting element (11) during moving.

**6.** The method according to any one of the preceding claims, wherein the increasing of the first diameter (D) comprises
pushing the inner edge protecting element (11) at a plurality of different positions towards the inner surface (IS) by spreading elements (46) comprised in the coil or roll packing machine (40).

**7.** The method according to any one of the preceding claims, comprising

arranging the inner edge protecting element (11) to a squeezing device (30),
reducing the first diameter (D) to be less than the inner diameter (D1) by the squeezing device (30) by pushing the inner edge protecting element (11) from outside with respect to the closed shape.

**8.** The method according to claim 7, comprising

arranging the two portions (12A, 12B) of the inner edge protecting element (11) to a first position in the squeezing device (30), and
gripping the inner edge protecting element (11) by the gripping elements (48) comprised in the coil or roll packing machine (40) such that the first position corresponds to a position of the securing device (44).

**9.** The method according to any one of the preceding claims, comprising, after the mechanical securing (1060),
pushing, by the coil or roll packing machine (40), the inner edge protector (13) to be in contact with a side surface (SS1, SS2) of the coil or roll (10).

**10.** The method according to any one of the preceding claims, comprising

arranging a header (14) or side cover (14) around the adapted inner edge protecting element (11), and
arranging the header (14) or side cover (14) onto a side surface (SS1, SS2) of the coil or roll (10).

**11.** A coil or roll packing arrangement (100) comprising:
a coil or roll packing machine (40) comprising a robot (42) for handling an inner edge protecting element (11), and a securing device (44), wherein the robot (42) is configured to:

- arrange (1040) a portion of the inner edge protecting element (11) into an inner space (ISP) at an end of an inner surface (IS) of a coil or roll (10), wherein the inner edge protecting element (11) comprises two overlapping portions (12A, 12B), thereby forming substantially a closed shape having a first diameter (D),
- increase (1050) the first diameter (D) so that at least part of the portion becomes in contact with the inner surface (IS); **characterized in that** the securing device (44) is configured to:

- mechanically secure (1060) the inner edge protecting element (11) at the two overlapping portions (12A, 12B) to provide an inner edge protector (13) secured into the inner space (ISP) and arranged along and in contact with an inner edge (IE1, IE2) of the coil or roll (10), wherein the mechanically securing comprises attaching the two overlapping portions (12A, 12B) to each other by the securing device (44), thereby fixing the increased first diameter (D).

**12.** The coil or roll packing arrangement (100) according to claim 11, wherein the securing device (44) is a welding device or a riveting device configured to mechanically secure the inner edge protecting element (11).

**13.** The coil or roll packing arrangement (100) according to claim 11 or 12, comprising
a squeezing device (30) configured to reduce the first diameter (D) to be less than an inner diameter (D1) of the coil or roll (10) by pushing the inner edge protecting element (11) from outside with respect to

the closed shape.

**14.** The coil or roll packing arrangement (100) according to any one of claims 11-13, wherein the robot (42) comprises spreading elements (46), and the robot (42) is configured to increase the first diameter (D) by pushing the inner edge protecting element (11) at a plurality of different positions towards the inner surface (IS) by the spreading elements (46).

**15.** A coil or roll packing system (300) comprising:
a plurality of stations (200-205), **characterized in that** one of the stations (200-205) comprises a coil or roll packing arrangement (100) according to any one of claims 11-14.

**Patentansprüche**

**1.** Verfahren zum Verpacken eines Coils oder einer Rolle (10), wobei das Verfahren Folgendes umfasst:

Bereitstellen (1010) des Coils oder der Rolle (10), das/die eine Innenkante (IE1, IE2) umfasst, die durch eine Innenfläche (IS) des Coils oder der Rolle (10) definiert ist, wobei die Innenkante (IE1, IE2) einen Innendurchmesser (D1) des Coils oder der Rolle (10) definiert und die Innenfläche (IS) einen Innenraum (ISP) des Coils oder der Rolle (10) definiert;
Bereitstellen (1020) eines Innenkantenschutzelements (11), das ein erstes Ende (11A) und ein zweites Ende (11B) umfasst, wobei die Enden (11A, 11B) entgegengesetzte Enden in Bezug zueinander in der Längsrichtung des Innenkantenschutzelements (11) sind;
Anpassen (1030) des Innenkantenschutzelements (11), sodass es an zwei Abschnitten (12C, 12D) des Innenkantenschutzelements (11) überlappt, wodurch eine im Wesentlichen geschlossene Form mit einem ersten Durchmesser (D) gebildet wird;
Anordnen (1040), mittels einer Coil- oder Rollenverpackungsmaschine (40), eines Abschnitts des angepassten Innenkantenschutzelements (11) im Innenraum (ISP) am Ende der Innenfläche (IS);
Vergrößern (1050), mittels der Coil- oder Rollenverpackungsmaschine (40), des ersten Durchmessers (D), sodass zumindest ein Teil des Abschnitts des angepassten Innenkantenschutzelements (11) in Kontakt mit der Innenfläche (IS) kommt;
**dadurch gekennzeichnet, dass** das Verfahren weiters Folgendes umfasst:
mechanisches Befestigen (1060), mittels der Coil- oder Rollenverpackungsmaschine (40), des Innenkantenschutzelements (11) an den beiden Abschnitten, um eine Innenkantenschutzvorrichtung (13) bereitzustellen, die im Innenraum (ISP) befestigt und entlang und in Kontakt mit der Innenkante (IE1, IE2) angeordnet ist, wobei das mechanische Befestigen das Anfügen der beiden Abschnitte (12C, 12D) aneinander mittels der Coil- oder Rollenverpackungsmaschine (40) umfasst, wodurch der vergrößerte erste Durchmesser (D) fixiert wird.

**2.** Verfahren nach Anspruch 1, das Folgendes umfasst:
Sicherstellen, dass der erste Durchmesser (D) kleiner als der Innendurchmesser (D1) ist, sodass der Abschnitt des Innenkantenschutzelements (11) in den Innenraum (ISP) passt.

**3.** Verfahren nach Anspruch 1 oder 2, wobei eine Befestigungsvorrichtung (44) der Coil- oder Rollenverpackungsmaschine (40) eine Schweißvorrichtung umfasst und wobei das Verfahren Folgendes umfasst:
Schweißen, mittels der Schweißvorrichtung, der beiden Abschnitte (12C, 12D) des Innenkantenschutzelements (11) aneinander, wodurch das Innenkantenschutzelement (11) mechanisch befestigt wird.

**4.** Verfahren nach einem der vorangegangenen Ansprüche, wobei die Befestigungsvorrichtung eine Nietvorrichtung umfasst und wobei das Verfahren Folgendes umfasst:
Befestigen, mittels der Nietvorrichtung, der beiden Abschnitte (12C, 12D) des Innenkantenschutzelements (11) aneinander, wodurch das Innenkantenschutzelement (11) mechanisch befestigt wird.

**5.** Verfahren nach einem der vorangegangenen Ansprüche, wobei das Verfahren Folgendes umfasst:
Greifen des Innenkantenschutzelements (11) durch Greifelemente (48), die in der Coil- oder Rollenverpackungsmaschine (40) enthalten sind, wobei die Greifelemente (48) ausgelegt sind, um das Innenkantenschutzelement (11) während einer Bewegung zu stützen.

**6.** Verfahren nach einem der vorangegangenen Ansprüche, wobei das Vergrößern des ersten Durchmessers (D) Folgendes umfasst:
Drücken des Innenkantenschutzelements (11) an einer Vielzahl von verschiedenen Positionen zur Innenfläche (IS) hin mittels Spreizelementen (46), die in der Coil- oder Rollenverpackungsmaschine (40) enthalten sind.

**7.** Verfahren nach einem der vorangegangenen Ansprüche, das Folgendes umfasst:

Anordnen des Innenkantenschutzelements (11) an einer Pressvorrichtung (30),

Verringern des ersten Durchmessers (D) auf weniger als den Innendurchmesser (D1) mittels der Pressvorrichtung (30) durch Drücken des Innenkantenschutzelements (11) von außen in Bezug auf die geschlossene Form.

**8.** Verfahren nach Anspruch 7, das Folgendes umfasst:

Anordnen der beiden Abschnitte (12A, 12B) des Innenkantenschutzelements (11) an einer ersten Position in der Pressvorrichtung (30) und Greifen des Innenkantenschutzelements (11) durch die Greifelemente (48), die in der Coil- oder Rollenverpackungsmaschine (40) enthalten sind, sodass die erste Position einer Position der Befestigungsvorrichtung (44) entspricht.

**9.** Verfahren nach einem der vorangegangenen Ansprüche, das nach dem mechanischen Befestigen (1060) Folgendes umfasst:
Drücken, mittels der Coil- oder Rollenverpackungsmaschine (40), der Innenkantenschutzvorrichtung (13) in Kontakt mit einer Seitenfläche (SS1, SS2) des Coils oder der Rolle (10).

**10.** Verfahren nach einem der vorangegangenen Ansprüche, das Folgendes umfasst:
Anordnen eine Kopfstücks (14) oder einer Seitenabdeckung (14) um das angepasste Innenkantenschutzelement (11) und Anordnen des Kopfstücks (14) oder der Seitenabdeckung (14) auf einer Seitenfläche (SS1, SS2) des Coils oder der Rolle (10).

**11.** Coil- oder Rollenverpackungsanordnung (100), die Folgendes umfasst:
eine Coil- oder Rollenverpackungsmaschine (40), die einen Roboter (42) zur Handhabung eines Innenkantenschutzelements (11) und eine Befestigungsvorrichtung (44) umfasst, wobei der Roboter (42) ausgelegt ist, um:

- einen Abschnitt des Innenkantenschutzelements (11) im Innenraum (ISP) an einem Ende einer Innenfläche (IS) eines Coils oder einer Rolle (10) anzuordnen (1040), wobei das Innenkantenschutzelement (11) zwei überlappende Abschnitte (12A, 12B) umfasst, wodurch eine im Wesentlichen geschlossene Form mit einem ersten Durchmesser (D) gebildet wird,
- den ersten Durchmesser (D) zu vergrößern (1050), sodass zumindest ein Teil des Abschnitts in Kontakt mit der Innenfläche (IS) kommt; **dadurch gekennzeichnet, dass** die Befestigungsvorrichtung (44) ausgelegt ist, um:

  - das Innenkantenschutzelement (11) an den beiden überlappenden Abschnitten (12A, 12B) mechanisch zu befestigen (1060), um eine Innenkantenschutzvorrichtung (13) bereitzustellen, die im Innenraum (ISP) befestigt und entlang und in Kontakt mit einer Innenkante (IE1, IE2) des Coils oder der Rolle (10) angeordnet ist, wobei das mechanische Befestigen das Anfügen der beiden überlappenden Abschnitte (12A, 12B) aneinander mittels der Befestigungsvorrichtung (44) umfasst, wodurch der vergrößerte erste Durchmesser (D) fixiert wird.

**12.** Coil- oder Rollenverpackungsanordnung (100) nach Anspruch 11, wobei die Befestigungsvorrichtung (44) eine Schweißvorrichtung oder eine Nietvorrichtung ist, die ausgelegt ist, um das Innenkantenschutzelement (11) mechanisch zu befestigen.

**13.** Coil- oder Rollenverpackungsanordnung (100) nach Anspruch 11 oder 12, die Folgendes umfasst:
eine Pressvorrichtung (30), die ausgelegt ist, um den ersten Durchmesser (D) auf weniger als den Innendurchmesser (D1) des Coils oder der Rolle (10) zu verkleinern, indem das Innenkantenschutzelement (11) von außen in Bezug auf die geschlossene Form gedrückt wird.

**14.** Coil- oder Rollenverpackungsanordnung (100) nach einem der Ansprüche 11-13, wobei der Roboter (42) Spreizelemente (46) umfasst und der Roboter (42) ausgelegt ist, um den ersten Durchmesser (D) durch Drücken des Innenkantenschutzelements (11) an einer Vielzahl von verschiedenen Positionen zur Innenfläche (IS) hin mittels Spreizelementen (46) zu vergrößern.

**15.** Coil- oder Rollenverpackungssystem (300), das Folgendes umfasst:
eine Vielzahl von Stationen (200-205), **dadurch gekennzeichnet, dass** eine der Stationen (200-205) eine Coil- oder Rollenverpackungsanordnung (100) nach einem der Ansprüche 11-14 umfasst.

**Revendications**

**1.** Procédé d'emballage d'une bobine ou d'un rouleau (10), le procédé comprenant :

la fourniture (1010) de la bobine ou du rouleau (10) comprenant un bord intérieur (IE1, IE2) défini par une surface intérieure (IS) de la bobine ou du rouleau (10), dans lequel le bord intérieur (IE1, IE2) définit un diamètre intérieur (D1) de la bobine ou du rouleau (10) et la surface intérieure (IS) définit un espace intérieur (ISP) de la bobine ou du rouleau (10) ;
la fourniture (1020) d'un élément de protection de bord intérieur (11) comprenant une première

extrémité (11A) et une seconde extrémité (11B), dans lequel lesdites extrémités (11A, 11B) sont des extrémités opposées l'une par rapport à l'autre dans une direction longitudinale de l'élément de protection de bord intérieur (11) ;
l'adaptation (1030) de l'élément de protection de bord intérieur (11) pour qu'il se chevauche au niveau de deux portions (12C, 12D) de l'élément de protection de bord intérieur (11), formant ainsi sensiblement une forme fermée ayant un premier diamètre (D) ;
la disposition (1040), par une machine d'emballage de bobine ou de rouleau (40), d'une portion de l'élément de protection de bord intérieur (11) adapté dans l'espace intérieur (ISP) au niveau de l'extrémité de la surface intérieure (IS) ;
l'augmentation (1050), par la machine d'emballage de bobine ou de rouleau (40), du premier diamètre (D) de sorte qu'au moins une partie de la portion de l'élément de protection de bord intérieur (11) adapté entre en contact avec la surface intérieure (IS) ;

**caractérisé en ce que** le procédé comprend en outre
l'assujettissement mécanique (1060), par la machine d'emballage de bobine ou de rouleau (40), de l'élément de protection de bord intérieur (11) au niveau des deux portions pour fournir un protecteur de bord intérieur (13) assujetti dans l'espace intérieur (ISP) et disposé le long du bord intérieur (IE1, IE2) et en contact avec celui-ci, dans lequel l'assujettissement mécanique comprend l'assujettissement des deux portions (12C, 12D) l'une à l'autre par la machine d'emballage de bobine ou de rouleau (40), fixant ainsi le premier diamètre (D) augmenté.

**2.** Procédé selon la revendication 1, comprenant :
l'agencement du premier diamètre (D) pour qu'il soit inférieur au diamètre intérieur (D1) de sorte que la portion de l'élément de protection de bord intérieur (11) s'adapte dans l'espace intérieur (ISP).

**3.** Procédé selon la revendication 1 ou 2, dans lequel un dispositif d'assujettissement (44) de la machine d'emballage de bobine ou de rouleau (40) comprend un dispositif de soudage, et dans lequel le procédé comprend :
le soudage, par le dispositif de soudage, des deux portions (12C, 12D) de l'élément de protection de bord intérieur (11) l'une à l'autre, assujettissant ainsi mécaniquement l'élément de protection de bord intérieur (11) .

**4.** Procédé selon l'une quelconque des revendications précédentes, dans lequel le dispositif d'assujettissement comprend un dispositif de rivetage, et dans lequel le procédé comprend :
l'assujettissement, par le dispositif de rivetage, des deux portions (12C, 12D) de l'élément de protection de bord intérieur (11) l'une à l'autre, assujettissant ainsi mécaniquement l'élément de protection de bord intérieur (11).

**5.** Procédé selon l'une quelconque des revendications précédentes, le procédé comprenant
la saisie de l'élément de protection de bord intérieur (11) par des éléments de préhension (48) compris dans la machine d'emballage de bobine ou de rouleau (40), dans lequel les éléments de préhension (48) sont configurés pour supporter l'élément de protection de bord intérieur (11) pendant le déplacement.

**6.** Procédé selon l'une quelconque des revendications précédentes, dans lequel l'augmentation du premier diamètre (D) comprend
le fait de pousser l'élément de protection de bord intérieur (11) à une pluralité de positions différentes vers la surface intérieure (IS) par des éléments d'écartement (46) compris dans la machine d'emballage de bobine ou de rouleau (40).

**7.** Procédé selon l'une quelconque des revendications précédentes, comprenant
la disposition de l'élément de protection de bord intérieur (11) sur un dispositif de compression (30),
la réduction du premier diamètre (D) pour qu'il soit inférieur au diamètre intérieur (D1) par le dispositif de compression (30) par poussée de l'élément de protection de bord intérieur (11) depuis l'extérieur par rapport à la forme fermée.

**8.** Procédé selon la revendication 7, comprenant

la disposition des deux portions (12A, 12B) de l'élément de protection de bord intérieur (11) dans une première position dans le dispositif de compression (30), et
la saisie de l'élément de protection de bord intérieur (11) par les éléments de préhension (48) compris dans la machine d'emballage de bobine ou de rouleau (40) de sorte que la première position correspond à une position du dispositif d'assujettissement (44).

**9.** Procédé selon l'une quelconque des revendications précédentes, comprenant, après l'assujettissement mécanique (1060),
la poussée, par la machine d'emballage de bobine ou de rouleau (40), du protecteur de bord intérieur (13) pour qu'il soit en contact avec une surface latérale (SS1, SS2) de la bobine ou du rouleau (10).

**10.** Procédé selon l'une quelconque des revendications précédentes, comprenant

la disposition d'un collecteur (14) ou d'un couvercle latéral (14) autour de l'élément de protection de bord intérieur (11) adapté, et
la disposition du collecteur (14) ou du couvercle latéral (14) sur une surface latérale (SS1, SS2) de la bobine ou du rouleau (10).

**11.** Agencement d'emballage de bobine ou de rouleau (100) comprenant :
une machine d'emballage de bobine ou de rouleau (40) comprenant un robot (42) pour manipuler un élément de protection de bord intérieur (11), et un dispositif d'assujettissement (44), dans lequel le robot (42) est configuré pour :

- disposer (1040) une portion de l'élément de protection de bord intérieur (11) dans un espace intérieur (ISP) au niveau d'une extrémité d'une surface intérieure (IS) d'une bobine ou d'un rouleau (10), dans lequel l'élément de protection de bord intérieur (11) comprend deux portions se chevauchant (12A, 12B), formant ainsi sensiblement une forme fermée ayant un premier diamètre (D),
- augmenter (1050) le premier diamètre (D) de sorte qu'au moins une partie de la portion entre en contact avec la surface intérieure (IS) ; **caractérisé en ce que** le dispositif d'assujettissement (44) est configuré pour :

- assujettir mécaniquement (1060) l'élément de protection de bord intérieur (11) au niveau des deux portions se chevauchant (12A, 12B) pour fournir un protecteur de bord intérieur (13) assujetti dans l'espace intérieur (ISP) et disposé le long d'un bord intérieur (IE1, IE2) de la bobine ou du rouleau (10) et en contact avec celui-ci, dans lequel l'assujettissement mécanique comprend l'attache des deux portions se chevauchant (12A, 12B) l'une à l'autre par le dispositif d'assujettissement (44), fixant ainsi le premier diamètre (D) augmenté.

**12.** Agencement d'emballage de bobine ou de rouleau (100) selon la revendication 11, dans lequel le dispositif d'assujettissement (44) est un dispositif de soudage ou un dispositif de rivetage configuré pour assujettir mécaniquement l'élément de protection de bord intérieur (11) .

**13.** Agencement d'emballage de bobine ou de rouleau (100) selon la revendication 11 ou 12, comprenant un dispositif de compression (30) configuré pour réduire le premier diamètre (D) afin qu'il soit inférieur à un diamètre intérieur (D1) de la bobine ou du rouleau (10) en poussant l'élément de protection de bord intérieur (11) depuis l'extérieur par rapport à la forme fermée.

**14.** Agencement d'emballage de bobine ou de rouleau (100) selon l'une quelconque des revendications 11 à 13, dans lequel le robot (42) comprend des éléments d'écartement (46), et le robot (42) est configuré pour augmenter le premier diamètre (D) en poussant l'élément de protection de bord intérieur (11) à une pluralité de positions différentes vers la surface intérieure (IS) par les éléments d'écartement (46).

**15.** Système d'emballage de bobine ou de rouleau (300) comprenant :

une pluralité de postes (200-205), **caractérisé en ce que** l'un des postes (200-205) comprend un agencement d'emballage de bobine ou de rouleau (100) selon l'une quelconque des revendications 11 à 14.

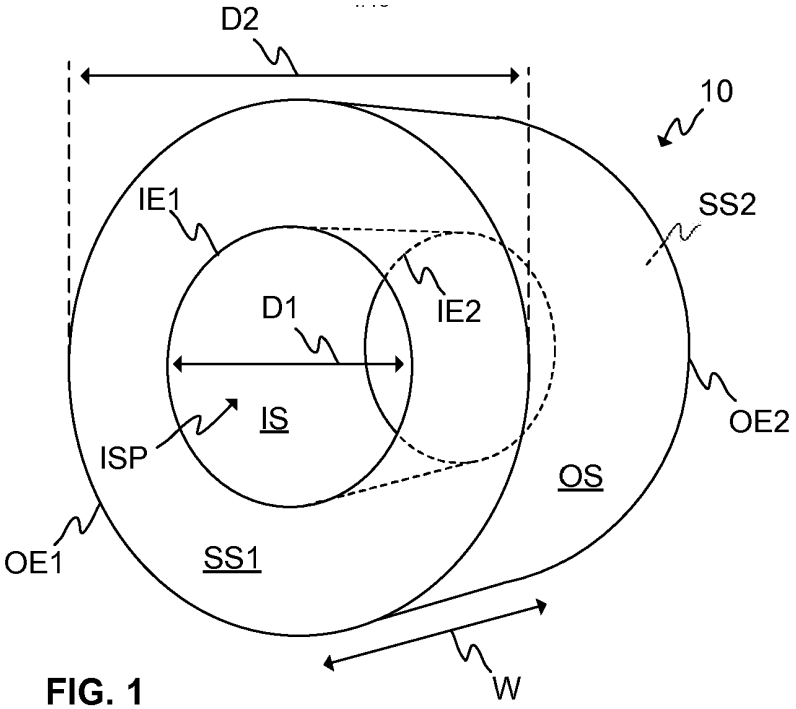


FIG. 1

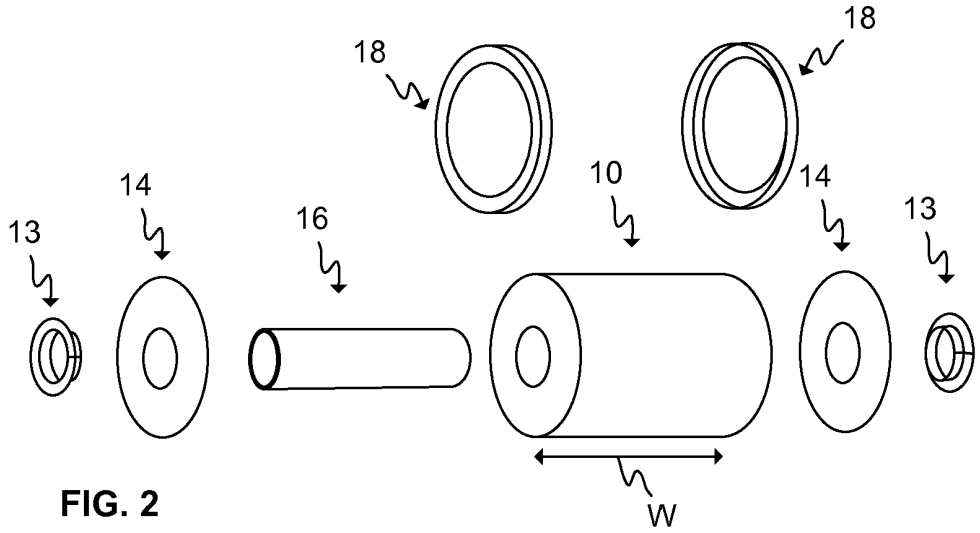


FIG. 2

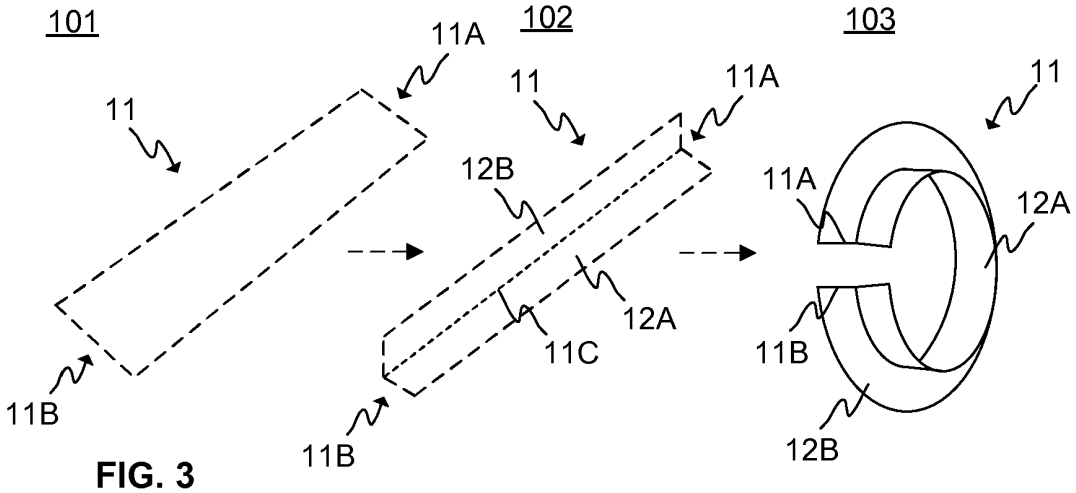


FIG. 3

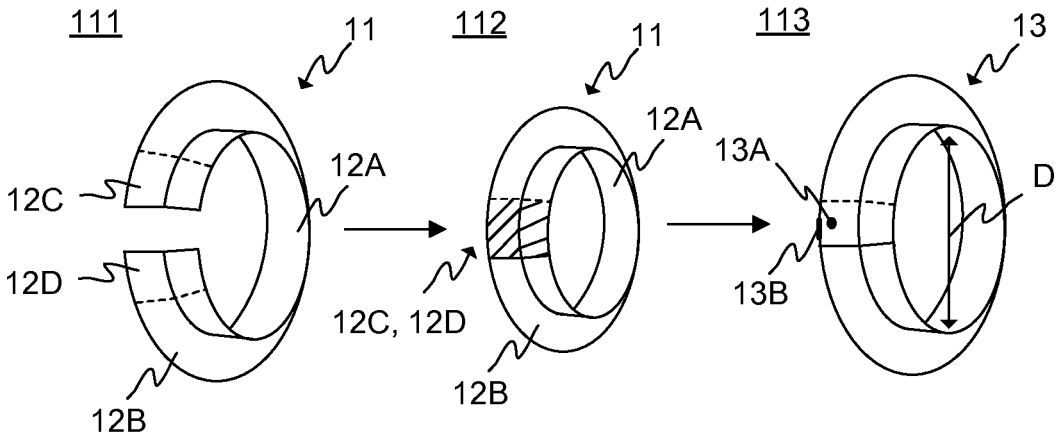
111
11
112
11
113
13
12A
12A
13A
D
12C
12D
12C, 12D
13B
12B
12B

FIG. 4

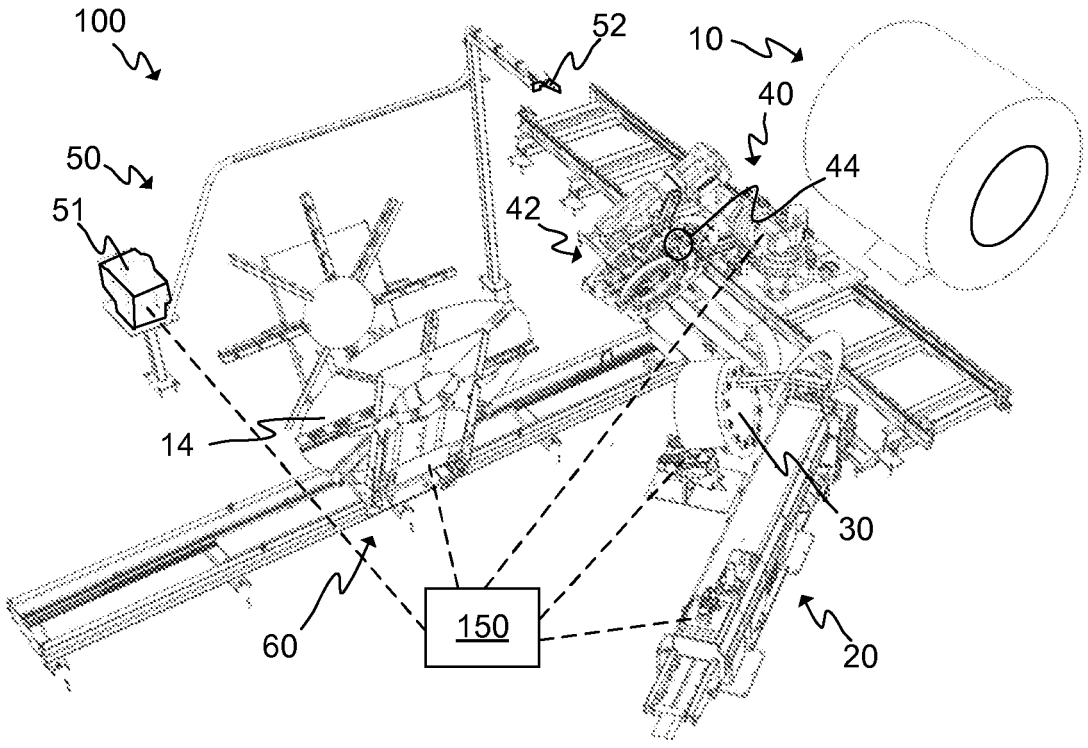
100
52
10
40
50
44
51
42
14
30
150
60
20

FIG. 5

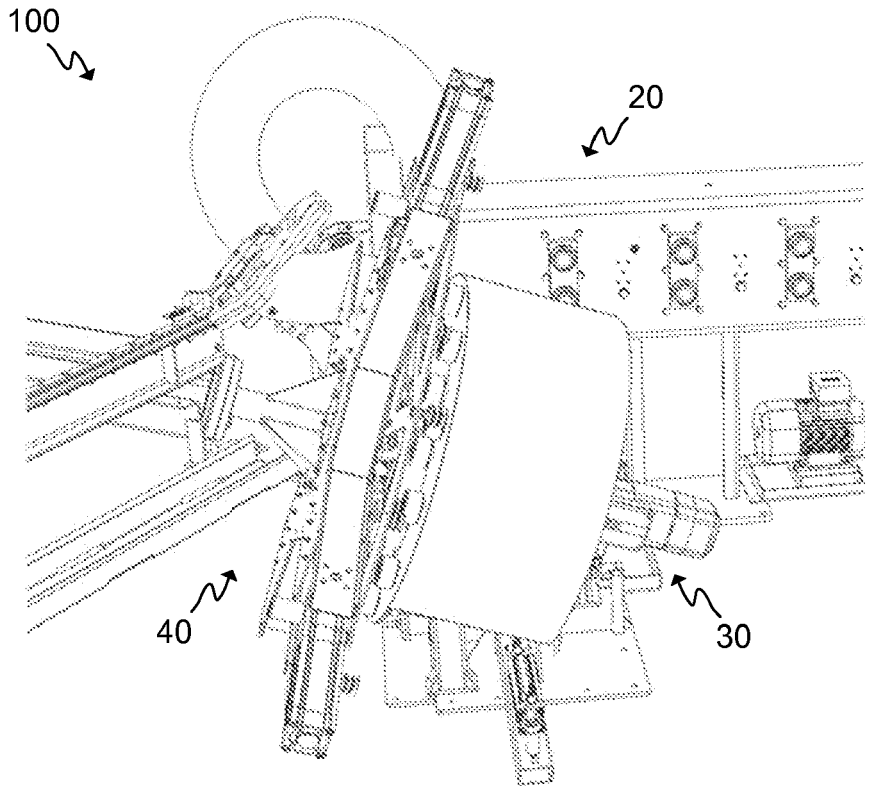


FIG. 6

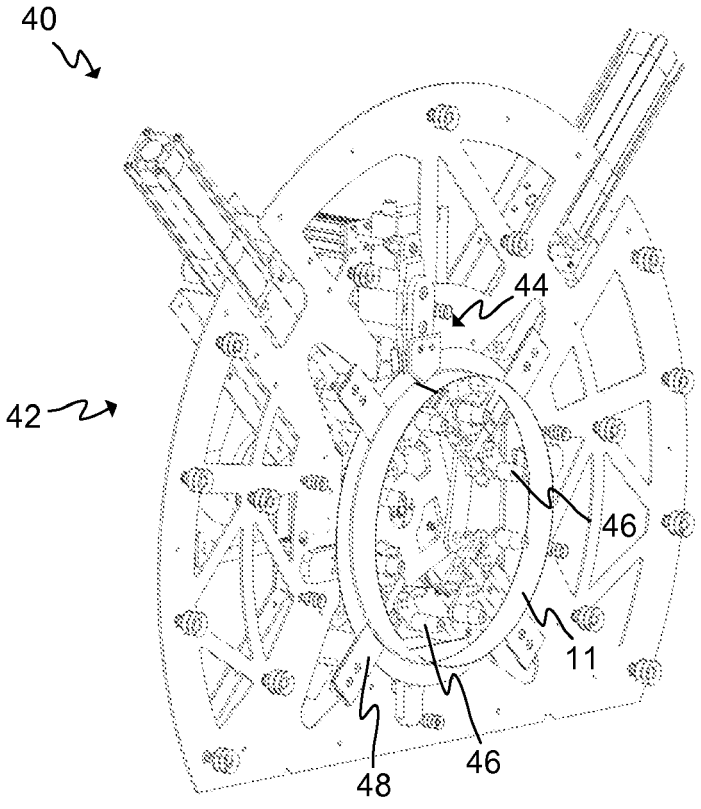


FIG. 7

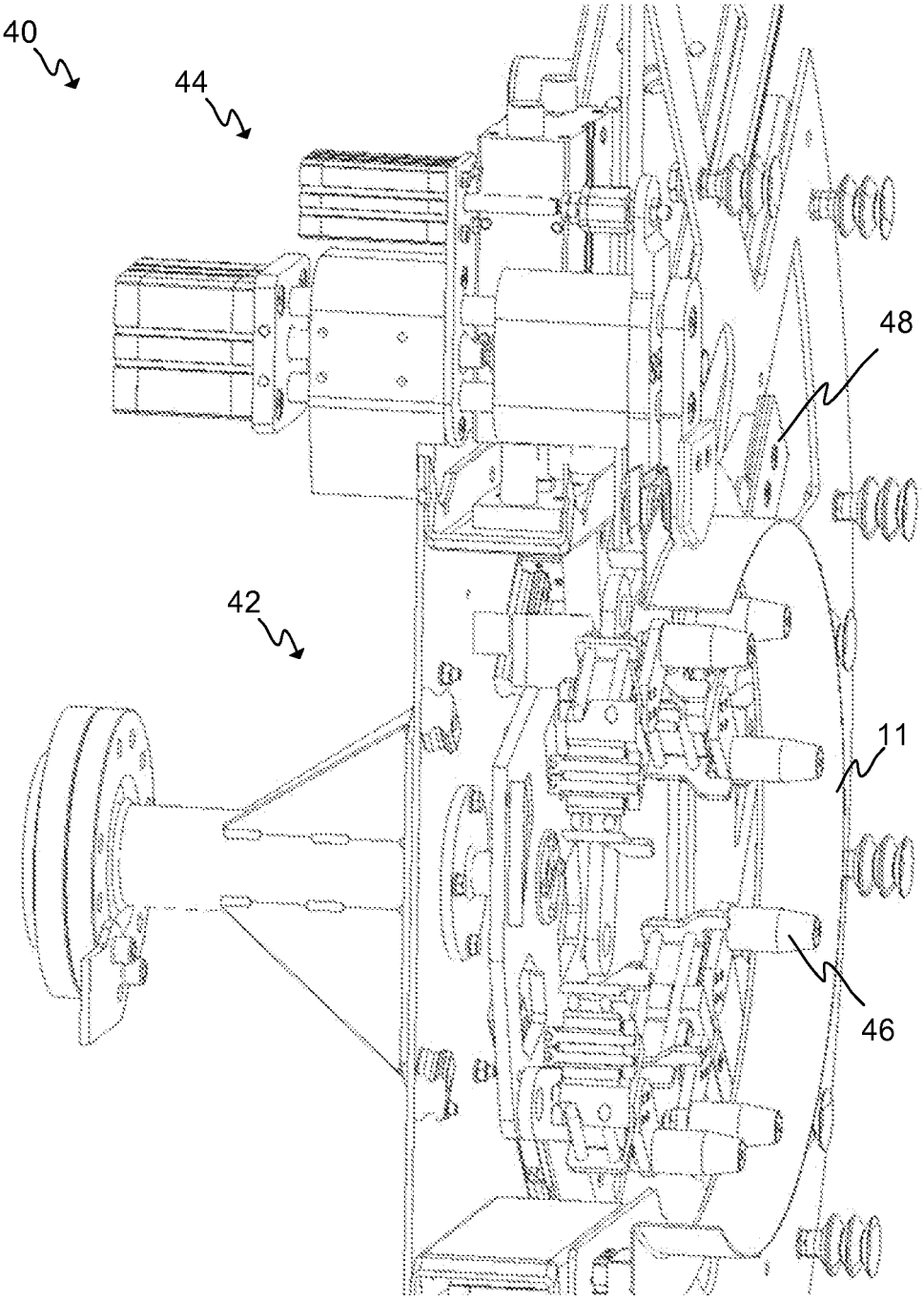


FIG. 8

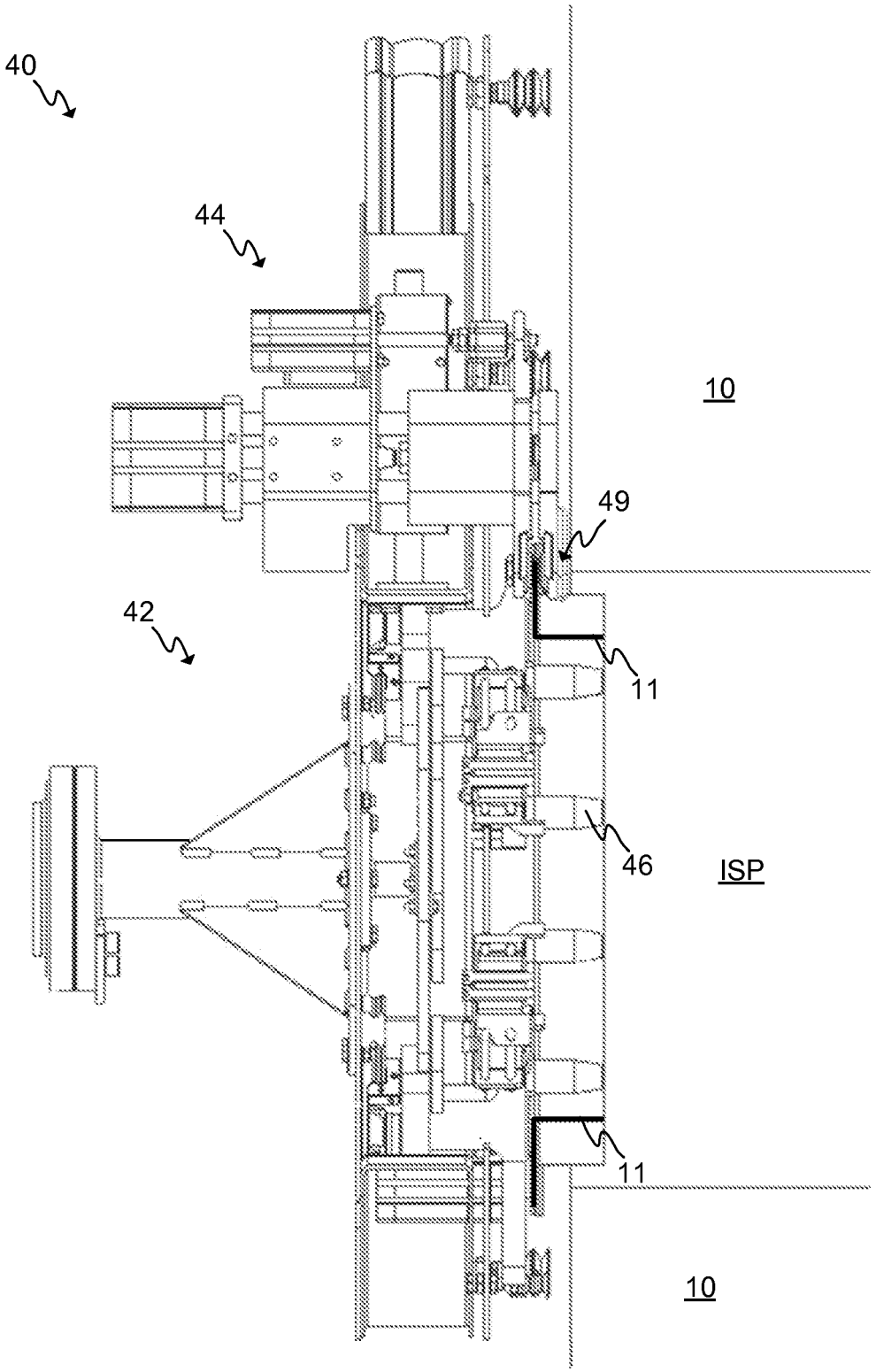


FIG. 9

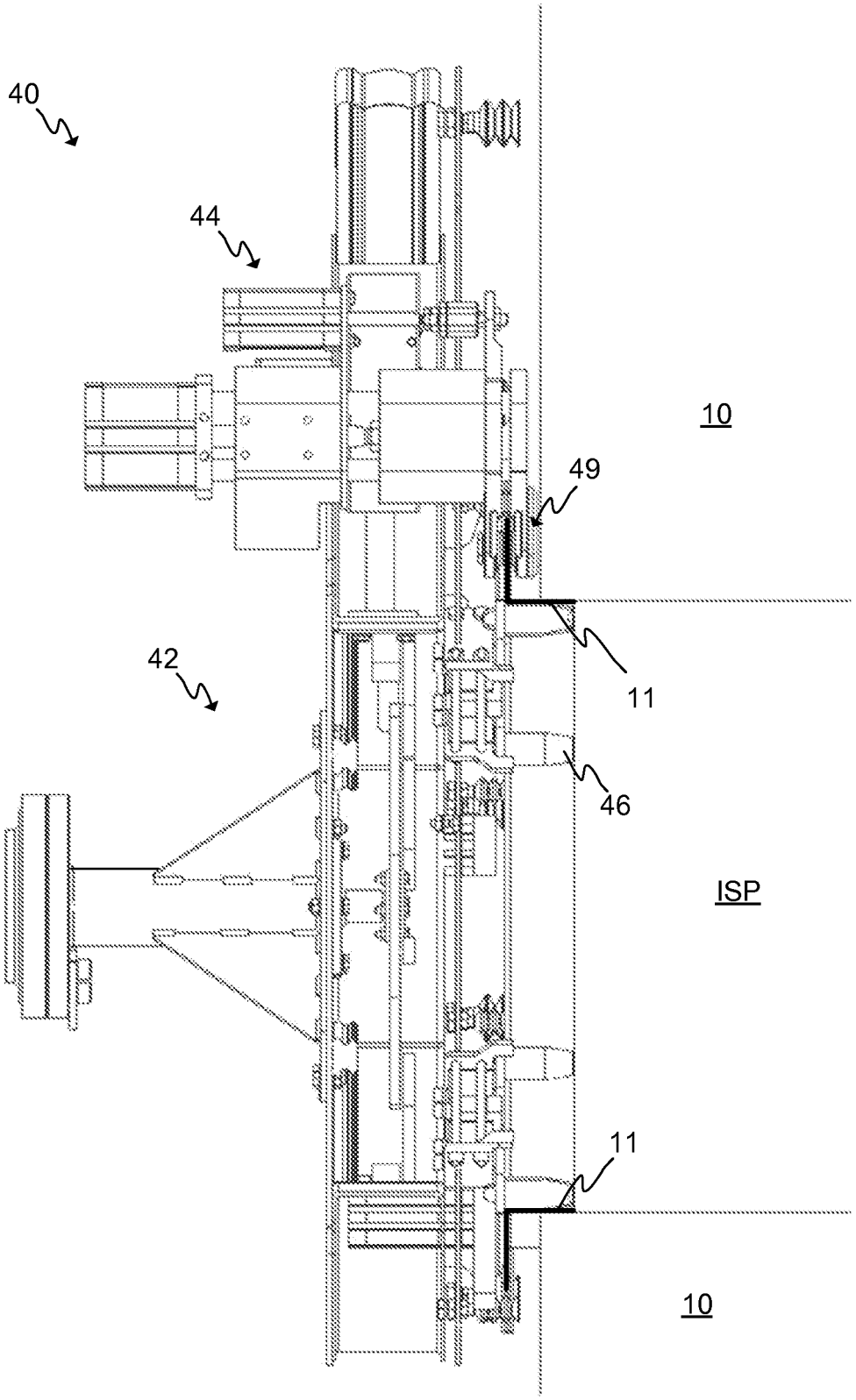


FIG. 10

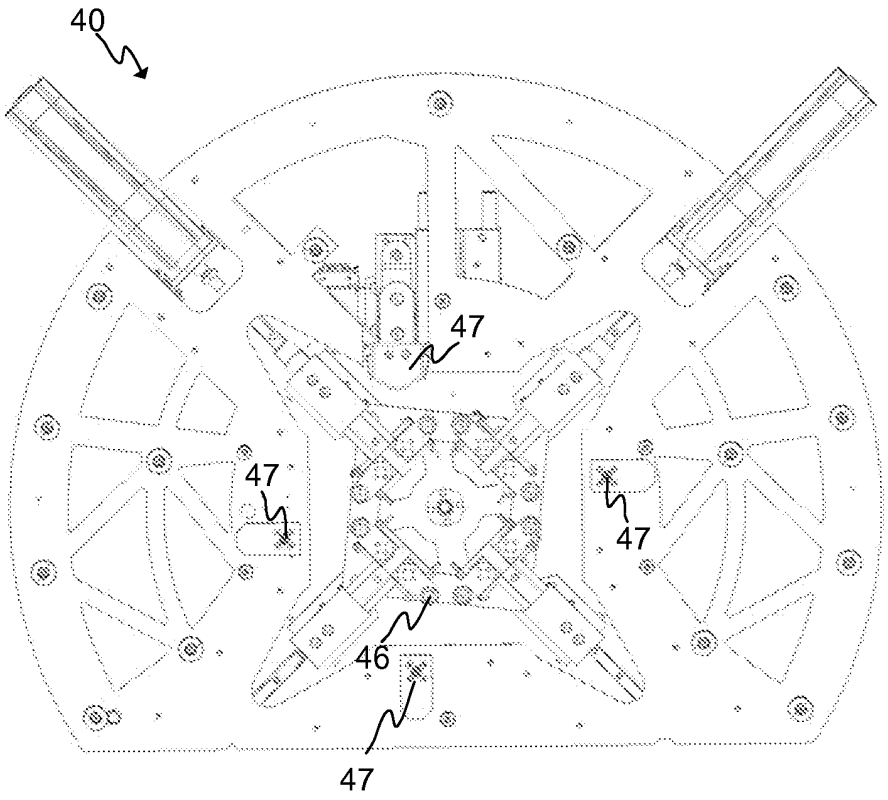


FIG. 11

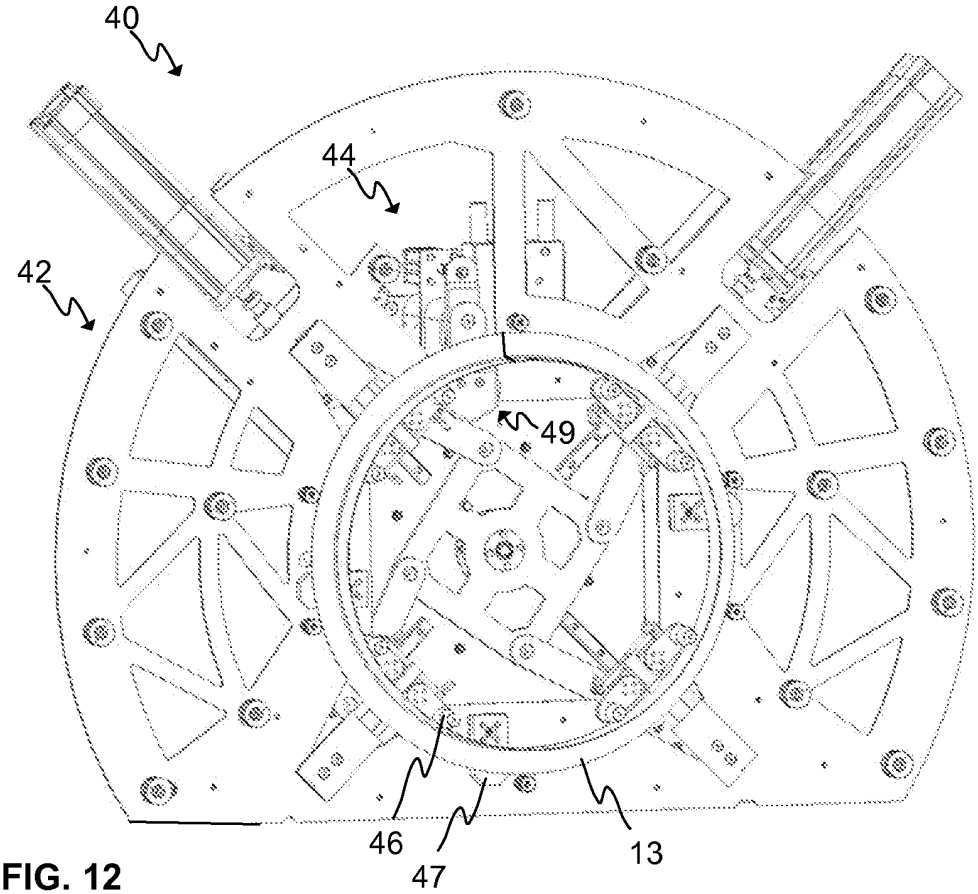


FIG. 12

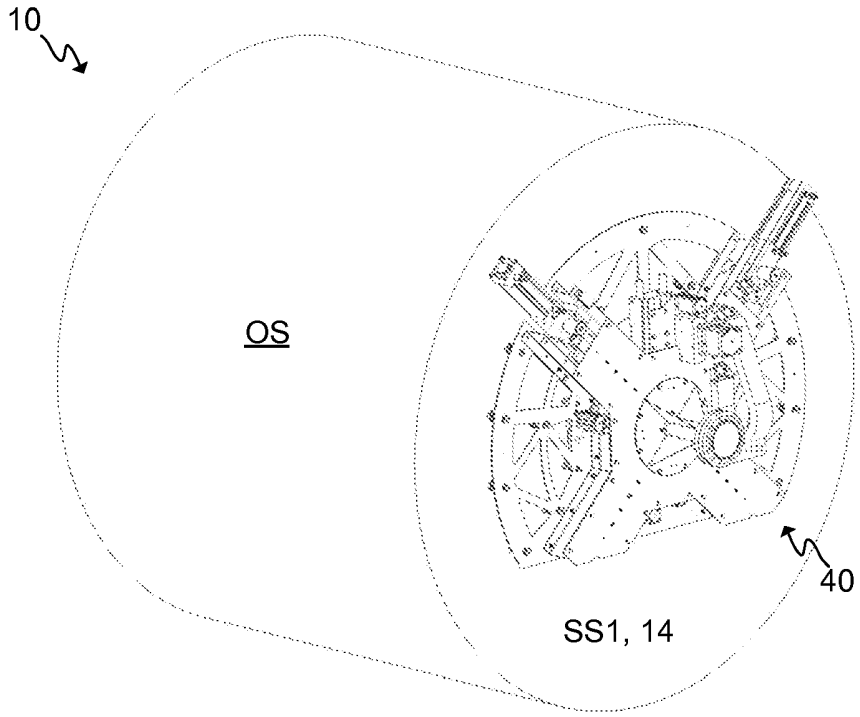


FIG. 13

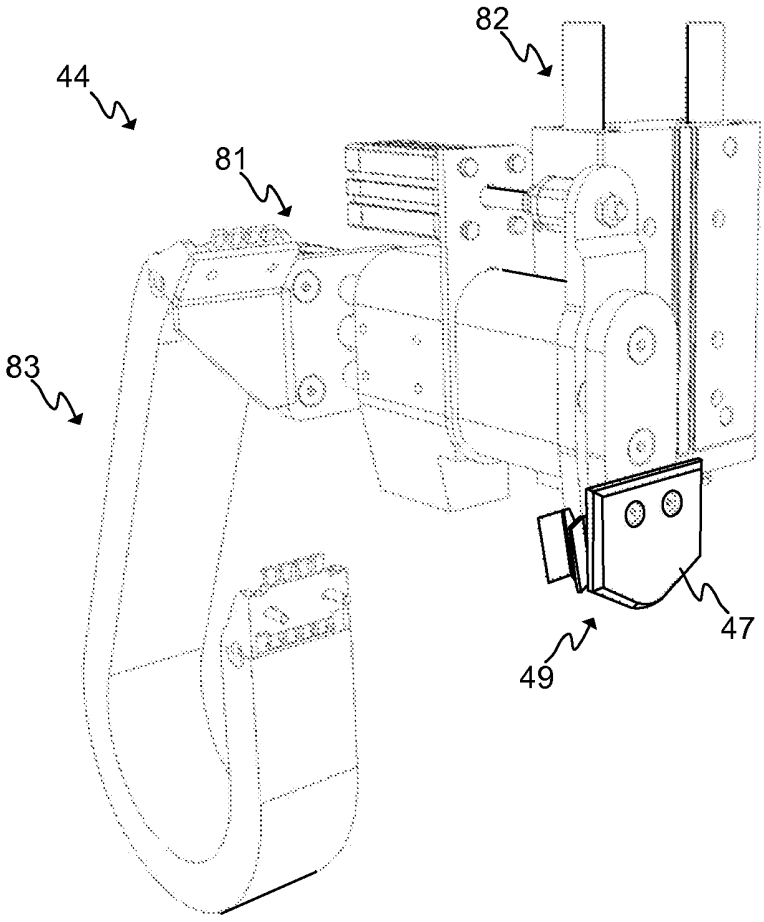


FIG. 14

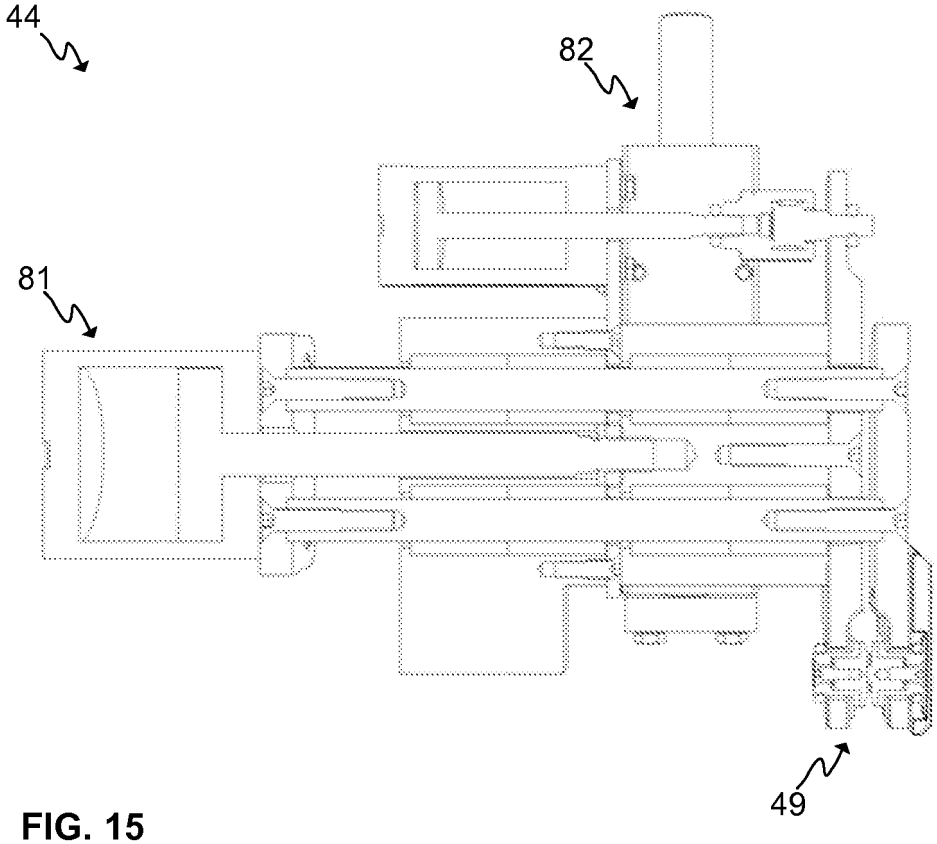


FIG. 15

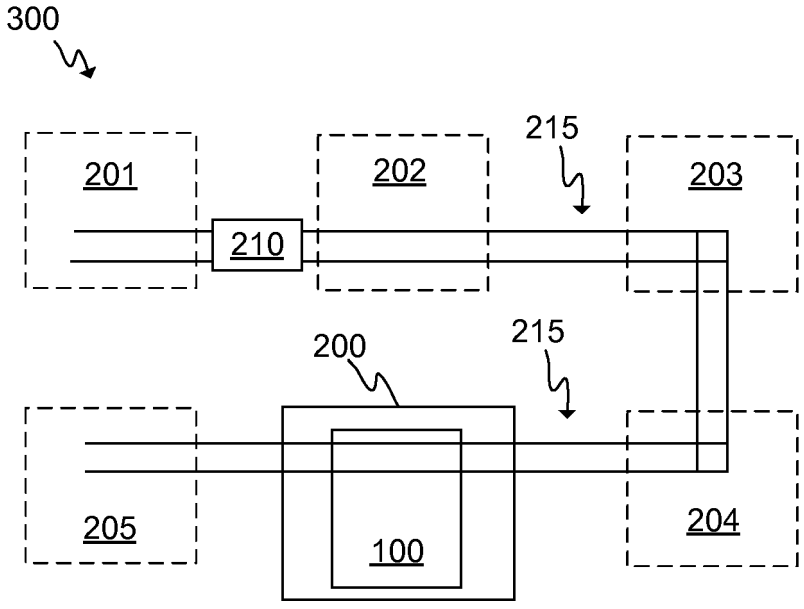


FIG. 16

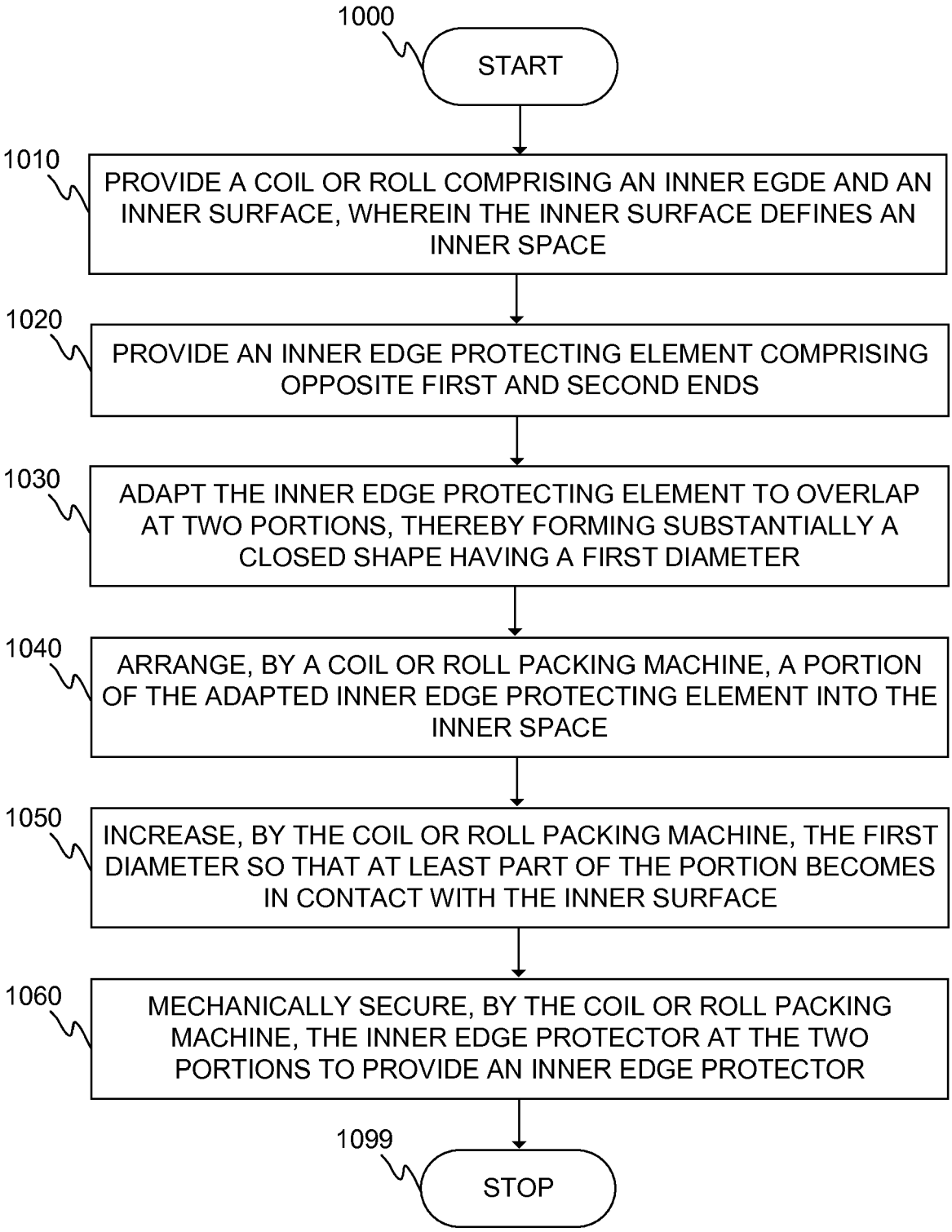
1000
START
1010
PROVIDE A COIL OR ROLL COMPRISING AN INNER EGDE AND AN INNER SURFACE, WHEREIN THE INNER SURFACE DEFINES AN INNER SPACE
1020
PROVIDE AN INNER EDGE PROTECTING ELEMENT COMPRISING OPPOSITE FIRST AND SECOND ENDS
1030
ADAPT THE INNER EDGE PROTECTING ELEMENT TO OVERLAP AT TWO PORTIONS, THEREBY FORMING SUBSTANTIALLY A CLOSED SHAPE HAVING A FIRST DIAMETER
1040
ARRANGE, BY A COIL OR ROLL PACKING MACHINE, A PORTION OF THE ADAPTED INNER EDGE PROTECTING ELEMENT INTO THE INNER SPACE
1050
INCREASE, BY THE COIL OR ROLL PACKING MACHINE, THE FIRST DIAMETER SO THAT AT LEAST PART OF THE PORTION BECOMES IN CONTACT WITH THE INNER SURFACE
1060
MECHANICALLY SECURE, BY THE COIL OR ROLL PACKING MACHINE, THE INNER EDGE PROTECTOR AT THE TWO PORTIONS TO PROVIDE AN INNER EDGE PROTECTOR
1099
STOP

FIG. 17

## REFERENCES CITED IN THE DESCRIPTION

*This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.*

### Patent documents cited in the description


- AU 2008221599 A1 **[0005]**
- KR 20180051769 A **[0006]**
- JP H07291218 A **[0007]**
- KR 20100110184 A **[0008]**