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(54) **Apparatus, method and system for wrapping a wrapping material, a wrapping device and a control unit**

Vorrichtung, Verfahren und System zum Verpacken eines Verpackungsmaterials, Verpackungsvorrichtung und Steuereinheit

Appareil, procédé et système permettant d'emballer un matériau d'emballage, dispositif d'emballage et unité de commande

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Description

[0001] The present invention relates to an apparatus for wrapping a wrapping material, which is arranged to be run around a wrapping track forming a guide for the apparatus in such a way that the apparatus is arranged to be travelled along the wrapping track and which wrapping track is arranged to be run through a centre hole of a piece to be wrapped, and which apparatus includes

- an assembly,
- a discharge arrangement at least partly fitted to the assembly for a wrapping-material source, which includes
    - a support-element arrangement for the wrapping-material source, from which the wrapping material is arranged to be discharged,
    - drive means including an operating device fitted to the assembly and arranged to act on the wrapping-material source, in order to maintain the tension in the wrapping material arranged to be discharged from it,
- measuring means for detecting the tension of the wrapping material, from which a feedback is arranged to the drive means,
- a guide arrangement through which the wrapping material is arranged to be led from the support-element arrangement to the piece to be wrapped.

[0002] In addition, the invention also relates to a method for wrapping a wrapping material, and a wrapping device. Several solutions are known for wrapping cylindrical pieces with a centre hole. In the arrangement for wrapping cylindrical pieces with a centre hole, the wrapping-material reel is taken through the centre hole of the piece to be wrapped by utilizing a wrapping shuttle travelling along an oval wrapping track. The piece to be wrapped is rotated around its axis at the same as the wrapping shuttle moves along the wrapping track through and around the piece to be wrapped. As a result of the wrapping, the wrapping material forms a continuous protective jacket on all the surfaces of the piece. In order to form a tight wrapping-material jacket, the wrapping material should be given sufficient tension or stretching, so that the wrapping material will press tightly onto the surface of the piece to be wrapped. In addition, during wrapping there must be no slipping between the edges of the piece to be wrapped and the wrapping material.

[0003] The pieces to be wrapped can be, for example, coiled steel, aluminium, or a similar sheet material, in which the edges of the piece are sharp. Slipping of the wrapping material at the edges of the piece easily causes the wrapping material to break and thus the wrapping to be interrupted. On account of the shape of the piece to be wrapped, the application uses an oval-shaped wrapping track, which runs through the centre hole of the piece to be wrapped and along which the wrapping shuttle moves. On account of the shape of the piece to be wrapped, the distance of the wrapping shuttle from the surface and edges of the piece to be wrapped varies during wrapping. Particularly when the wrapping shuttle goes into the centre hole of the piece to be wrapped, or comes out from it, the said change in distance is considerable.

[0004] In terms of the wrapping result, there is reason to maintain sufficient tension in the wrapping material, despite the distance of the wrapping shuttle from the surface and edges of the piece to be wrapped. In order to maintain a sufficient tension, the change in the said distance should be taken into account in the length of the wrapping material between the piece to be wrapped and the wrapping-material reel. One attempt to resolve this is disclosed in EP application publication number 0936141 A1.

[0005] The use of mechanical apparatuses to control the tension of the wrapping material and to take into account the aforementioned change in length is problematic, when the wrapping material or its physical properties vary. In practice, the mechanical arrangements operate well only if the wrapping material meets preset criteria. Changes in the wrapping material or its properties required changes in the mechanical apparatuses of the wrapping shuttle, in order for the aforementioned functions to operate in the desired manner. The need for these changes interferes with efficient wrapping operation. In addition, besides being complicated in construction, the mechanical apparatuses are also failure-sensitive. They include wearing components, which can break and which require maintenance.

[0006] The invention is intended to create an apparatus and method for wrapping a wrapping material, which permits variation in the properties of the wrapping material, and which effectively implements the re-reeling of the wrapping material during wrapping. The characterizing features of the apparatuses according to the invention are stated in Claims 1 and 6, and those of the method in Claim 7. In addition, the invention also relates to a wrapping device the characteristic features of which are stated in Claim 8.

[0007] In the invention, the tension of the wrapping material is arranged to be detected from the discharge arrangement arranged to affect to the wrapping-material source. Owing to the solution according to the invention, the mechanical implementation of the apparatus is simplified. The invention also permits variation in the properties of the wrapping material. Also in addition, owing to the invention is achieved effective re-reeling of the wrapping material. Thanks to the re-reeling, changes taking place during wrapping in the distance between the apparatus and the piece to be wrapped can be taken into account. The tension of the wrapping material then remains as desired in each position of the apparatus relative to the piece to be wrapped.

[0008] According to a first embodiment, the invention

can be implemented, for example, as internal feedback. In this, it is possible to utilize an electric motor solution, and particularly the feedback of the motor's control to the control unit of the motor relative to the force or moment caused by the motor to the wrapping-material source. There can be several constructional solutions implementing internal feedback. One first exemplary constructional solution is to arrange the motor to act on the wrapping-material source through a support-element arrangement. A second exemplary constructional solution is to arrange the motor to act on the surface of the wrapping-material source through a pressure-roller arrangement. In both of the aforementioned embodiments, the implementation of the invention requires no external sensoring at all.

[0009] According to a second embodiment, the invention can also be implemented by means of external feedback. One exemplary way of implementing this is by sensoring fitted to a support-element arrangement of the wrapping-material source.

[0010] According to one embodiment, the wrapping material can be led to the piece to be wrapped through a guide arrangement, in which principally one change of direction is created for the wrapping material. For example, guiding the wrapping material to the piece to be wrapped through a single deflector roll makes the implementation of the apparatus very simple and compact. Other additional advantages gained by means of the apparatus and method according to the invention are stated in the description portion while the characteristic features are stated in the accompanying Claims.

[0011] The apparatus and method according to the invention, which is not restricted to the embodiments presented in the following, is described in greater detail with reference to the accompanying drawings, in which

Figure 1 shows a top view of an application example of a wrapping device, in which the invention can be applied,

Figure 2 shows a bottom view of a first example of the apparatus,

Figure 3 shows a side view of the apparatus according to Figure 2,

Figure 4 shows a side view of a second embodiment of the apparatus, and

Figure 5 shows a top view of a third example of the apparatus.

[0012] Figure 1 shows an example as a rough schematic diagram of the application environment of the apparatus 10 according to the invention, with a wrapping device 31. The figure shows a top view of a wrapping device 31 used for wrapping cylindrical pieces 19 with a centre hole and the apparatus 10 arranged to move in it, in different locations E1 - E5, and a cross-section of the piece 19 to be wrapped.

[0013] In the case according to the embodiment, the wrapping device 31 can include, as its basic components, the rotation apparatus (not shown) under the piece 19 required to rotate the piece 19 to be wrapped around its axis, the wrapping track 23, and the apparatus 10. In the example of Figure 1, the wrapping track 23 is oval in shape and can be arranged to run through the centre hole 24 of the piece 19 to be wrapped. For this purpose, the wrapping track 23 can be cut and turned or lifted, so that it can be taken to run through the centre hole 24 of the piece 19 and, on the other hand, also removed from there. The wrapping track 23 forms a path of motion for the apparatus 10, a guide, in which the elements arranged for it in the apparatus 10 can be arranged, in such a way that the apparatus 10 travels along the wrapping track 23 in a closed loop.

[0014] In Figure 1, the apparatus 10 has reference numbering for a support-element arrangement 12 for the wrapping-material source 11 and a wrapping-material source 11 fitted to it. From the wrapping-material source 11 the wrapping material 16 is arranged to be led, through a guide arrangement 28 belonging to the apparatus 10, to the piece 19 to be wrapped. Here the apparatus 10 is in two parts. The parts are pivoted to each other in such a way that they can turn relative to each other, for example, in the sharp end curves of the wrapping track 23 and thus can retain the apparatus's 10 current-collector elements' 25 continuous unbroken contact with the counter-elements of the wrapping track 23.

[0015] Figure 1 also shows schematically the change in length of the wrapping material 16 between the piece 19 to be wrapped and the apparatus 10. As can be easily seen from Figure 1, the length of the wrapping material 16 varies as the distance between the edges A, B, C, and D of the piece 19 to be wrapped and the point E1 - E5 of the path of motion of the apparatus 10. The apparatus 10 progresses along the wrapping track 23 in the direction E1 - E5. The length of the wrapping material 16 between the apparatus 10 and the piece 19 diminished especially quickly between E2 - E3. The need for re-reeling of the wrapping material 16 is then greatest, in order to be able to preserve a suitable tension of the wrapping material 16 in terms of achieving a successful wrapping result.

[0016] Figure 2 shows a bottom view of a first example of the apparatus 10 for wrapping a wrapping material 16 and Figure 3 correspondingly a side view. The basic components of the apparatus 10 include an assembly 14, a discharge arrangement 30 fitted at least partly to the assembly 14 for the wrapping-material source 11, and measuring means 17 for detecting the tension of the wrapping material 16.

[0017] The assembly 14 includes, for example, a body of the apparatus 10 assembled from one or more parts and, in addition, various equipment fitted to it for achieving the functions of the apparatus 10, which can vary even widely within the scope of the basic idea of the invention. In addition, a discharge arrangement 30 for the wrapping-material source 11 is also fitted to the assembly 14. The wrapping material 16 is arranged to be dis-

charged from the wrapping-material source 11 by means of the discharge arrangement 30.

[0018] According to one embodiment, the discharge arrangement 30 can include a support-element arrangement 12 fitted to the apparatus 10 for the wrapping-material source 11, and drive means 38 (Figure 3). The wrapping material 16 is arranged to be discharged to wrapping from the support-element arrangement 12. The support-element arrangement 12 can be formed of, for example, a rotatably arranged shaft arranged for the wrapping-material source 11. The wrapping-material source 11, from which the wrapping material 16 is arranged to be discharged, can be, for example, a reel equipped with a centre hole. The reel can be fitted to the shaft in such a way that it rotates along with the shaft.

[0019] The drive means 38 belonging to the discharge arrangement 30 are arranged to act on the wrapping-material source 11, in order to maintain the tension of the wrapping material 16 arranged to be discharged from it. The drive means 38 can include, for example, an electric motor or similar operating device 13. In the case according to the embodiment, the operating device 13 is arranged to act on the wrapping-material source 11 through the support-element arrangement 12. In that case, the electric motor is connected to the support-element arrangement 12 to maintain the tension of the wrapping material 16 being discharged from the wrapping-material source 11 and to re-reel the wrapping material 16. The operating device 13 can be connected directly or indirectly to the support-element arrangement 12. In a direct connection, the motor can be attached directly to the shaft (not shown). In an indirect connection, the power of the motor to the shaft can be transmitted, for example, by means of a cogwheel, belt, or chain transmission. In that case, transmission can be direct primary transmission from the motor, or also secondary transmission. In the example, transmission is implemented by means of a cogwheel 26 fitted to the shaft, a cogwheel 32 fitted to the motor, and a chain 21 arranged between them. By means of the transmission connection, the torque produced by the motor is transferred to the shaft of the wrapping-material reel, and is used to maintain the tension of the wrapping material 16 when performing wrapping of the piece 19.

[0020] The drive means 38 belonging to the apparatus 10 and more particularly to the discharge arrangement 30 can also include a control unit 20 for the operating device 13. In the solution according to the embodiment, the control unit 20 too is fitted to the apparatus 10, but equally it can also be separate from the apparatus 10, for example, in a control cabinet (not shown). By means of the control unit 20 the movement of the motor is controlled by feeding it voltage (or current) of a suitable magnitude.

[0021] The apparatus 10 also includes measuring means 17 for detecting the tension of the wrapping material 16. Feedback 18 from the measuring means 17 is arranged to the drive means 38 and in this case particularly to the movement controller of the operating device 13, concerning the tension of the wrapping material 16 or a comparable variable. The feedback 18 permits the control of the operating device 13 in such a way that the tension of the wrapping material 16 discharging from the reel will remain as desired and slack will not arise. In addition, by means of the feedback 18 it is also possible to compensate for the change during wrapping in the distance between the path of motion of the apparatus 10 and the edges A - D of the piece 19 to be wrapped.

[0022] The tension of the wrapping material 16 being discharged from the wrapping-material source 11 is arranged to be detected from the discharge arrangement 30. This substantially simplifies the construction of the apparatus 10, because in this way the complicated measuring arrangements relating to a set of control rolls of the wrapping material 16, known from the prior art, are avoided.

[0023] According to a first embodiment, the feedback 18 can be internal. The internal feedback 18 can be implemented, for example, by means of a control unit 20 of the operating device 13 belonging to the discharge arrangement 30 of the apparatus 10. Thus, the operating device 13 and its control unit 20, by means of which the tension of the wrapping material 16 to be discharged from the wrapping-material source 11 is controlled, can be arranged itself to also act as the measuring means 17 of the tension of the wrapping material 16. By means of the control unit 20, the tension of the wrapping material 16 can be detected, for example, from the actual value of the current of the operating device 13, or a corresponding variable. In Figure 3, this function is depicted by the block 17 marked in the control unit 20, in which the signal proportional to the actual value of the current can be analysed and a possible change to the control of the operating device 13 can be made on its basis.

[0024] In the aforementioned solution based on a so-called torque servo, control can be by the torque, which the servomotor develops. The control of the servomotor can be set to follow a torque value given to it. The response to this is produced by the torque arising in the shaft of the reel of the wrapping material 16. This torque is caused by the rope force of the wrapping material 16. In the motor, the current produces a torque, so that this can be controlled without external feedback by measuring the actual value of the current of the motor. Adjustment of the torque is based on adjustment of the current of the servomotor, which creates the torque. Measurement of the current and feedback are implemented, for example, in a servo-amplifier. The implementation of this embodiment is extremely simple. The tension measurement can be performed without surplus mechanical components or external sensoring, purely by a software component 17 in the motion-control unit. In addition, this is a quick way to adjust.

[0025] Figure 4 shows a second embodiment for implementing feedback 18 from the discharge arrangement 30. The feedback 18 can also be external. External feed-

back 18 can be implemented, for example, in such a way that the measuring means 17 include sensoring 27 fitted for this purpose to the discharge arrangement 30 for measuring, for example, torque or force. According to one embodiment, the sensoring 27 can be, for example, in connection with the support-element arrangement 12. This embodiment too simplifies the implementation of the set of deflector rolls, because measurement of the variable proportional to the tension of the wrapping material 16 is no longer performed there.

[0026] Owing to the invention, the set of deflector rolls, more generally the guide arrangement 28 for the wrapping material 16, is simplified substantially. The wrapping material 16 is arranged to be led to the piece 19 to be wrapped through a guide arrangement 28, in which principally one change in direction is arranged to be achieved for the wrapping material 16. The guide arrangement 28 can be formed of a single deflector roll 29. The deflector roll 29 arranged in the assembly 14, through which the wrapping material 16 is led to the piece 19 to be wrapped, can be freely rotating or nonrotating.

[0027] Owing to the guide arrangement 28, the tension of the wrapping material 16 can no longer substantially change between the wrapping-material reel and the piece 19 to be wrapped, as is the case in solutions according to the prior art based on several deflector rolls, for example from the affect of the rope force. In the solution of a single deflector roll 29, the tension in the wrapping material 16 is directly dependent on the torque acting on the shaft of the wrapping-material reel. In the single-deflector roll solution, bearing friction is also minimized. Owing to the invention, the response of the rope force to the shaft of the servo does not greatly weaken, because the wrapping material 16 runs through only a single deflector roll 28.

[0028] According to one embodiment, the force creating tension in the wrapping material 16 can also be transmitted directly to the surface 34 of the wrapping-material source 11. Figure 5 shows an example of one possible arrangement relating to this. Now the operating device 33 is arranged to act on the surface 34 of the wrapping-material source 11 through a pressure-roll arrangement 22. The pressure-roll arrangement 22 includes a pressure roll, through which a braking force is transmitted to the surface 34 of the wrapping-material reel. The operating device 33 affects the pressure roll 37. The pressure roll 37 is now arranged at the end of a lever arm 35, which is rotatably pivoted to the assembly 14 at the opposite end. The lever 35 is affected by, for example, a spring 36, which presses it against the surface 34 of the wrapping-material reel. In this embodiment, the wrapping-material source 11 is arranged to either rotate freely relative to the support-element arrangement 12, or alternatively non-rotatably to the support-element arrangement 12, when it is able in turn to rotate freely on its bearings.

[0029] Naturally, the arrangement 22 based on a pressure roll can also be such, in which the movement of the pressure roll 37 is linear, i.e. straight towards the wrapping-material reel (in the direction of its radius). In addition, the lever-arm or linear-motion arrangement may also be arranged to act on the support-element arrangement 12 of the wrapping-material reel, in which case the embodiment corresponds in principle to that shown in Figures 2 - 4 (the chain drive has been replaced by a roll drive). In that case, the pressure roll 37 can be stationary against the shaft. The drive of the pressure roll 37 by the operating device 33 can again be arranged either directly or through a transmission. By means of this embodiment based on a pressure roll 37 it is possible to eliminate the change in tensioning force caused by the decrease in the wrapping material 16 (the reduction in the radius of the reel).

[0030] At least part of the drive means 38 and the wrapping-material source 11 can be fitted to the apparatus 10 detachably. Thus the wrapping-material source 11 and also the motor can be changed easily and quickly.

[0031] From the diameter of the wrapping-material source 11 it is possible to arrange, for example, external feedback to the control unit 20 of the drive means 38. There can be sensoring for the feedback. External feedback can be achieved, for example, by means of a location sensor, which is in contact with the surface of the wrapping-material source 11. Other examples of sensoring are ultrasound, a laser, or a potentiometer. The change in the radius of the reel of wrapping material 16, i.e. the decrease in wrapping material 16, causes a reduction in the force arm, which is compensated for by correspondingly correcting the torque instruction.

[0032] According to one embodiment, the control unit 20 of the drive means 38 can be located separately from the apparatus 10. In that case, a connection is implemented between the servo-controller and the servomotor fitted to the apparatus 10, in such a way that the controller can be located permanently outside the wrapping carriage, for example in a control cabinet. Thus, the invention relates equally to a system for wrapping a wrapping material 16, in which an apparatus 10, which in its basic principles is like that described above, is without a control unit 20 fitted to it, which is now therefore separate from the apparatus 10. The tension of the wrapping material 16 is arranged to be detected by means of the control unit 20.

[0033] In addition to the apparatus 10, the invention also relates to a method for wrapping a wrapping material. In the method, wrapping material 16 is discharged from a wrapping-material source 11 by means of a discharge arrangement 30, the tension of the wrapping material 16 is determined while discharging it from the wrapping-material source 11, and the tension of the wrapping material 16 being discharged from the wrapping-material source 11 is maintained on the basis of the determination. The tension of the wrapping material 16 is determined from the discharge arrangement 30, for example, according to any of the embodiments described above. In addition, the wrapping material 16 can, in the method, be guided through a single change in direction to the piece

19 to be wrapped.

[0034] In addition, the invention also relates to a wrapping device 31, which is shown schematically in Figure 1. The device 31 includes a wrapping track 23 and at least one wrapping shuttle arranged to run around the wrapping track 23. At least one of the wrapping shuttles can be, for example, the apparatus 10 shown in Figures 2 - 5 and described above.

[0035] Further, the invention also relates to a control unit 20 for the apparatus 10, which can be arranged to wrap the wrapping material 16. The operation of the operating device 13, 33 is arranged to be controlled by the control unit 20. The operating device 13, 33 can be arranged to act on the wrapping-material source 11, in order to maintain the tension of the wrapping material 16 arranged to be discharged from it. The tension of the wrapping material 16 is arranged to be detected by means of the control unit 20.

[0036] Real-time automatic adjustment of the tension of the wrapping material 16 becomes possible owing to the invention and at required points in the wrapping track 23, the efficient re-reeling of the wrapping material 16.

[0037] It must be understood that the above description and the related figures are only intended to illustrate the apparatus, method, and system according to the present invention. The invention is thus in no way restricted to only the embodiments disclosed or stated in the Claims, but many different variations and adaptations of the invention, which are possible within the scope on the inventive idea defined in the accompanying Claims, will be obvious to one skilled in the art.

Claims

1. Apparatus for wrapping a piece (19) to be wrapped with a wrapping material, which is arranged to run around a wrapping track (23) forming a guide for the apparatus (10) in such a way that the apparatus (10) is arranged to travel along the wrapping track (23) and which wrapping track (23) is arranged to run through a centre hole (24) of the piece (19) to be wrapped, and which apparatus (10) includes

   - an assembly (14),
   - a discharge arrangement (30) at least partly fitted to the assembly (14) for a wrapping-material source (11), which includes

     - a support-element arrangement (12) for the wrapping-material source (11), from which the wrapping material (16) is arranged to be discharged,
     - drive means (38) including an operating device (13, 33) fitted to the assembly (14) and arranged to act on the wrapping-material source (11), in order to maintain the tension in the wrapping material (16) arranged to be discharged from it,

     - measuring means (17) for detecting the tension of the wrapping material (16), from which a feedback (18) is arranged to the drive means (38),
     - a guide arrangement (28) through which the wrapping material (16) is arranged to be led from the support-element arrangement (12) to the piece (19) to be wrapped,

   characterized in that

     - the guide arrangement (28) includes only a single deflector roll (29) in order to achieve only a single change of direction in the wrapping material (16) between the piece (19) to be wrapped and the support-element arrangement (12),
     - the tension of the wrapping material (16) is arranged to be detected from the discharge arrangement (30)
     - the feedback (18) is internal in which the drive means (38) include a control unit (20) of the operating device (13, 33) arranged to act as the said measuring means (17), and in which the tension of the wrapping material (16) is arranged to be detected from the actual value of the current of the operating device (13, 33).

2. Apparatus according to Claim 1, **characterized in that** the operating device (13) is arranged to act on the wrapping-material source (11) through the support-element arrangement (12).

3. Apparatus according to Claim 1, **characterized in that** the operating device (33) is arranged to act on the surface (34) of the wrapping-material source (11) through a pressure-roll arrangement (22).

4. Apparatus according to any of Claims 1 - 3, **characterized in that** an another feedback to the control unit (20) is arranged from a diameter of the wrapping-material source (11).

5. Apparatus according to any of Claims 1 - 4, **characterized in that** the control unit (20) of the operating device (13, 33) is located separately from the apparatus (10).

6. Apparatus for wrapping a piece (19) to be wrapped with a wrapping material, which is arranged to run around a wrapping track (23) forming a guide for the apparatus (10) in such a way that the apparatus (10) is arranged to travel along the wrapping track (23) and which wrapping track (23) is arranged to run through a centre hole (24) of the piece (19) to be wrapped, and which apparatus (10) includes

   - an assembly (14),

- a discharge arrangement (30) at least partly fitted to the assembly (14) for a wrapping-material source (11), which includes

  - a support-element arrangement (12) for the wrapping-material source (11), from which the wrapping material (16) is arranged to be discharged,
  - drive means (38) including an operating device (13, 33) fitted to the assembly (14) and arranged to act on the wrapping-material source (11), in order to maintain the tension in the wrapping material (16) arranged to be discharged from it,

- measuring means (17) for detecting the tension of the wrapping material (16), from which a feedback (18) is arranged to the drive means (38),
- a guide arrangement (28) through which the wrapping material (16) is arranged to be led from the support-element arrangement (12) to the piece (19) to be wrapped,

characterized in that

- the guide arrangement (28) includes only a single deflector roll (29) in order to achieve only a single change of direction in the wrapping material (16) between the piece (19) to be wrapped and the support-element arrangement (12),
- the tension of the wrapping material (16) is arranged to be detected from the discharge arrangement (30) from which the feedback (18) is arranged to be implemented externally by means of measuring means (17) including sensoring (27) fitted to the support-element arrangement (12).

7. Method for wrapping a piece (19) to be wrapped with a wrapping material, in which

- the wrapping material (16) is discharged from a wrapping-material source (11) by means of a discharge arrangement (30) of an apparatus (10) running around a wrapping track (23) that can be arranged to run through a centre hole (24) of the piece (19) to be wrapped,
- the tension of the wrapping material (16) is determined while discharging it from the wrapping-material source (11),
- the tension of the wrapping material (16) being discharged from the wrapping-material source (11) is maintained on the basis of the determination,
- the wrapping material (16) is led from the discharge arrangement (30) to the piece (19) to be wrapped through a guide arrangement (28),

characterized in that

- the wrapping material (16) is led through only a single change in direction to the piece (19) to be wrapped by means of the guide arrangement (28) between the discharge arrangement (30) and the piece (19) to be wrapped,
- the tension of the wrapping material (16) is determined from the discharge arrangement (30).

8. Wrapping device, which includes

- a wrapping track (23) that is arranged to run through a centre hole (24) of a piece (19) to be wrapped,
- a wrapping shuttle arranged to run around the wrapping track (23),

characterized in that the wrapping shuttle is an apparatus (10) according to any of Claims 1 - 6.

Patentansprüche

1. Vorrichtung zum Umwickeln eines mit Verpackungsmaterial zu umwickelnden Stücks (19), die so angeordnet ist, dass sie im Kreis entlang einer Wickelschiene (23) läuft, die derart eine Führung für die Vorrichtung (10) bildet, dass die Vorrichtung (10) entlang der Wickelschiene (23) läuft und die Wickelschiene (23) so angeordnet ist, dass sie durch eine zentrale Öffnung (24) des zu umwickelnden Stücks (19) läuft, wobei die Vorrichtung (10) Folgendes umfasst

- eine Baugruppe (14),
- eine Abgabevorrichtung (30), die zumindest teilweise an der Baugruppe (14) für eine Verpackungsmaterialquelle (11) befestigt ist, die Folgendes umfasst

  - eine Stützelementvorrichtung (12) für die Verpackungsmaterialquelle (11), von der das Verpackungsmaterial (16) abgegeben wird,
  - Antriebsvorrichtung (38) einschließlich Bediengerät (13, 33), die an der Baugruppe (14) befestigt und so eingerichtet ist, dass sie auf die Verpackungsmaterialquelle (11) wirkt, um die Spannung des Verpackungsmaterials (16), das von ihr abgegeben werden soll, aufrechtzuerhalten,

- Messmittel (17) zum Ermitteln der Spannung des Verpackungsmaterials (16), das eine Rückmeldung (18) an die Antriebsvorrichtung (38) gibt,
- eine Führungsanordnung (28), durch die das

Verpackungsmaterial (16) von der Stützelementvorrichtung (12) zum zu umwickelnden Stück (19) geleitet wird,

gekennzeichnet dadurch, dass

- die Führungsanordnung (28) nur eine einzige Umlenkrolle (29) beinhaltet, um zu erreichen, dass es nur einen Richtungswechsel des Verpackungsmaterials (16) zwischen dem zu umwickelnden Stück (19) und der Stützelementvorrichtung (12) gibt,
- die Spannung des Verpackungsmaterials (16) von der Abgabevorrichtung (30) ermittelt wird
- die Rückmeldung (18) intern erfolgt, wobei die Antriebsvorrichtung (38) eine Steuereinheit (20) des Bediengeräts (13, 33) beinhaltet, die als das erwähnte Messmittel (17) fungiert und in der die Spannung des Verpackungsmaterials (16) vom jeweiligen Stromwert des Bediengeräts (13, 33) ermittelt wird.

2. Vorrichtung nach Anspruch 1, **dadurch gekennzeichnet, dass** das Bediengerät (13) über die Stützelementvorrichtung (12) auf die Verpackungsmaterialquelle (11) wirkt.

3. Vorrichtung nach Anspruch 1, **dadurch gekennzeichnet, dass** das Bediengerät (33) über eine Andruckrollenvorrichtung (22) auf die Oberfläche (34) der Verpackungsmaterialquelle (11) wirkt.

4. Vorrichtung nach einem der Ansprüche 1 - 3, **dadurch gekennzeichnet, dass** eine weitere Rückmeldung zur Steuereinheit (20) vom Durchmesser der Verpackungsmaterialquelle (11) eingerichtet ist.

5. Vorrichtung nach einem der Ansprüche 1 - 4, **dadurch gekennzeichnet, dass** die Steuereinheit (20) des Bediengeräts (13, 33) von der Vorrichtung (10) räumlich getrennt ist.

6. Vorrichtung zum Umwickeln eines mit Verpackungsmaterial zu umwickelnden Stücks (19), die so angeordnet ist, dass sie im Kreis entlang einer Wickelschiene (23) läuft, die derart eine Führung für die Vorrichtung (10) bildet, dass die Vorrichtung (10) entlang der Wickelschiene (23) läuft und die Wickelschiene (23) so angeordnet ist, dass sie durch eine zentrale Öffnung (24) des zu umwickelnden Stücks (19) läuft, wobei die Vorrichtung (10) Folgendes umfasst

- eine Baugruppe (14),
- eine Abgabevorrichtung (30), die zumindest teilweise an der Baugruppe (14) für eine Verpackungsmaterialquelle (11) befestigt ist, die Folgendes umfasst
- eine Stützelementvorrichtung (12) für die Verpackungsmaterialquelle (11), von der das Verpackungsmaterial (16) abgegeben wird,
- Antriebsvorrichtung (38) einschließlich Bediengerät (13, 33), die an der Baugruppe (14) befestigt und so eingerichtet ist, dass sie auf die Verpackungsmaterialquelle (11) wirkt, um die Spannung des Verpackungsmaterials (16), das von ihr abgegeben werden soll, aufrechtzuerhalten,

- Messmittel (17) zum Ermitteln der Spannung des Verpackungsmaterials (16), das eine Rückmeldung (18) an die Antriebsvorrichtung (38) gibt,
- eine Führungsanordnung (28), durch die das Verpackungsmaterial (16) von der Stützelementvorrichtung (12) zum zu umwickelnden Stück (19) geleitet wird,

gekennzeichnet dadurch, dass

- die Führungsanordnung (28) nur eine einzige Umlenkrolle (29) beinhaltet, um zu erreichen, dass es nur einen Richtungswechsel des Verpackungsmaterials (16) zwischen dem zu umwickelnden Stück (19) und der Stützelementvorrichtung (12) gibt,
- die Spannung des Verpackungsmaterials (16) wird von der Abgabevorrichtung (30) ermittelt, von der die Rückmeldung (18) mit Hilfe von Messmitteln (17), einschließlich Sensoren (27), die an der Stützelementvorrichtung (12) angebracht sind, extern realisiert wird.

7. Verfahren zum Verpacken eines Stücks (19), das mit Verpackungsmaterial umwickelt werden soll, bei dem

- das Verpackungsmaterial (16) von einer Verpackungsmaterialquelle (11) mithilfe einer Abgabevorrichtung (30) einer Vorrichtung (10) abgegeben wird, die im Kreis entlang einer Wickelschiene (23) läuft, die so eingerichtet werden kann, dass sie durch eine zentrale Öffnung (24) eines zu umwickelnden Stücks (19) führt.
- die Spannung des Verpackungsmaterials (16) während der Abgabe von der Verpackungsmaterialquelle (11) festgestellt wird,
- die Spannung des Verpackungsmaterials (16), das von der Verpackungsmaterialquelle (11) abgegeben wird, auf Grundlage dieser Feststellung aufrechterhalten wird,
- das Verpackungsmaterial (16) von der Abgabevorrichtung (30) zum zu umwickelnden Stück (19) über eine Führungsanordnung (28) geführt wird,

gekennzeichnet dadurch, dass

- das Verpackungsmaterial (16) mit nur einem Richtungswechsel zum zu umwickelnden Stück (19) mit Hilfe der Führungsanordnung (28) zwischen Abgabevorrichtung (30) und dem zu umwickelnden Stück (19) geführt wird,
- die Spannung des Verpackungsmaterials (16) von der Abgabevorrichtung (30) festgestellt wird.

8. Wickelvorrichtung, umfassend

- eine Wickelschiene (23), die so eingerichtet ist, dass sie durch eine zentrale Öffnung (24) eines zu umwickelnden Stücks (19) verläuft,
- ein Wickelschiffchen, das so eingerichtet ist, dass es im Kreis entlang der Wickelschiene (23) läuft,

gekennzeichnet dadurch, dass das Wickelschiffchen eine Vorrichtung (10) entsprechend Ansprüche 1-6 ist.

Revendications

1. Appareil pour l'emballage d'une pièce (19) à emballer avec un matériel d'emballage, lequel est disposé de sorte à tourner autour d'une voie d'emballage (23) formant un guide pour l'appareil (10) de sorte que l'appareil (10) est disposé de manière à se déplacer le long de la voie d'emballage (23) et que ladite voie d'emballage (23) est disposée de sorte à passer à travers un trou central (24) de la pièce (19) à emballer, et ledit appareil (10) inclut

- un assemblage (14),
- une installation de déroulage (30) au moins partiellement ajustée à l'assemblage (14) pour une source de matériel d'emballage (11), qui inclut

  - une installation d'élément de support (12) pour la source de matériel d'emballage (11), à partir de laquelle le matériel d'emballage (16) est disposé de sorte à être déroulé,
  - des moyens d'entraînement (38) incluant un dispositif de commande (13, 33) ajusté à l'assemblage (14) et disposé de sorte à commander la source de matériel d'emballage (11), afin de maintenir la tension du matériel d'emballage (16) disposé de sorte à être déroulé de cette dernière,

- des moyens de mesure (17) pour la détection de la tension du matériel d'emballage (16), à partir duquel un retour (18) est prévu vers le moyen d'entraînement (38),
- une installation de guidage (28) à travers laquelle le matériel d'emballage (16) est disposé de sorte à être guidé depuis l'installation d'élément de support (12) vers la pièce (19) à emballer,

caractérisé en ce que

- l'installation de guidage (28) inclut un seul rouleau déflecteur (29) afin de n'effectuer qu'un seul changement de direction du matériel d'emballage (16) entre la pièce (19) à emballer et l'installation d'élément de support (12),
- la tension du matériel d'emballage (16) est détectée à partir de l'installation de déroulage (30),
- le retour (18) est interne, ce qui signifie que les moyens d'entraînement (38) incluent une unité de contrôle (20) du dispositif de commande (13, 33) disposé de sorte à agir en tant que lesdits moyens de mesure (17), et dans lequel la tension du matériel d'emballage (16) est détectée à partir de la valeur réelle du courant du dispositif de commande (13, 33).

2. Appareil conformément à la revendication 1, **caractérisé en ce que** le dispositif de commande (13) est disposé de sorte à agir sur la source de matériel d'emballage (11) à travers l'installation d'élément de support (12).

3. Appareil conformément à la revendication 1, **caractérisé en ce que** le dispositif de commande (33) est disposé de sorte à agir sur la surface (34) de la source de matériel d'emballage (11) à travers une installation de rouleau de pression (22).

4. Appareil conformément à l'une quelconque des revendications 1 à 3, **caractérisé en ce qu'**un autre retour vers l'unité de contrôle (20) est disposé à partir d'un diamètre de la source de matériel d'emballage (11).

5. Appareil conformément à l'une quelconque des revendications 1 à 4, **caractérisé en ce que** l'unité de contrôle (20) du dispositif de commande (13, 33) est située séparément de l'appareil (10).

6. Appareil pour l'emballage d'une pièce (19) à emballer avec un matériel d'emballage, lequel est disposé de sorte à tourner autour d'une voie d'emballage (23) formant un guide pour l'appareil (10) de sorte que l'appareil (10) est disposé de manière à se déplacer le long de la voie d'emballage (23) et que ladite voie d'emballage (23) est disposée de sorte à passer à travers un trou central (24) de la pièce (19) à emballer, et ledit appareil (10) inclut

- un assemblage (14),
- une installation de déroulage (30) au moins partiellement ajustée à l'assemblage (14) pour une source de matériel d'emballage (11), qui inclut

  - une installation d'élément de support (12) pour la source de matériel d'emballage (11), à partir de laquelle le matériel d'emballage (16) est disposé de sorte à être déroulé,
  - des moyens d'entraînement (38) incluant un dispositif de commande (13, 33) ajusté à l'assemblage (14) et disposé de sorte à commander la source de matériel d'emballage (11), afin de maintenir la tension du matériel d'emballage (16) disposé de sorte à être déroulé de cette dernière,

- des moyens de mesure (17) pour la détection de la tension du matériel d'emballage (16), à partir duquel un retour (18) est prévu vers le moyen d'entraînement (38),
- une installation de guidage (28) à travers laquelle le matériel d'emballage (16) est disposé de sorte à être guidé depuis l'installation d'élément de support (12) vers la pièce (19) à emballer,

caractérisé en ce que

- l'installation de guidage (28) inclut un seul rouleau déflecteur (29) afin de n'effectuer qu'un seul changement de direction du matériel d'emballage (16) entre la pièce (19) à emballer et l'installation d'élément de support (12),
- la tension du matériel d'emballage (16) est détectée à partir de l'installation de déroulage (30) à partir de laquelle le retour (18) est disposé de sorte à être mis en oeuvre de manière externe par le biais de moyens de mesure (17) comprenant la détection (27) ajustés à l'installation d'élément de support (12).

7. Méthode pour l'emballage d'une pièce (19) à emballer avec un matériel d'emballage, dans laquelle

- le matériel d'emballage (16) est déroulé à partir d'une source de matériel d'emballage (11) au moyen d'une installation de déroulage (30) d'un appareil (10) tournant autour d'une voie d'emballage (23) pouvant être disposé de sorte à tourner autour d'un trou central (24) de la pièce (19) à emballer,
- la tension du matériel d'emballage (16) est déterminée lors de son déroulage à partir de la source de matériel d'emballage (11),
- la tension du matériel d'emballage (16) déroulé de la source de matériel d'emballage (11) est maintenue sur la base de la détermination,
- le matériel d'emballage (16) est guidé depuis l'installation de déroulage (30) jusqu'à la pièce (19) à emballer à travers une installation de guidage (28),

caractérisée en ce que

- le matériel d'emballage (16) est guidé avec un seul changement de direction vers la pièce (19) à emballer au moyen de l'installation de guidage (28) entre l'installation de déroulage (30) et la pièce (19) à emballer,
- la tension du matériel d'emballage (16) est déterminée à partir de l'installation de déroulage (30).

8. Dispositif d'emballage, qui inclut

- une voie d'emballage (23) disposée de sorte à passer à travers un trou central (24) d'une pièce (19) à emballer,
- une navette d'emballage disposée de sorte à tourner autour de la voie d'emballage (23),

caractérisée en ce que la navette d'emballage est un appareil (10) conformément à l'une quelconque des revendications 1 à 6.

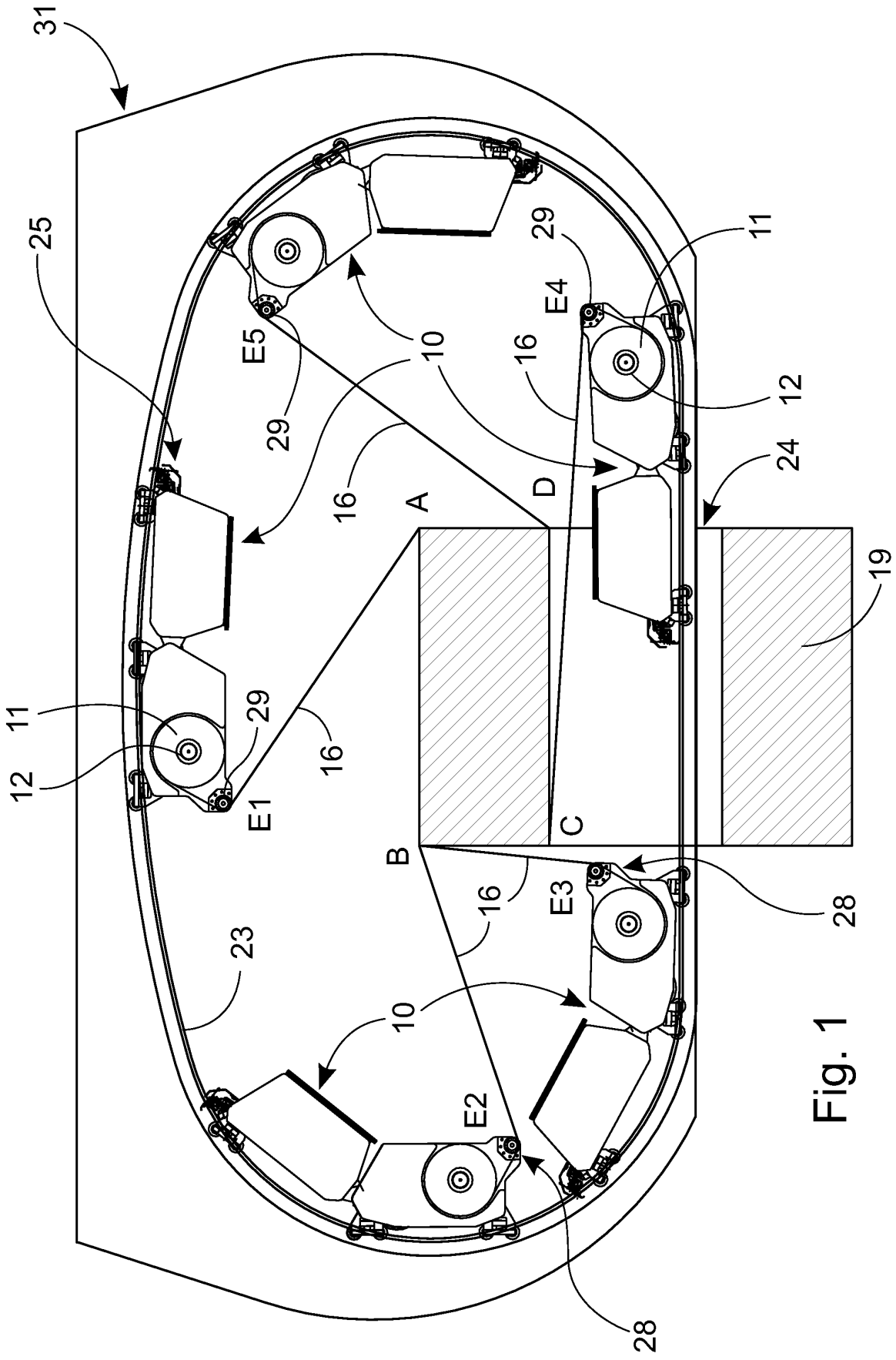


Fig. 1

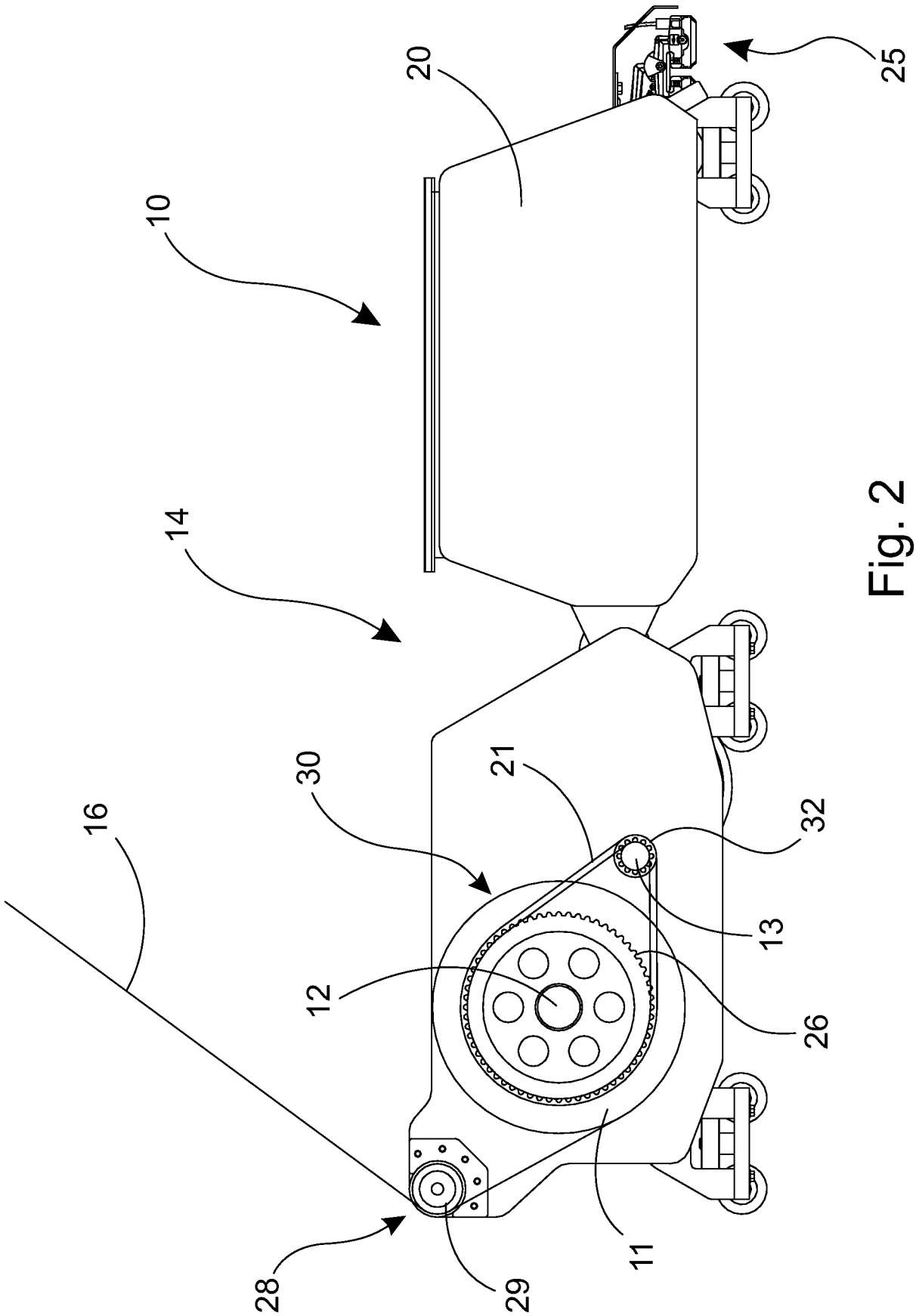


Fig. 2

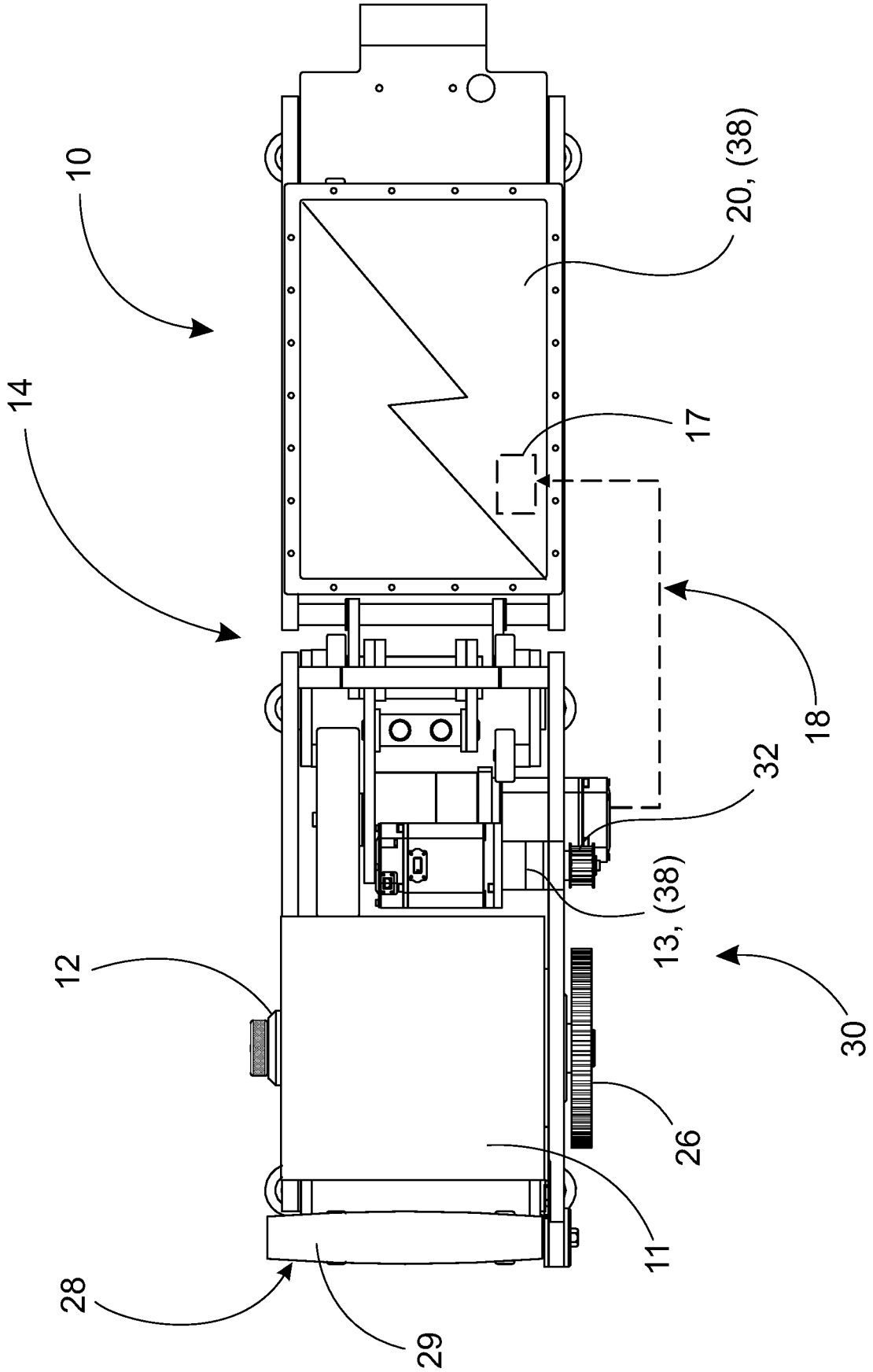


Fig. 3

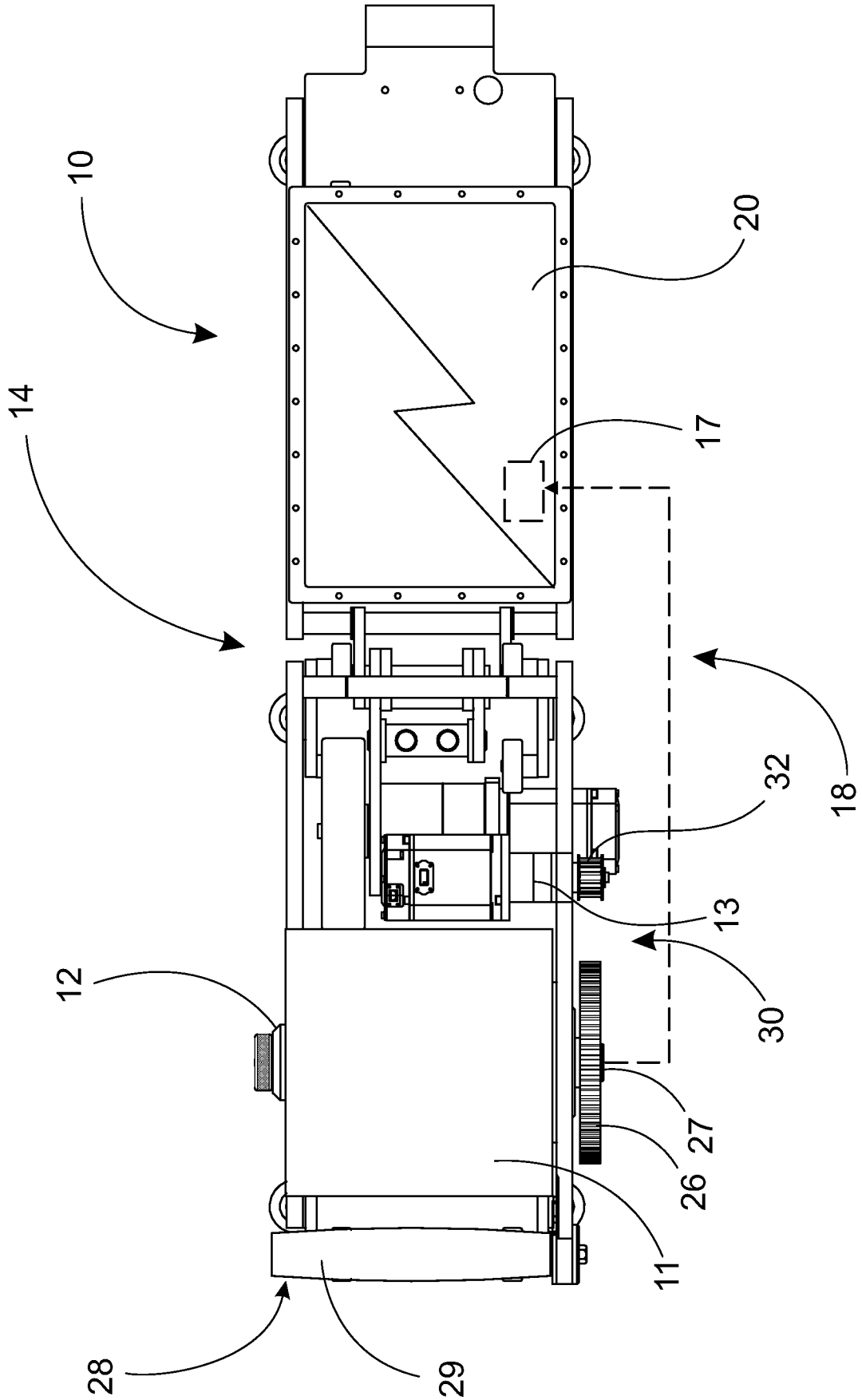


Fig. 4

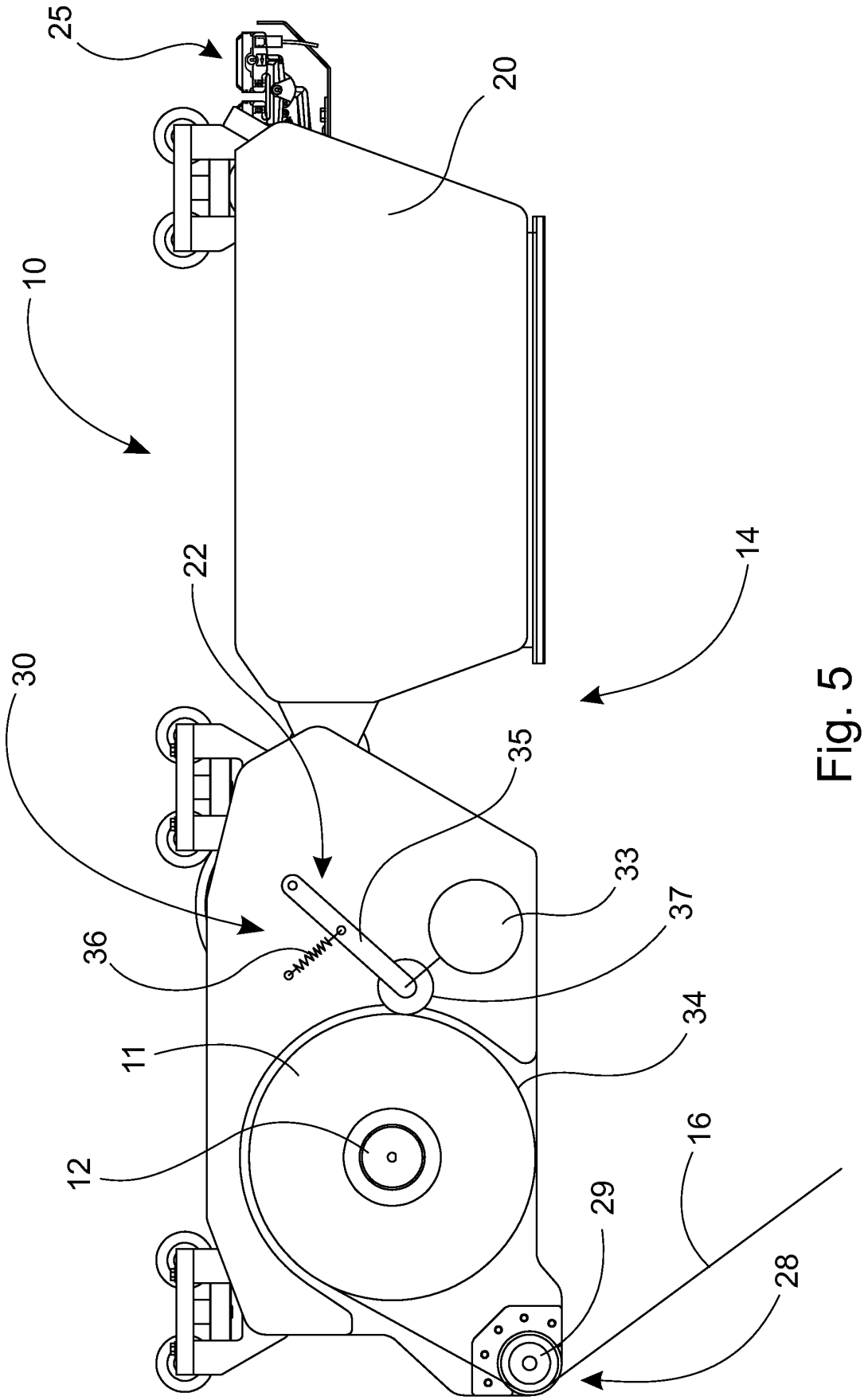


Fig. 5

REFERENCES CITED IN THE DESCRIPTION

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