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

(11) **EP 3 398 866 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
07.11.2018 Bulletin 2018/45

(51) Int Cl.:
B65B 65/02 *(2006.01)* ***B65B 13/18*** *(2006.01)*
B65B 13/22 *(2006.01)*

(21) Application number: **17169708.9**

(22) Date of filing: **05.05.2017**

(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
Designated Extension States:
BA ME
Designated Validation States:
MA MD

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(54) **FEEDING AND TENSIONING UNIT FOR USE IN A STRAPPING MACHINE OR WIRE BINDING MACHINE**

(57) Feeding and tensioning unit comprising:
- a feeding wheel (14) for feeding and retracting a binding element (3), the feeding wheel being fixed to a first wheel shaft (11);
- a tensioning wheel (15) for tensioning the binding element, the tensioning wheel being fixed to a second wheel shaft (12);
- a reversible drive motor (13) for rotating said wheel shafts;
- a first reduction gear (16) for transmitting torque from the drive motor to the first wheel shaft and a second reduction gear (17) for transmitting torque from the first wheel shaft to the second wheel shaft.

The second reduction gear comprises a first gear member (17a) fixed to the first wheel shaft and a second gear member (17b) fixed to the second wheel shaft, wherein the second gear member has a larger diameter than the first gear member and is in engagement with the first gear member or operatively connected to the first gear member via an intermediate gear member (17c).

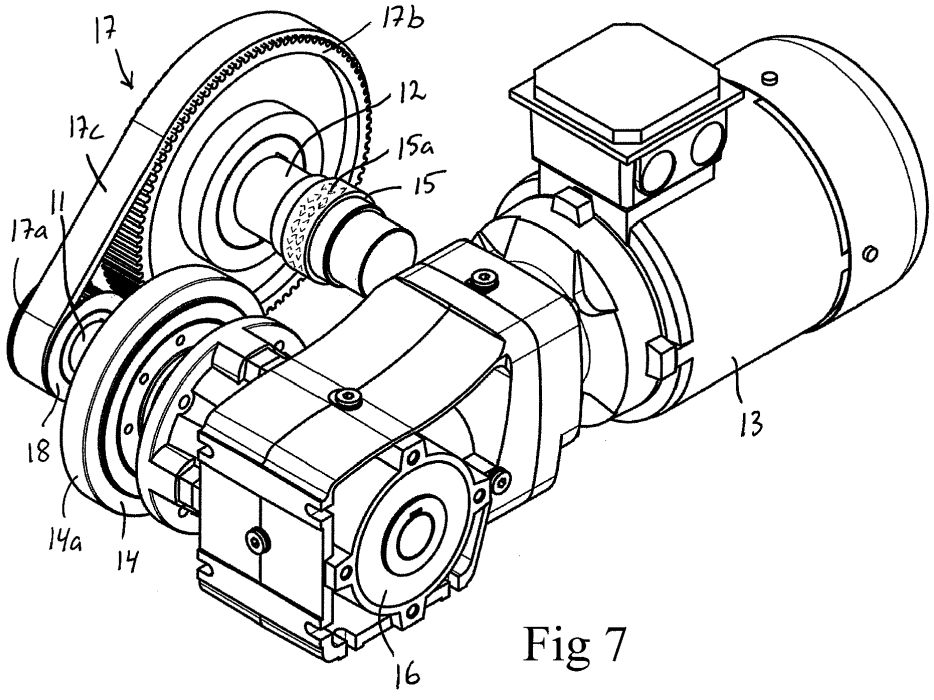

Fig 7

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Description

FIELD OF THE INVENTION AND PRIOR ART

[0001] The present invention relates to a feeding and tensioning unit according to the preamble of claim 1 for use in a strapping machine or wire binding machine in order to feed an elongated binding element in the form of a strap or wire in a loop around a space configured for receiving one or more objects to be bound and subsequently retract the binding element to draw it tightly around one or more objects received in said space.

[0002] Automatic strapping or wire binding machines for applying an elongated binding element in the form of a strap or wire in a loop around an object or a bundle of objects, drawing the binding element tightly around the object/bundle and thereafter joining overlapping sections of the binding element, or parallel sections of the binding element arranged at the side of each other, in order to secure the binding element around the object/bundle are known in many different configurations. Such a machine comprises a feeding and tensioning unit for feeding the binding element in a loop around the object/bundle and thereafter retracting the binding element to draw it tightly around the object/bundle. Different types of feeding and tensioning units for use in a strapping machine are for instance previously known from US 4 691 498 A, US 6 463 848 A, US 2014/0083310 A1 and DE 102008004118 B4.

OBJECT OF THE INVENTION

[0003] The object of the present invention is to provide a feeding and tensioning unit of the type mentioned by way of introduction with a new and favourable design.

SUMMARY OF THE INVENTION

[0004] According to the present invention, the above-mentioned object is achieved by means of a feeding and tensioning unit having the features defined in claim 1.

[0005] The feeding and tensioning unit according to the invention comprises:

- a rotatable first wheel shaft;
- a rotatable second wheel shaft;
- a reversible drive motor for rotating the first and second wheel shafts;
- a feeding wheel for feeding and retracting the binding element, the feeding wheel being fixed to the first wheel shaft;
- a tensioning wheel for tensioning the binding element, the tensioning wheel being fixed to the second wheel shaft;
- a first pinch member, which is moveable between an advanced active position, in which the first pinch member is pressed towards the feeding wheel in order to allow the feeding wheel to exert a feeding force on a binding element received in a nip between the feeding wheel and the first pinch member, and a retracted inactive position, in which the first pinch member is withdrawn from the feeding wheel in order to prevent the feeding wheel from exerting a feeding force on the binding element;
- a second pinch member, which is moveable between an advanced active position, in which the second pinch member is pressed towards the tensioning wheel in order to allow the tensioning wheel to exert a tensioning force on a binding element received in a nip between the tensioning wheel and the second pinch member, and a retracted inactive position, in which the second pinch member is withdrawn from the tensioning wheel in order to prevent the tensioning wheel from exerting a tensioning force on the binding element;
- a first reduction gear for transmitting torque from the drive motor to the first wheel shaft; and
- a second reduction gear for transmitting torque from the first wheel shaft to the second wheel shaft, the second reduction gear comprising a first gear member fixed to the first wheel shaft and a second gear member fixed to the second wheel shaft, wherein the second gear member has a larger diameter than the first gear member and is in engagement with the first gear member or operatively connected to the first gear member via an intermediate gear member.

[0006] The feeding wheel of the feeding and tensioning unit according to the present invention is to be rotated in a first rotary direction at high speed and low torque in order to feed the binding element forwards in a loop around a space configured for receiving one or more objects to be bound, whereupon the drive motor is to be reversed so as to rotate the feeding wheel in an opposite rotary direction at high rotational speed and low torque in order to retract the binding element and pull it into contact with one or more objects received in said space while subjecting the binding element to an initial stretching. During this feeding and retraction of the binding element, the first pinch member is in its advanced active position and the second pinch member in its retracted inactive position. Thereafter, the first pinch member is to be moved to its retracted inactive position and the second pinch member to its advanced active position and the drive motor is to be operated to rotate the tensioning wheel at low speed and high torque in order to draw the binding element more tightly around said one or more objects while subjecting the binding element to a final stretching. Under the effect of the tensioning wheel, the binding element is subjected to a tensile stress of a desired magnitude before being secured around said one or more objects. The feeding wheel is connected to the output shaft of the drive motor via the first reduction gear, whereas the tensioning wheel is connected to the output shaft of the drive motor via the first reduction gear and the second reduction gear. Thus, the rotational speed is

reduced in one step between the drive motor and the feeding wheel by the first reduction gear and in two steps between the drive motor and the tensioning wheel by the first and second reduction gears, which implies that the tensioning wheel is driven at lower speed and higher torque than the feeding wheel. With the solution according to the invention, one and the same drive motor may be used for rotating the feeding wheel in two different directions at high speed and low torque and for rotating the tensioning wheel at low speed and high torque, without requiring any complex clutch or the similar between the output shaft of the drive motor and the wheel shafts. Thus, the feeding and tensioning unit of the present invention has a simple construction and it can be designed in a compact manner.

[0007] Further advantageous features of the feeding and tensioning unit according to the present invention will appear from the description following below and the dependent claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] The invention will in the following be more closely described by means of embodiment examples, with reference to the appended drawings. In the drawings:

Fig 1 is a lateral view of a strapping machine provided with a feeding and tensioning unit according to an embodiment of the present invention,

Fig 2 is a lateral view from a first side of the feeding and tensioning unit included in the strapping machine of Fig 1,

Fig 3 is a lateral view from an opposite side of the feeding and tensioning unit of Fig 2,

Fig 4 is a planar view from below of the feeding and tensioning unit of Fig 2,

Fig 5a is a cut according to the line V-V in Fig 4, as seen with the feeding and tensioning unit set for feeding a strap by means of a feeding wheel included in the feeding and tensioning unit,

Fig 5b is a cut according to the line V-V in Fig 4, as seen with the feeding and tensioning unit set for tensioning the strap by means of a tensioning wheel included in the feeding and tensioning unit,

Fig 6 is a perspective view of parts included in the feeding and tensioning unit of Fig 2,

Fig 7 is a perspective view of some of the parts illustrated in Fig 6,

Fig 8 is a planar view from above of the parts illustrated in Fig 7, and

Fig 9 is a perspective view of some of the other parts illustrated in Fig 6.

DETAILED DESCRIPTION OF EMBODIMENTS OF THE INVENTION

[0009] A binding machine 1 according to an embodiment of the present invention is illustrated in Fig 1. The binding machine 1 comprises:

- a guide track 2 for guiding an elongated binding element 3 (see Figs 5a and 5b) in the form of a wire or strap in a loop around a space 4 configured for receiving one or more objects 8 to be bound;
- a supply coil holder 5 for rotatably supporting a binding element supply coil (not shown);
- a feeding and tensioning unit 6 for feeding the binding element 3 from a supply coil supported by the supply coil holder 5, into said guide track 2 and along the guide track in a loop around said space 4 and subsequently retracting the binding element 3 to draw it tightly around one or more objects 8 received in said space 4; and
- a sealing unit 7 for securing the binding element 3 around said one or more objects 8.

[0010] The guide track 2 may for instance have the form of a rail with a longitudinal opening facing the above-mentioned space 4. In the illustrated example, a part 2a of the guide track 2 is fixed to a housing 10 of the feeding and tensioning unit 6.

[0011] The sealing unit 7 comprises a gripping device (not shown) for gripping and locking a first binding element section at the leading end of the binding element 3 after the feeding of a part of the binding element in a loop around the above-mentioned space 4. The sealing unit 7 also comprises some type of joining device (not shown) for joining said first binding element section to an adjoining second binding element section at the trailing end of the part of the binding element fed in a loop around said space 4 to thereby secure this part of the binding element in a loop around said one or more objects 8.

[0012] The binding machine 1 may have the form of a strapping machine, wherein the binding element 3 is a strap of metallic or plastic material. In this case, the above-mentioned joining device may be a strapping head of conventional type provided with punching members for punching locking seals and a securing seal at mutually overlapping ends of a binding element in the form of a metallic strap applied in a loop around said one or more objects 8. As an alternative, the joining device of the strapping machine may be a welding device, for instance a laser welding device, which is configured to form a welded joint between the above-mentioned first and second binding element sections.

[0013] The binding machine 1 may also have the form

of a wire binding machine, wherein the binding element 3 is a wire of metallic material. In this case, the above-mentioned joining device may be a binding head of conventional type provided with a twisting member for making a twisted knot at mutually overlapping ends of a binding element in the form of a metallic wire applied in a loop around said one or more objects 8. As an alternative, the joining device of the wire binding machine may be a welding device, for instance a laser welding device, which is configured to form a welded joint between the above-mentioned first and second binding element sections.

[0014] The feeding and tensioning unit 6 comprises:

- a housing 10;
- a first wheel shaft 11 rotatably mounted to the housing 10 by means of one or more bearings of any suitable type;
- a second wheel shaft 12 rotatably mounted to the housing 10 by means of one or more bearings of any suitable type;
- a reversible drive motor 13, preferably in the form of an electric motor, for rotating the first and second wheel shafts 11, 12, the drive motor 13 being fixed to the housing 10;
- a feeding wheel 14 for feeding and retracting the binding element 3, the feeding wheel 14 being non-rotatably fixed to the first wheel shaft 11; and
- a tensioning wheel 15 for tensioning the binding element 3, the tensioning wheel 15 being non-rotatably fixed to the second wheel shaft 12.

[0015] The feeding wheel 14 has a larger diameter than the tensioning wheel 15. The diameter of the feeding wheel 14 is preferably at least twice as large as the diameter of the tensioning wheel 15. In the illustrated embodiment, the diameter of the feeding wheel 14 is four times as large as the diameter of the tensioning wheel 15.

[0016] The feeding and tensioning unit 6 comprises a first reduction gear 16 for transmitting torque from the output shaft of the drive motor 13 to the first wheel shaft 11 and a second reduction gear 17 for transmitting torque from the first wheel shaft 11 to the second wheel shaft 12. The first reduction gear 16 effects a gear reduction between the drive motor 13 and the feeding wheel 14. Furthermore, the first and second reduction gears 16, 17 together effect gear reductions in two steps between the drive motor 13 and the tensioning wheel 15. Thus, the tensioning wheel 15 will operate at lower rotational speed and higher torque than the feeding wheel 14. The second reduction gear 17 preferably has a gear ratio of at least 1:3. The first reduction gear 16 may for instance have a gear ratio of 1:5.

[0017] The second reduction gear 17 comprises a first gear member 17a non-rotatably fixed to the first wheel shaft 11 and a second gear member 17b non-rotatably fixed to the second wheel shaft 12, wherein the second gear member 17b has a larger diameter than the first gear member 17a. In the illustrated embodiment, the first and second gear members 17a, 17b have the form of sprocket wheels and are operatively connected to each other via an intermediate gear member 17c in the form of an endless toothed belt which is configured to run over the first and second gear members 17a, 17b. As an alternative, the first and second gear members 17a, 17b could be operatively connected to each other via an intermediate gear member in the form of an endless sprocket chain. As a further alternative, the first and second gear members 17a, 17b could have the form of gear wheels, which are in direct engagement with each other or operatively connected to each other via one or more intermediate gear wheels.

[0018] In the illustrated example, the first gear member 17a is provided with gables 18 for preventing the toothed belt 17c from slipping off the first gear member.

[0019] In the illustrated embodiment, the first reduction gear 16 is a bevel gear. However, the first reduction gear 16 could be of any other suitable type, such as for instance a planetary gear or a parallel shaft gear.

[0020] The feeding and tensioning unit 6 further comprises a first pinch member 19a configured to co-operate with the feeding wheel 14 and a second pinch member 19b configured to co-operate with the tensioning wheel 15. The first pinch member 19a is moveable between an advanced active position, in which the first pinch member 19a is pressed towards the feeding wheel 14 in order to allow the feeding wheel to exert a feeding force on a binding element 3 received in a nip between a peripheral surface 14a on the feeding wheel 14 and the first pinch member 19a, and a retracted inactive position, in which the first pinch member 19a is withdrawn from the feeding wheel 14 in order to prevent the feeding wheel 14 from exerting a feeding force on the binding element 3. The second pinch member 19b is moveable between an advanced active position, in which the second pinch member 19b is pressed towards the tensioning wheel 15 in order to allow the tensioning wheel to exert a tensioning force on a binding element 3 received in a nip between a peripheral surface 15a on the tensioning wheel 15 and the second pinch member 19b, and a retracted inactive position, in which the second pinch member 19b is withdrawn from the tensioning wheel 15 in order to prevent the tensioning wheel 15 from exerting a tensioning force on the binding element 3.

[0021] The first pinch member 19a and the feeding wheel 14 are located opposite each other and configured to be in contact with opposite sides of a part of the binding element 3 received in the nip between them when the first pinch member 19a is in its advanced active position. In a corresponding manner, the second pinch member 19b and the tensioning wheel 15 are located opposite each other and configured to be in contact with opposite sides of a part of the binding element 3 received in the nip between them when the second pinch member 19b is in its advanced active position.

[0022] The peripheral surface 15a of the tensioning wheel 15 is with advantage provided with a friction en-

hancing pattern formed by protrusions and/or indentations in order to improve the grip between the tensioning wheel 15 and the binding element 3 when the binding element is pressed against the peripheral surface 15a of the tensioning wheel under the effect of the second pinch member 19b.

[0023] In the illustrated embodiment, the first and second pinch members 19a, 19b have the have the form of rotatable rollers, but any other suitable type of pinch members could also be used.

[0024] In the illustrated embodiment, the first and second pinch members 19a, 19b are rotatably mounted to a rocker arm 20, which in its turn is pivotally mounted to the housing 10 so as to be pivotable in relation to the housing about a pivot axis PA between a first position (see Fig 5a), in which the first pinch member 19a is in its advanced active position and the second pinch member 19b in its retracted inactive position, and a second position (see Fig 5b), in which the first pinch member 19a is in its retracted inactive position and the second pinch member 19b in its advanced active position. The feeding and tensioning unit 6 comprises an actuator 21 for moving the rocker arm 20 between the first and second positions.

[0025] A guide member 22 (see Figs 5a and 5b) is fixed to the rocker arm 20 and is configured to be in contact with the binding element 3. This guide member 22 will move slightly in relation to the tensioning wheel 15 when the rocker arm 20 is pivoted between the above-mentioned first and second positions and it is configured to lift the binding element 3 out of contact with the peripheral surface 15a of the tensioning wheel when the second pinch member 19b is moved away from the tensioning wheel 15, i.e. when the second pinch member 19b is moved from its advanced active position to its retracted inactive position.

[0026] In the illustrated embodiment, the actuator 21 is a pneumatic cylinder with a cylinder part 21a and a piston (not shown) received in the cylinder part 21a, wherein the piston is displaceable in relation to the cylinder part 21a and fixed to a piston rod 21 b. The piston rod 21 b is moveable in relation to the cylinder part 21a in the axial direction thereof. The cylinder part 21 a is articulately connected to the housing 10 by a joint 23 (see Fig 3). An axial motion of the piston rod 21 b is converted into a pivotal motion of the rocker arm 20 by means of a motion conversion mechanism 24. In the illustrated embodiment, this motion conversion mechanism 24 comprises an operating shaft 25 (see Fig 9), which is rotatably mounted to the housing 10 and connected to the piston rod 21 b via a lever 26. The lever 26 is non-rotatably fixed to the operating shaft 25 and the piston rod 21 b is articulately connected to the lever 26 by a joint 27 so as to allow the operating shaft 25 to be rotated by an axial movement of the piston rod 21 b. An eccentric element 28 in non-rotatably fixed to the operating shaft 25 or integrated with the operating shaft, wherein this eccentric element 28 is received in a through hole 29 in the rocker arm 20 so as to allow the rocker arm to be pivoted between the first and second positions by rotation of operating shaft 25.

[0027] It would also be possible to use any other suitable type of actuator for moving the rocker arm 20 between the above-mentioned first and second positions, such as for instance an electromechanical actuator or an electric motor. As a further alternative, each pinch member 19a, 19b may be provided with its own actuator for moving the pinch member between the retracted inactive position and the advanced active position.

[0028] In a first phase, under the effect of the feeding wheel 14, the binding element 3 is first fed forwards in a loop around the above-mentioned space 4 and thereafter retracted in order to be pulled into contact with one or more objects 8 to be bound, wherein the binding element 3 is subjected to an initial stretching when being retracted by the feeding wheel 14. During this first phase, the first pinch member 19a is in its advanced active position and the second pinch member 19b in its retracted inactive position. In a second phase, the binding element 3 is subjected to a final stretching under the effect of the tensioning wheel 15 and thereby subjected to a tensile stress of a desired magnitude before being secured around said one or more objects 8. During this second phase, the second pinch member 19b is in its advanced active position and the first pinch member 19a in its retracted inactive position.

[0029] An operating sequence for securing a binding element 3 in the form of a strap or wire in a loop around an object 8 or bundle of objects by means of the above-described binding machine 1 will now be described. In a first step, the drive motor 13 of the feeding and tensioning unit 6 is operated to rotate the feeding wheel 14 at high speed and low torque in a first rotary direction in order to feed the binding element 3 forwards from a supply coil, through a guide channel 31 (see Figs 5a and 5b) in the housing 10 of the feeding and tensioning unit 6 and into the guide track 2. During the feeding of the binding element 3, the rocker arm 20 is in the above-mentioned first position (see Fig 5a) with the first pinch member 19a in its advanced active position and the second pinch member 19b in its retracted inactive position. The tensioning wheel 15 also rotates during the rotation of the feeding wheel 14. However, the guide member 22 keeps the binding element 3 out of contact with the peripheral surface 15a of the tensioning wheel when the second pinch member 19b is in its retracted inactive position and the tensioning wheel 15 is thereby prevented from acting on the binding element 3 as long as the second pinch member 19b is in its retracted inactive position. The binding element 3 is fed forwards in the guide track 2 in a loop around an object 8 or a bundle of objects received in the space 4 surrounded by the guide track 2. When the leading end of the binding element 3 has reached a given end position, the leading end of the binding element 3 will actuate a stop member (not shown) and the drive motor 13 of the feeding and tensioning unit 6 is stopped. The gripping device of the sealing unit 7 is then actuated in order to

grip the leading end of the binding element 3. Thereafter, the drive motor 13 is reversed in order to rotate the feeding wheel 14 at high speed and low torque in an opposite second rotary direction in order to retract the binding element 3 and thereby pull the binding element 3 out of the guide track 2 and into contact with the object 8 or bundle of objects. The feeding wheel 14 is suitably arranged to continue acting in a retracting manner on the binding element 3 until it has been detected, by means of a suitable sensor, that the binding element 3 has stopped moving or until it has been detected that the torque of the drive motor 13 has reached a given threshold value. In the next step, the actuator 21 is operated in order to pivot the rocker arm 20 from the first position illustrated in Fig 5a to the second position illustrated in Fig 5b. Hereby, the first pinch member 19a is moved from its advanced active position to its retracted inactive position at the same time as the second pinch member 19b is moved from its retracted inactive position to its advanced active position. Upon continued operation of the drive motor 13 in the reversed direction, the drive motor 13 will rotate the tensioning wheel 15 at low speed and high torque in order to draw the binding element 3 more tightly around the object 8 or bundle of objects and thereby subject the binding element 3 to a tensile stress of a desired magnitude. Thereafter, the sealing device of the sealing unit 7 is operated in order to secure the loop-shaped part of the binding element 3 around the object 8 or bundle of objects and in order to release this loop-shaped part of the binding element from the remaining part of the binding element.

[0030] The invention is of course not in any way restricted to the embodiments described above. On the contrary, many possibilities to modifications thereof will be apparent to a person with ordinary skill in the art without departing from the basic idea of the invention such as defined in the appended claims.

Claims

1. A feeding and tensioning unit for use in a strapping machine or wire binding machine in order to feed an elongated binding element (3) in the form of a strap or wire in a loop around a space (4) configured for receiving one or more objects to be bound and subsequently retract the binding element (3) to draw it tightly around one or more objects received in said space (4), the feeding and tensioning unit (6) comprising:

    - a rotatable first wheel shaft (11);
    - a rotatable second wheel shaft (12);
    - a reversible drive motor (13) for rotating the first and second wheel shafts (11, 12);
    - a feeding wheel (14) for feeding and retracting the binding element (3), the feeding wheel (14) being fixed to the first wheel shaft (11);
    - a tensioning wheel (15) for tensioning the binding element (3), the tensioning wheel (15) being fixed to the second wheel shaft (12);
    - a first pinch member (19a), which is moveable between an advanced active position, in which the first pinch member (19a) is pressed towards the feeding wheel (14) in order to allow the feeding wheel to exert a feeding force on a binding element (3) received in a nip between the feeding wheel and the first pinch member (19a), and a retracted inactive position, in which the first pinch member (19a) is withdrawn from the feeding wheel (14) in order to prevent the feeding wheel (14) from exerting a feeding force on the binding element (3); and
    - a second pinch member (19b), which is moveable between an advanced active position, in which the second pinch member (19b) is pressed towards the tensioning wheel (15) in order to allow the tensioning wheel to exert a tensioning force on a binding element (3) received in a nip between the tensioning wheel and the second pinch member (19b), and a retracted inactive position, in which the second pinch member (19b) is withdrawn from the tensioning wheel (15) in order to prevent the tensioning wheel (15) from exerting a tensioning force on the binding element (3),

    characterized in:

    - **that** the feeding and tensioning unit (6) comprises a first reduction gear (16) for transmitting torque from the drive motor (13) to the first wheel shaft (11) and a second reduction gear (17) for transmitting torque from the first wheel shaft (11) to the second wheel shaft (12); and
    - **that** the second reduction gear (17) comprises a first gear member (17a) fixed to the first wheel shaft (11) and a second gear member (17b) fixed to the second wheel shaft (12), wherein the second gear member (17b) has a larger diameter than the first gear member (17a) and is in engagement with the first gear member (17a) or operatively connected to the first gear member (17a) via an intermediate gear member (17c).

2. A feeding and tensioning unit according to claim 1, **characterized in** the tensioning wheel (15) has a smaller diameter than the feeding wheel (14).

3. A feeding and tensioning unit according to claim 1 or 2, **characterized in that** the drive motor (13) is an electric motor.

4. A feeding and tensioning unit according to any of claims 1-3, **characterized in that** the second reduction gear (17) has a gear ratio of at least 1:3.

5. A feeding and tensioning unit according to any of claims 1-4, **characterized in:**

- **that** the first and second gear members (17a, 17b) have the form of sprocket wheels; and
- **that** the first gear member (17a) is operatively connected to the second gear member (17b) via an intermediate gear member (17c) in the form of an endless sprocket chain or toothed belt which is configured to run over the first and second gear members (17a, 17b).

6. A feeding and tensioning unit according to any of claims 1-5, **characterized in that** the first and second gear members have the form of gear wheels.

7. A feeding and tensioning unit according to claim 6, **characterized in that** the second gear member is operatively connected to the first gear member via one or more intermediate gear members in the form of gear wheels.

8. A feeding and tensioning unit according to any of claims 1-7, **characterized in that** the first pinch member (19a) has the form of a roller.

9. A feeding and tensioning unit according to any of claims 1-8, **characterized in that** the second pinch member (19b) has the form of a roller.

10. A feeding and tensioning unit according to any of claims 1-9, **characterized in that** the first and second wheel shafts (11, 12) are rotatably mounted to a housing (10) of the feeding and tensioning unit (6).

11. A feeding and tensioning unit according to claim 10, **characterized in:**

- **that** the first and second pinch members (19a, 19b) are mounted to a rocker arm (20), which is pivotally mounted to the housing (10) so as to be pivotable between a first position, in which the first pinch member (19a) is in its advanced active position and the second pinch member (19b) in its retracted inactive position, and a second position, in which the first pinch member (19a) is in its retracted inactive position and the second pinch member (19b) in its advanced active position; and
- **that** the feeding and tensioning unit (6) comprises an actuator (21) for moving the rocker arm (20) between the first and second positions.

12. A feeding and tensioning unit according to claim 11, **characterized in:**

- **that** the actuator (21) is a pneumatic cylinder, which comprises a cylinder part (21a) fixed to the housing (10) and a piston rod (21 b) moveably connected to the cylinder part (21 a) so as to be moveable in the axial direction thereof; and
- **that** feeding and tensioning unit (6) comprises a motion conversion mechanism (24) for converting an axial motion of the piston rod (21 b) into a pivotal motion of the rocker arm (20).

13. A feeding and tensioning unit according to claim 12, **characterized in that** the motion conversion mechanism (24) comprises an operating shaft (25), which is rotatably mounted to the housing (10) and connected to the piston rod (21 b) via a lever (26) so as to allow the operating shaft (25) to be rotated by an axial movement of the piston rod (21 b), wherein an eccentric element (28) on the operating shaft (25) is received in a through hole (29) in the rocker arm (20) so as to allow the rocker arm (20) to be pivoted between the first and second positions by rotation of operating shaft (25).

14. A feeding and tensioning unit according to any of claims 1-13, **characterized in that** the first reduction gear (16) is a bevel gear.

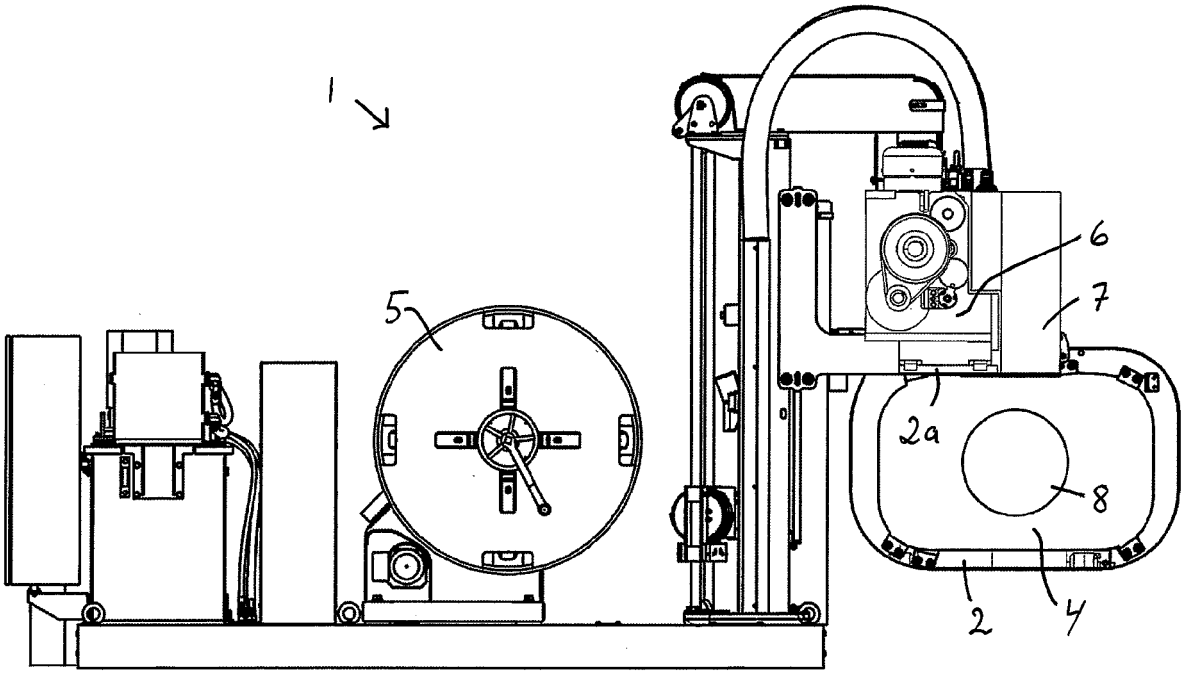


Fig 1

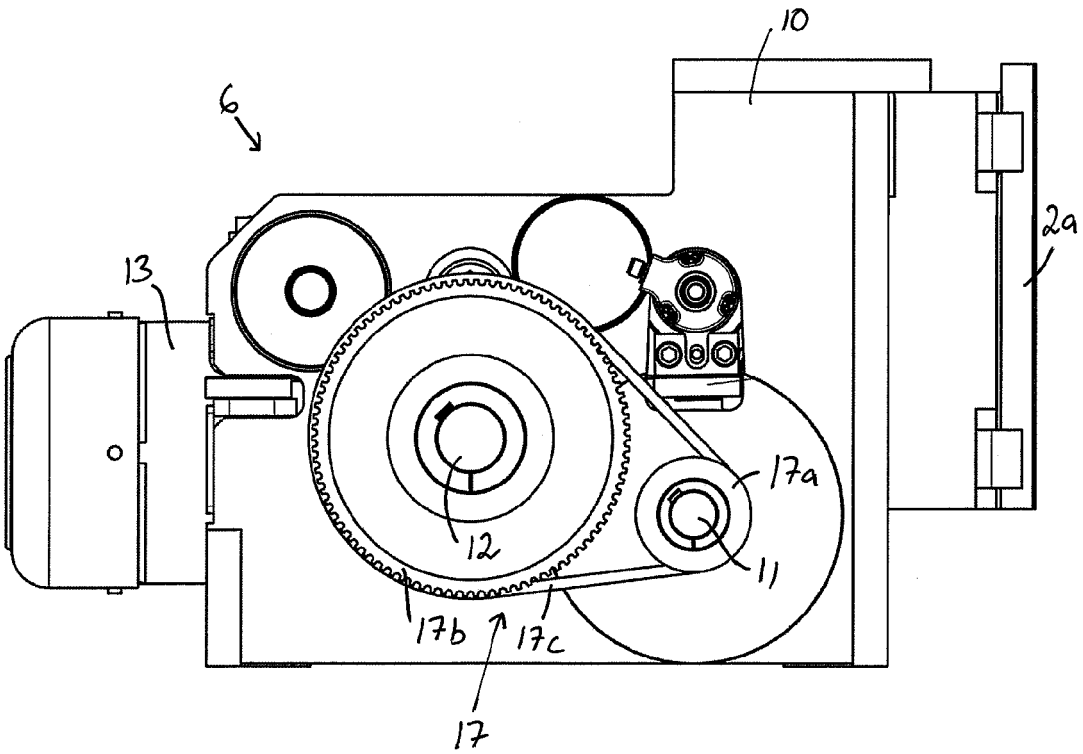


Fig 2

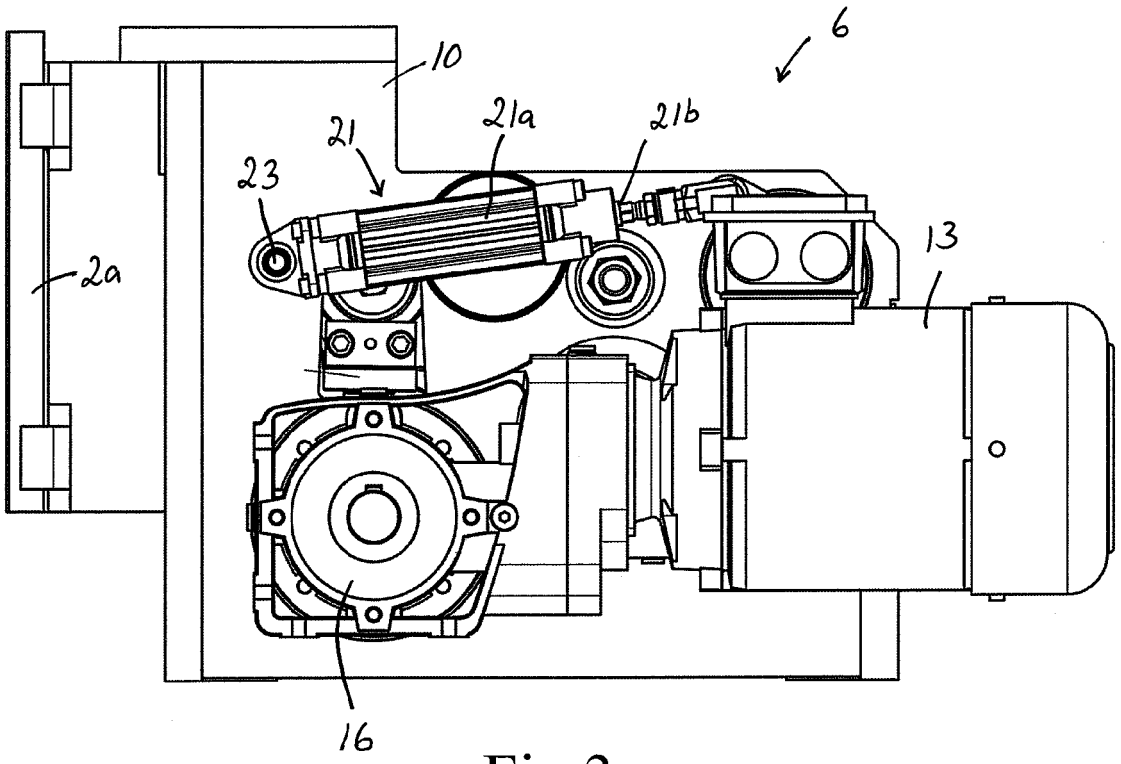


Fig 3

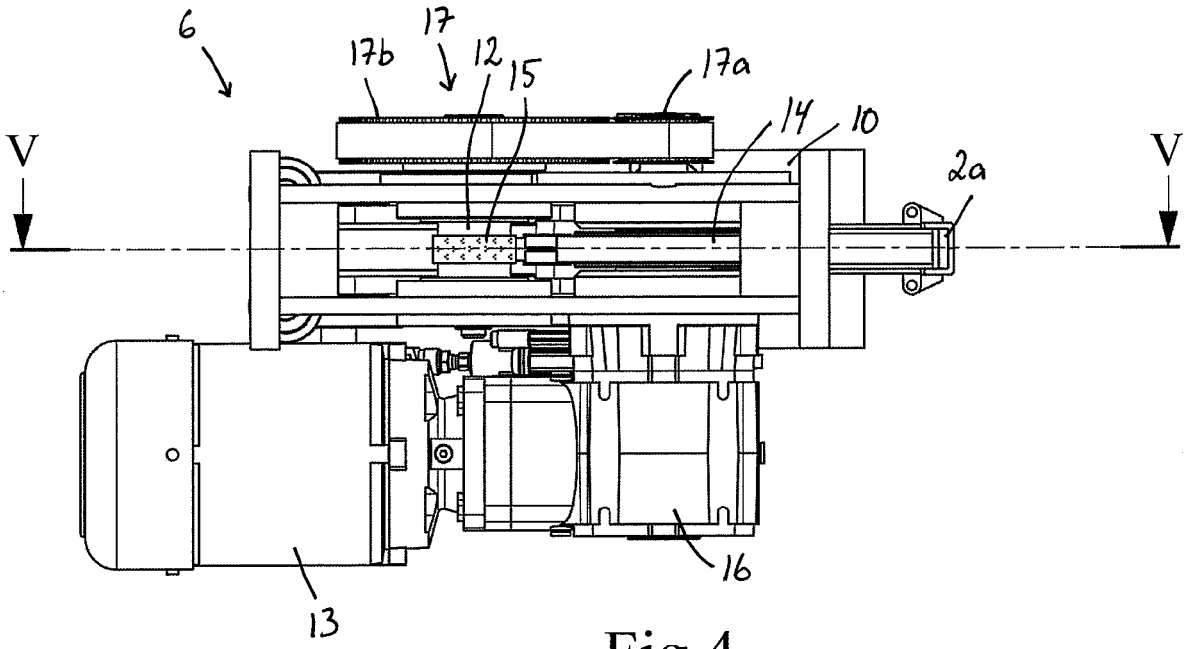
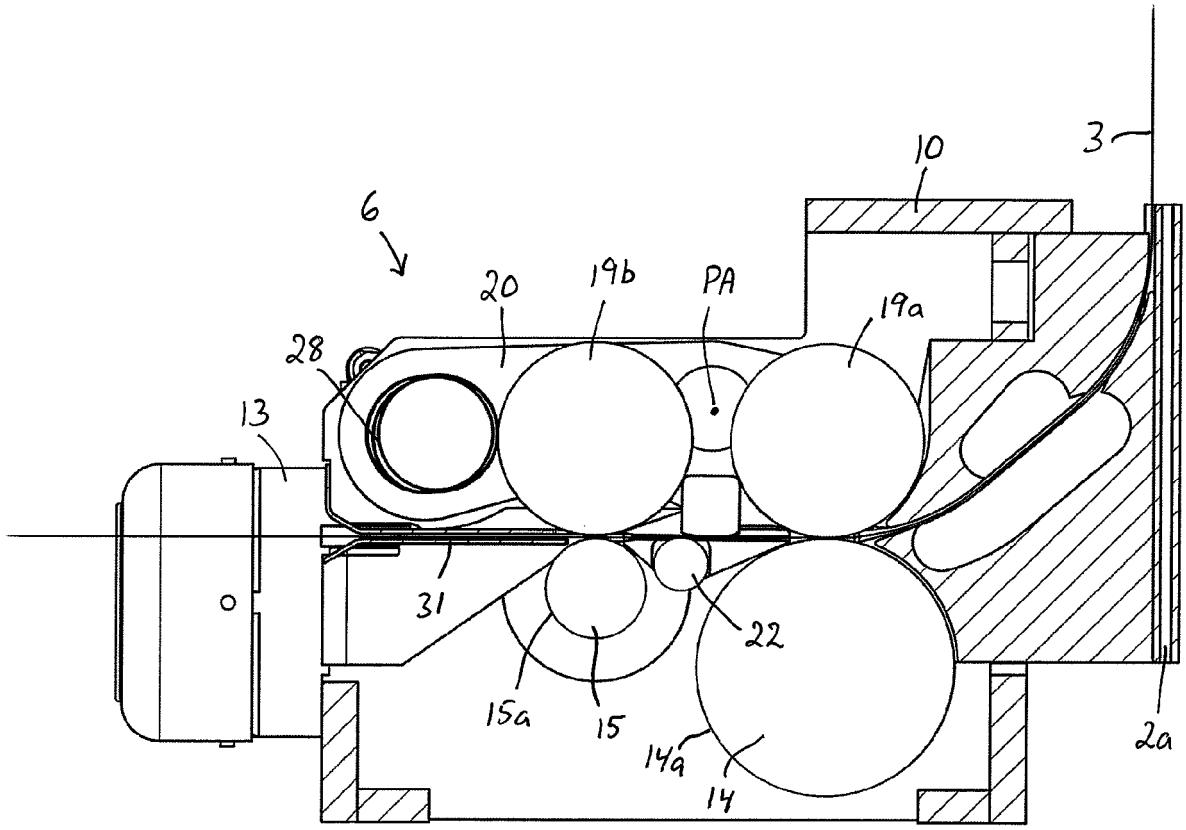


Fig 4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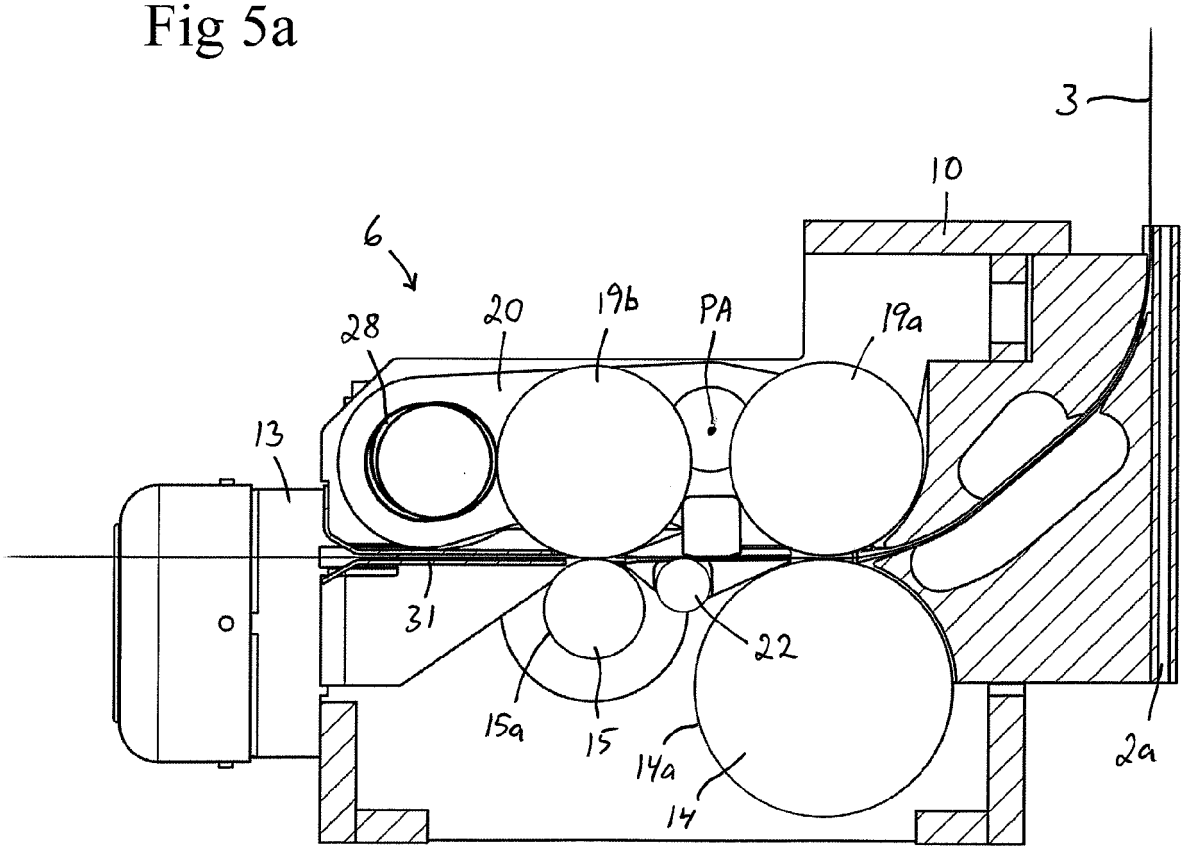
19b
PA
19a
28
13
31
22
15a
15
14a
14
2a

Fig 5a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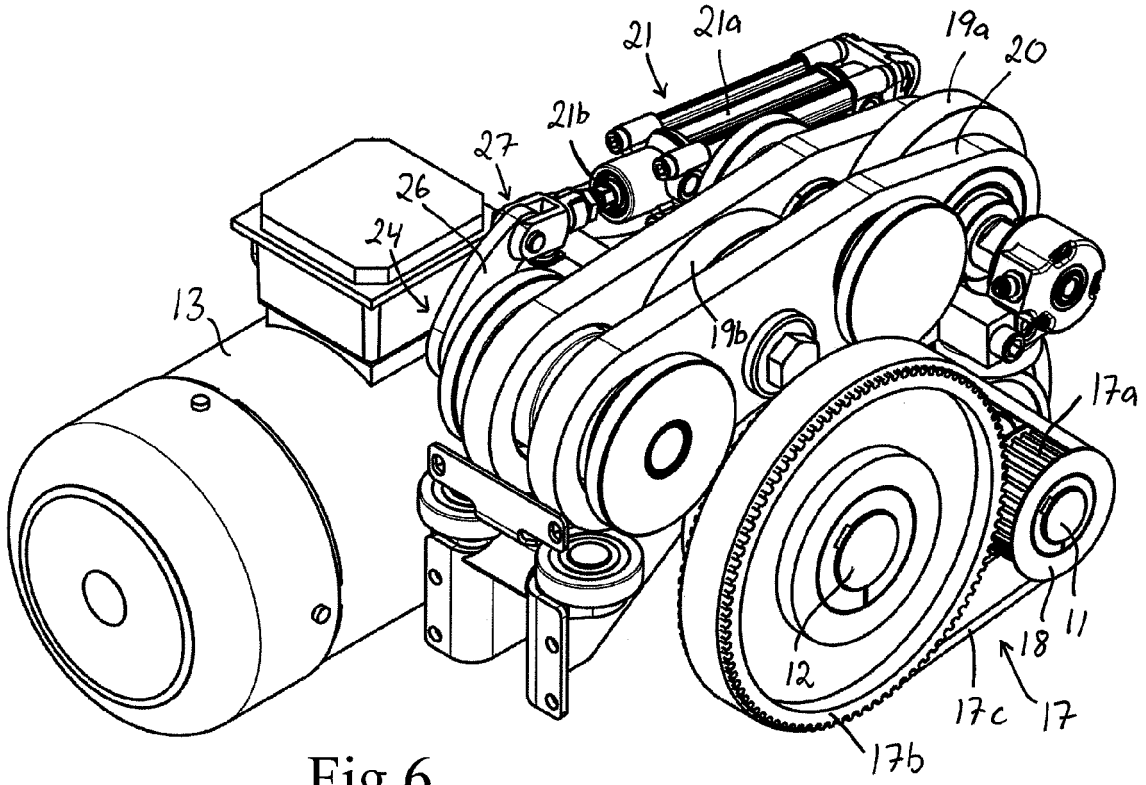
19b
PA
19a
28
13
31
22
15a
15
14a
14
2a

Fig 5b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21b
27
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19b
17a
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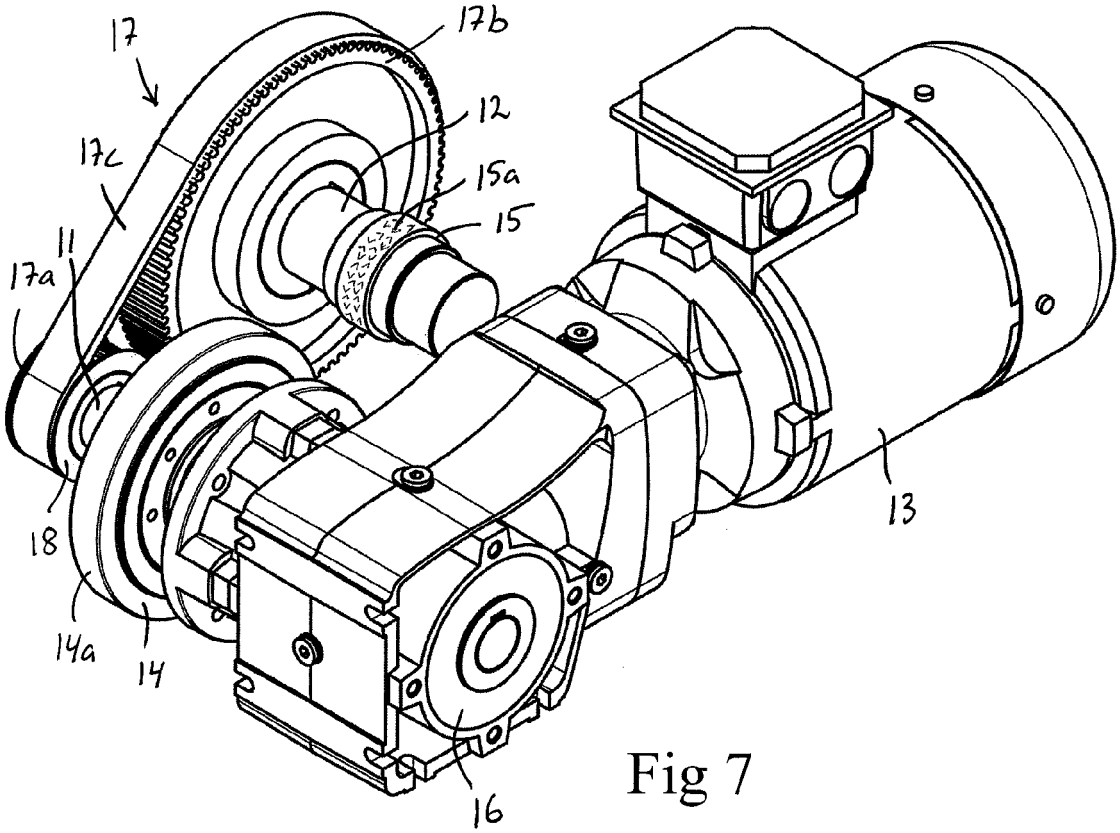
12
17c
17
17b

Fig 6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17c
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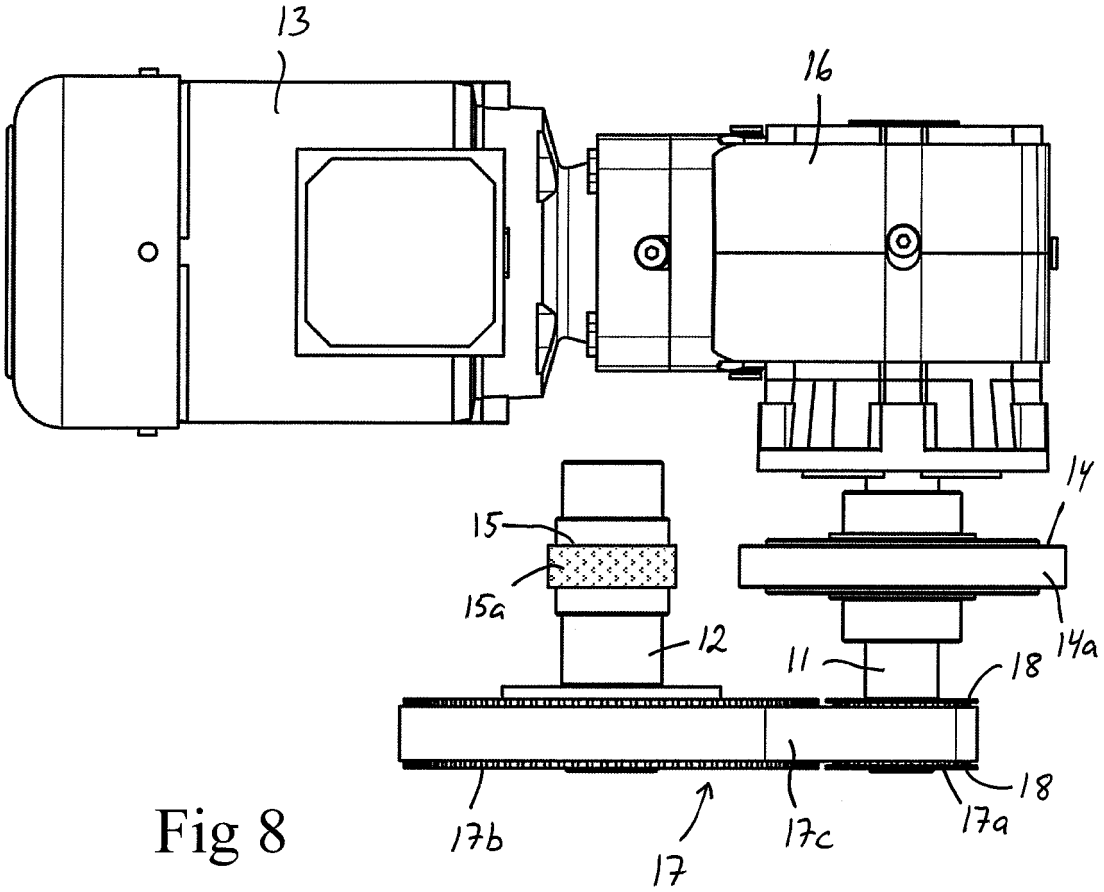
11
17a
18
14a
14
13
16

Fig 7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15a
12
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14a
18
17b
17
17c
17a

Fig 8

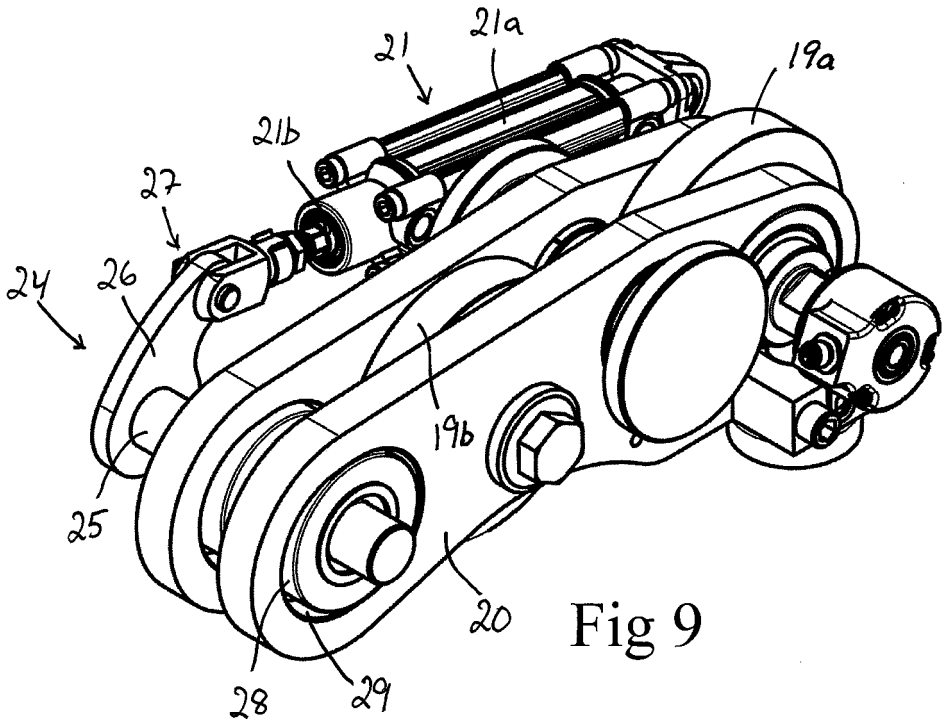
21
21a
19a
21b
27
24
26
19b
25
20
28
29

Fig 9

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EUROPEAN SEARCH REPORT

Application Number
EP 17 16 9708

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Place of search	Date of completion of the search	Examiner
Munich	9 November 2017	Damiani, Alberto

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