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WIRE BINDING MACHINE

(57) A wire binding machine with a twisting head (22), which is rotatable to bind portions of a wire (2) together by twisting and which comprises two wire gripping members (27a, 27b). A first drive member (41) is non-rotatably fixed to the twisting head and rotatable by a first electric motor (24) in order to rotate the twisting head. A second drive member (42) is rotatable in relation to the twisting head by a second electric motor (44) from a rotary starting

position to a rotary end position. A motion transferring mechanism (50, 51a, 51b) is configured to transfer a rotary movement of the second drive member (42) in relation to the twisting head (22) from the rotary starting position to the rotary end position into sequential movements of the gripping members (27a, 27b) from a wire releasing position to a wire gripping position.

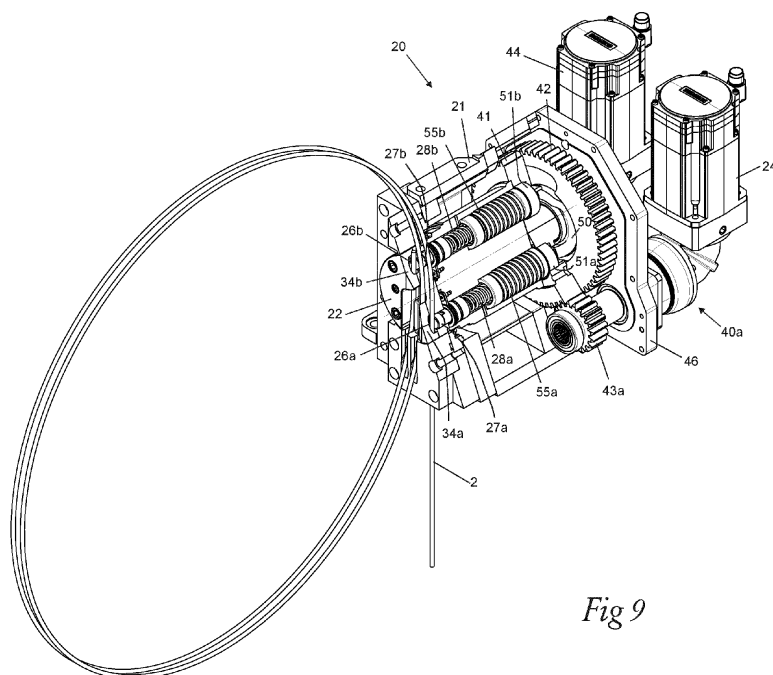


Fig 9

Description**FIELD OF THE INVENTION AND PRIOR ART**

[0001] The present invention relates to a wire binding machine according to the preamble of claim 1.

[0002] Automatic wire binding machines for applying a wire in one or more loops around an object or a bundle of objects, drawing the wire tightly around the object/bundle and thereafter tying partly overlapping wire portions together in order to secure the wire around the object/bundle are known in many different configurations.

[0003] A wire binding machine according to the preamble of claim 1 is previously known from EP 2 578 498 B1. The wire binding machine disclosed in EP 2 578 498 B1 comprises a rotatable twisting head provided with two gripping members, which are individually moveable from a retracted wire releasing position to an advanced wire gripping position against the action of a spring force from a respective spring member. The actuators for moving the gripping members from the wire releasing position to the wire gripping position are not described in closer detail in EP 2 578 498 B1, but a hydraulic or pneumatic actuation of the gripping members is suggested in EP 2 578 498 B1. When implementing a wire binding machine of the type disclosed in EP 2 578 498 B1, the obvious choice for a person skilled in the art would therefore be to provide each gripping member with its own actuator in the form of a hydraulic or pneumatic cylinder mounted in the rotatable twisting head.

OBJECT OF THE INVENTION

[0004] The object of the present invention is to achieve a further development of a wire binding machine of the type described above in order to provide a wire binding machine with a configuration which in at least some aspect offers an advantage as compared to this previously known wire binding machine.

SUMMARY OF THE INVENTION

[0005] According to the invention, this object is achieved by means of a wire binding machine having the features defined in claim 1.

[0006] The wire binding machine according to the present invention comprises:

- a wire guide track arrangement, by means of which a wire is guidable in one or more loops around a space configured for receiving one or more objects to be bound;
- a twisting device, which comprises a housing, a twisting head rotatably mounted in the housing so as to be rotatable in relation to the housing about an axis of rotation and a first electric motor for rotating the twisting head in relation to the housing, the twisting head being rotatable by the first electric motor to bind

portions of said wire together by twisting to thereby secure the wire around said one or more objects, wherein the twisting head is provided with:

- a first wire guide channel that extends through the twisting head at a front end thereof,
- a second wire guide channel that extends through the twisting head at the front end thereof,
- a first gripping member for gripping and locking a wire portion received in the first wire guide channel, and
- a second gripping member for gripping and locking a wire portion received in the second wire guide channel, wherein the first and second gripping members are individually moveable in the twisting head from a wire releasing position to a wire gripping position; and
- a feeding device for feeding the wire through the first wire guide channel in the twisting head, into the wire guide track arrangement, along the wire guide track arrangement around said space in one or more loops and into the second wire guide channel in the twisting head and subsequently retracting the wire to draw it tightly around one or more objects received in said space.

[0007] The twisting device of the wire binding machine further comprises:

- a first drive member, which is non-rotatably fixed to the twisting head and which is configured to be rotated by the first electric motor in order to rotate the twisting head;
- a first transmission mechanism for transmitting torque from the first electric motor to the first drive member;
- a second drive member, which is rotatably mounted in the housing so as to be rotatable in relation to the housing about said axis of rotation, wherein the second drive member is rotatable in relation to the twisting head from a rotary starting position to a rotary end position;
- a second electric motor for rotating the second drive member in relation to the twisting head from said rotary starting position to said rotary end position;
- a second transmission mechanism for transmitting torque from the second electric motor to the second drive member; and
- a motion transferring mechanism, which is configured to transfer a rotary movement of the second drive member in relation to the twisting head from said rotary starting position to said rotary end position into sequential movements of the second gripping member and the first gripping member from its wire releasing position to its wire gripping position.

[0008] The above-mentioned sequential movements of the second gripping member and the first gripping member implies that the second gripping member is moved from its wire releasing position to its wire gripping position in a first step, when the wire is to be retracted and drawn tightly around the objects to be bound, whereupon the first gripping member is moved from its wire releasing position to its wire gripping position in a subsequent second step, when the twisting head is to be rotated in order to achieve a twisting together of the wire portions received in the first and second wire guide channels in the twisting head.

[0009] When a gripping member is in its wire releasing position, the wire is free to pass through the wire guide channel associated with the gripping member and may be released from this wire guide channel. When a gripping member is in its wire gripping position, the wire is retained in the wire guide channel associated with the gripping member and prevented from being released from this wire guide channel. In the wire binding machine of the present invention, the prevailing position of each individual gripping member, i.e. whether the gripping member is in the wire releasing position or in the wire gripping position, is determined by the rotary position of the second drive member in relation to the twisting head, wherein the movement of the second drive member between its different rotary positions in relation to the twisting head is controlled by the second electric motor. Thus, no hydraulic or pneumatic cylinder needs to be arranged in the twisting head in order to control the movement of the gripping members from the wire releasing position to the wire gripping position, which facilitates the construction of the interface between the twisting head and the surrounding housing since no rotary fluid seals will be required at this interface when no hydraulic or pneumatic cylinder is arranged in the rotatable twisting head.

[0010] In this description and the subsequent claims, the "front end" of the twisting head refers to the end of the twisting head that faces the space configured for receiving one or more objects to be bound.

[0011] According to an embodiment of the invention, the first gripping member and the second gripping member are both configured to be in its wire releasing position when the second drive member is in the rotary starting position in relation to the twisting head, wherein the motion transferring mechanism is configured:

- to move the second gripping member from its wire releasing position to its wire gripping position and allow the first gripping member to remain its wire releasing position when the second drive member is rotated in relation to the twisting head by the second electric motor from said rotary starting position to an intermediate rotary position between the rotary starting position and said rotary end position, and
- to move the first gripping member from its wire releasing position to its wire gripping position and keep the second gripping member in its wire gripping po-

sition when the second drive member is rotated in relation to the twisting head by the second electric motor from said intermediate rotary position to said rotary end position.

[0012] Another embodiment of the invention, is characterized in:

- that the first wire guide channel in the twisting head has an inlet opening that is connected to an outlet opening of a wire inlet channel in the housing;
- that at least one cutting edge is provided at an interface between the outlet opening of the wire inlet channel and the inlet opening of the first wire guide channel, wherein the at least one cutting edge is configured to cut off the wire at this interface when the twisting head is rotated in relation to the housing; and
- that the twisting device comprises a third transmission mechanism capable of transmitting torque from the second drive member to the twisting head when the second drive member is in said rotary end position in relation to the twisting head, wherein the second electric motor, via the second transmission mechanism, the second drive member and the third transmission mechanism, is configured to assist the first electric motor in rotating the twisting head at an initial phase of a rotation of the twisting head in relation to the housing.

[0013] Thus, the first and second electric motors jointly rotate the twisting head during the initial phase of the rotary movement of the twisting head when the cutting of the wire is effected at the interface between the outlet opening of the wire inlet channel in the housing and the inlet opening of the first wire guide channel in the twisting head. During this initial phase of the rotary movement, a comparatively high torque is required for rotating the twisting head. When the wire has been cut at said interface, a much lower torque is required for rotating the twisting head in order to achieve the desired twisting together of the wire portions received in the first and second wire guide channels in the twisting head, which implies that this phase of the rotation of the twisting head in relation to the housing can be effected by the first electric motor without any further assistance of the second electric motor. By taking assistance of the second electric motor during the initial phase of the rotation of the twisting head in relation to the housing, the requirements on the power output of the first electric motor is reduced, which implies that the size and cost of the first electric motor can be reduced as compared to the case when the entire rotation of the twisting head in relation to the housing is effected only by the first electric motor.

[0014] According to another embodiment of the invention, the third transmission mechanism comprises a first torque transmitting member that is fixed to the second drive member and an associated second torque transmitting member that is fixed to the twisting head or to the

first drive member, wherein the first torque transmitting member is configured to be in torque transmitting contact with the second torque transmitting member only when the second drive member is in said rotary end position in relation to the twisting head. Hereby, torque for assisting in rotating the twisting head may only be transmitted from the second drive member to the twisting head via the third transmission mechanism when the second drive member is in the above-mentioned rotary end position in relation to the twisting head, i.e. when the first and second gripping members have both been moved to the wire gripping position.

[0015] According to another embodiment of the invention, one of the first and second torque transmitting members is formed by a shoulder at an end of a track in the first or second drive member or in the twisting head, wherein the other one of the first and second torque transmitting members comprises a projection that is received in and moveable along said track. The design of the third transmission mechanism is hereby simplified, at the same time as it will be capable of transmitting torque from the second drive member to the twisting head in an efficient and reliable manner when the second drive member is in the above-mentioned rotary end position in relation to the twisting head. However, the third transmission mechanism may as an alternative be designed in any other suitable manner.

[0016] As an alternative to a cutting of the wire by rotation of the twisting head in the manner described above, the cutting of the wire could be effected by a cutting member that is moveably mounted to the housing of the twisting device and actuated, for instance by means of an electric or hydraulic actuator, to cut the wire before the first electric motor is actuated to rotate the twisting head. In this case, the wire is consequently cut when the twisting head is standing still, which implies that no assistance from the second electric motor in the rotation of the twisting head is needed in this case.

[0017] The first gripping member is preferable moveable from its wire releasing position to its wire gripping position against the action of a spring force from a first spring member that is arranged in the twisting head, wherein the second gripping member in a corresponding manner is moveable from its wire releasing position to its wire gripping position against the action of a spring force from a second spring member that is arranged in the twisting head. Hereby, the force required for returning a gripping member from its wire gripping position to its wire releasing position can be provided in a simple manner by the spring member associated with the gripping member.

[0018] Furthermore, each one of the first and second gripping members is preferably linearly moveable between its wire releasing position and its wire gripping position in the axial direction of the twisting head, wherein the gripping member is in a retracted position in the twisting head in its wire releasing position and in an advanced position in the twisting head in its wire gripping position.

In this case, the motion transferring mechanism is configured to transfer the rotary movement of the second drive member in relation to the twisting head into sequential translatory movements of the gripping members in a direction in parallel with the longitudinal axis of the twisting head and in parallel with the above-mentioned axis of rotation.

[0019] However, each one of the first and second gripping members may as an alternative be rotatably moveable in the twisting head between its wire releasing position and its wire gripping position, wherein the gripping member is in a first rotary position in the twisting head in its wire releasing position and in a second rotary position in the twisting head in its wire gripping position. In this case, the motion transferring mechanism is configured to transfer the rotary movement of the second drive member in relation to the twisting head into sequential rotary movements of the gripping members in the twisting head.

[0020] According to another embodiment of the invention, the motion transferring mechanism comprises:

- a cam member, which is non-rotatably fixed to the second drive member;
- a first cam follower, which bears against a first guide surface on the cam member and which is mounted to the twisting head and connected to the first gripping member, wherein the first gripping member is moveable from its wire releasing position to its wire gripping position under the effect of the cam member and the first cam follower; and
- a second cam follower, which bears against a second guide surface on the cam member and which is mounted to the twisting head and connected to the second gripping member, wherein the second gripping member is moveable from its wire releasing position to its wire gripping position under the effect of the cam member and the second cam follower.

[0021] Another embodiment of the invention, in which the first and second gripping members are linearly moveable between the wire releasing position and the wire gripping position in the axial direction of the twisting head, is characterized in:

- that the first cam follower is moveable in relation to the first gripping member in the axial direction of the twisting head;
- that the motion transferring mechanism comprises a first compression spring acting between the first cam follower and the first gripping member, wherein the first cam follower is configured to push the first gripping member from its wire releasing position to its wire gripping position via the first compression spring when the second drive member is moved by the second electric motor from said intermediate rotary position to said rotary end position;
- that the second cam follower is moveable in relation to the second gripping member in the axial direction

- of the twisting head; and
- that the motion transferring mechanism comprises a second compression spring acting between the second cam follower and the second gripping member, wherein the second cam follower is configured to push the second gripping member from its wire releasing position to its wire gripping position via the second compression spring when the second drive member is moved by the second electric motor from said rotary starting position to said intermediate rotary position.

[0022] Thus, in order to move a gripping member from its wire releasing position to its wire gripping position, the cam follower associated with the gripping member is in this case configured to push the gripping member via the intermediate compression spring, which implies that it will be possible for the gripping member to assume different end positions in its wire gripping position in dependence on the diameter of the wire presently used. Hereby, wires of different diameters can be used in the wire binding machine without requiring any adjustment of the gripping members.

[0023] As an alternative to cam mechanisms of the type described above, the motion transferring mechanism may comprise any other suitable type of mechanisms, such as for instance gear mechanisms, for transferring the rotary movement of the second drive member in relation to the twisting head into the desired movements of the first and second gripping members.

[0024] Other favourable features of the wire binding machine according to the invention will appear from the dependent claims and the description following below.

BRIEF DESCRIPTION OF THE DRAWINGS

[0025] With reference to the appended drawings, a specific description of embodiments of the invention cited as examples follows below.

[0026] In the drawings:

- Fig 1 is a perspective view of a wire binding machine according to an embodiment of the present invention,
- Fig 2 is a perspective view of a twisting device included in the wire binding machine of Fig 1,
- Fig 3 is an exploded view of the twisting device of Fig 2,
- Fig 4 is an exploded view from another direction of the twisting device of Fig 2,
- Fig 5 is a perspective view of the twisting device of Fig 2, as seen with a part of the housing removed,

Fig 6

is a perspective view from another direction of the twisting device of Fig 2, as seen with another part of the housing removed,

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Fig 7

is a front view of the twisting device of Fig 2,

Fig 8

is a perspective view of the twisting device of Fig 2, as seen with a wire feed through the wire guiding channels in the twisting head included in the twisting device,

10

Fig 9

is a partly cut perspective view corresponding to Fig 8,

Fig 10

is a longitudinal cut through the twisting device of Fig 2,

20

Fig 11

is a longitudinal cut through a first gripping member and a first cam follower included in the twisting device of Fig 2,

Fig 12

is a longitudinal cut through a second gripping member and a second cam follower included in the twisting device of Fig 2,

Fig 13

is a partly cut perspective view of parts included in the twisting device of Fig 2,

Fig 14

is a perspective view of a cam member included in the twisting device of Fig 2,

35

Fig 15

is a perspective view of a front part of the twisting head included in the twisting device of Fig 2,

Fig 16

is a perspective view of a part of the housing included in the twisting device of Fig 2,

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Fig 17

is a perspective view of a drive member included in the twisting device of Fig 2, and

Figs 18a-18c

are schematic illustrations of a transmission mechanism included in the twisting device of Fig 2, as seen in different positions.

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DETAILED DESCRIPTION OF EMBODIMENTS OF THE INVENTION

[0027] A wire binding machine 1 according to an embodiment of the present invention is illustrated in Fig 1. The wire binding machine 1 comprises a wire guide track

arrangement 10, by means of which a wire 2 (see Figs 8 and 9) may be guided in one loop or two continuous loops around a space 3 configured for receiving one or more objects (not shown) to be bound. The guide track arrangement 10 is of the type described in closer detail in EP 2 578 498 B1, the content of which being incorporated herein by reference. The guide track arrangement 10 comprises a guide plate 11, which extends in a curve around said space 3. Plate-shaped and curved first guide elements 12 are mounted to the guide plate 11 on a first side thereof and corresponding plate-shaped and curved second guide elements (not shown) are mounted to the guide plate 11 on the opposite side thereof. A curved first guide track 14 is formed between the guide plate 11 and the first guide elements 12 on one side of the guide plate 11 for guiding the wire 2 in a first loop around said space 3, and a curved second guide track (not shown) is formed between the guide plate 11 and the second guide elements on the other side of the guide plate 11 for guiding the wire 2 in a subsequent second loop around said space 3. Guide rollers 15 are rotatably mounted between the guide plate 11 and each guide element 12. These guide rollers 15 are distributed along each guide track 14.

[0028] The wire binding machine 1 may as an alternative be provided with a guide track arrangement configured to guide a wire in only one loop around a space 3 configured for receiving one or more objects to be bound.

[0029] In the illustrated embodiment, retainer units 16 are mounted to the guide plate 11 in order to retain and subsequently release the wire during the tightening of the wire 2 around one or more objects. The design and functioning of these retainer units 16 is described in closer detail in EP 2 535 278 B1.

[0030] A twisting device 20 is located between the ends of the guide plate 11. This twisting device 20 comprises a housing 21 and a twisting head 22 rotatably mounted in the housing, wherein the twisting head 22 is rotatable in relation to the housing 21 about an axis of rotation 23. The twisting head 22 is rotatable by means of a first electric motor 24 in order to bind partly overlapping wire portions of the wire 2 together by twisting to thereby secure the wire in one or two loops around one or more objects received in the above-mentioned space 3.

[0031] The twisting head 22 is provided with:

- a first wire guide channel 26a (see Fig 7), which extends through the twisting head at the front end thereof;
- a second wire guide channel 26b, which extends through the twisting head at the front end thereof alongside of at least a part of the first wire guide channel 26a;
- a first gripping member 27a for gripping and locking a wire portion received in the first wire guide channel 26a; and
- a second gripping member 27b for gripping and locking a wire portion received in the second wire guide channel 26b.

[0032] In the illustrated embodiment, the twisting head 22 is also provided with a third wire guide channel 26c, which extends across the twisting head at the front end thereof alongside of at least a part of the first and second wire guide channels 26a, 26b and in the area between them. The third wire guide channel 26c in the twisting head 22 may of course be omitted if the wire binding machine 1 is designed for securing a wire in one single loop around one or more objects to be bound.

[0033] The first and second gripping members 27a, 27b are individually moveable in the twisting head 22 between a wire releasing position, in which the wire 2 is free to pass through the associated wire guide channel 26a, 26b and may be released from it, and a wire gripping position, in which the wire 2 is retained in the associated wire guide channel 26a, 26b by clamping and prevented from being released from it. In the illustrated embodiment, each gripping member 27a, 27b is linearly moveable between its wire releasing position and its wire gripping position in the axial direction of the twisting head 22, wherein the gripping member 27a, 27b is in a retracted position in the twisting head 22 in its wire releasing position and in an advanced position in the twisting head 22 in its wire gripping position. Thus, in this case, each gripping member 27a, 27b is moveable from its wire releasing position to its wire gripping position by a movement towards the front end of the twisting head 22 in parallel with the above-mentioned axis of rotation 23.

[0034] In the illustrated embodiment, each gripping member 27a, 27b is moveable from the retracted wire releasing position to the advanced wire gripping position against the action of the spring force from a spring member 28a, 28b and moveable in the opposite direction from the advanced wire gripping position to the retracted wire releasing position by the spring force from this spring member 28a, 28b. Thus, the spring member 28a, 28b constitutes a return spring for the associated gripping member 27a, 27b.

[0035] The first wire guide channel 26a has an inlet opening 29a at a first end and an outlet opening 29b at the other end. The inlet opening 29a is provided in an outer peripheral surface of the twisting head 22 and connected to an outlet opening 31 of a wire inlet channel 30 that extends through a part of the housing 21. At least one cutting edge 32a, 32b is provided at the interface between the outlet opening 31 of the wire inlet channel 30 and the inlet opening 29a of the first wire guide channel 26a and configured to cut off the wire 2 at this interface when the twisting head 22 is rotated in relation to the housing 21. If only one such cutting edge is used, this cutting edge may be provided in the twisting head 22 at the inlet opening 29a of the first wire guide channel 26a or in the housing 21 at the outlet opening 31 of the wire inlet channel 30. However, there are with advantage two cooperating cutting edges 32a, 32b at this interface. In the illustrated embodiment, a first cutting edge 32a is formed in the twisting head 22 at the inlet opening 29a of the first wire guide channel 26a and a second cutting

edge 32b is formed in the housing 21 at the outlet opening 31 of the wire inlet channel 30. When the twisting head 22 is rotated in relation to the housing 21, the first cutting edge 32a is moved towards the stationary second cutting edge 32b to thereby cut through the part of the wire 2 located between these cutting edges 32a, 32b and cut off the wire at the interface between the first wire guide channel 26a and the wire inlet channel 30.

[0036] The part of the first wire guide channel 26a closest to the inlet opening 29a is covered by a structural part 34a which forms a counter member for the first gripping member 27a. The remaining part of the first wire guide channel 26a is not covered and consequently open towards the front end of the twisting head 22. The outlet opening 29b of the first wire guide channel 26a is connected to a guide groove 35 provided in the housing 21. Through this guide groove 35, the leading end of the wire 2 is directed from the first wire guide channel 26a towards the first guide track 14 of the guide track arrangement 10.

[0037] The second wire guide channel 26b has an inlet opening 36a at a first end. A stop surface (not shown) is provided at the other end of the second wire guide channel 26b. In the illustrated embodiment, the second wire guide channel 26b is provided with an outlet opening 36b (see Fig 4) in an outer peripheral surface of the twisting head 22, wherein said stop surface is provided on a part of the housing 21 facing said outlet opening 36b. As an alternative, the stop surface could be integrated in the twisting head 22 and form an end surface in the second wire guide channel 26b. In the latter case, the second wire guide channel 26b would lack said outlet opening 36b. The part of the second wire guide channel 26b closest to the stop surface is covered by a structural part 34b which forms a counter member for the second gripping member 27b. The remaining part of the second wire guide channel 27b is not covered and consequently open towards the front end of the twisting head 22. The inlet opening 36a of the second wire guide channel is connected to a guide groove 37 provided in the housing 21. Through this guide groove 37, the leading end of the wire 2 is directed into the second wire guide channel 26b.

[0038] The third wire guide channel 26c has an inlet opening 38a at a first end and an outlet opening 38b at the other end, as illustrated in Fig 7. The third wire guide channel 26c is not covered and consequently open along its entire length towards the front end of the twisting head 22. The inlet opening 38a of the third wire guide channel is connected to a guide groove 39a provided in the housing 21. Through this guide groove 39a, the leading end of the wire 2 is directed into the third wire guide channel 26c. The outlet opening 38b of the third wire guide channel is connected to another guide groove 39b provided in the housing 21. Through this guide groove 39b, the leading end of the wire 2 is directed from the third wire guide channel 26c towards the second guide track of the guide track arrangement 10.

[0039] The wire binding machine 1 also comprises a feeding device 5 (see Fig 1) for feeding the wire 2 into

said wire guide track arrangement 10 and along the wire guide track arrangement in one or two loops around said space 3 and subsequently retracting the wire to draw it tightly around one or more objects received in said space 3. The feeding device 5 is with advantage provided with an electric or hydraulic motor 6 for feeding and pulling the wire. At the beginning and at the end of each loop, the leading end of the wire 2 is guided into one of the wire guide channels 26a, 26b, 26c of the twisting head 22.

[0040] The guide track arrangement 10 comprises a guiding device 17, by means of which the leading end of the wire 2 is guidable into the third wire guide channel 26c of the twisting head when the wire has been guided by the guide track arrangement 10 in a first loop around the above-mentioned space 3 and into the second wire guide channel 26b of the twisting head when the wire has been guided by the guide track arrangement in a subsequent second loop around said space 3. The design and functioning of this guiding device 17 is described in closer detail in EP 2 578 498 B1.

[0041] The twisting device 20 comprises a first drive member 41, which is non-rotatably fixed to the twisting head 22 and which is configured to be rotated by the first electric motor 24 in order to rotate the twisting head 22. Driving torque for rotating the first drive member 41 in relation to the housing 21 is transmitted from the first electric motor 24 to the first drive member 41 through a first transmission mechanism 40a.

[0042] The twisting device 20 further comprises a second drive member 42, which is rotatably mounted in the housing 21 so as to be rotatable in relation to the housing about the axis of rotation 23, wherein the second drive member 42 is rotatable in relation to the twisting head 22 about the axis of rotation 23 from a rotary starting position to a rotary end position by means of a second electric motor 44. Driving torque for rotating the second drive member 42 in relation to the twisting head 22 is transmitted from the second electric motor 44 to the second drive member 42 through a second transmission mechanism 40b.

[0043] Each drive member 41, 42 preferably has the form of an externally toothed wheel or ring, wherein the transmission mechanism 40a, 40b associated with the drive member comprises a toothed drive belt or a gear 43a, 43b that is in driving engagement with the drive member. In the illustrated embodiment, each drive member 41, 42 has the form of an externally toothed wheel, which is in engagement with a gear 43a, 43b included in the associated transmission mechanism 40a, 40b. The gears 43a, 43b are non-rotatably fixed to a respective shaft 45a, 45b, which in its turn is rotatably mounted to the housing 21 and rotatable by the associated electric motor 24, 44.

[0044] In the illustrated embodiment, the first drive member 41 is arranged at the rear end of the twisting head 22 and the second drive member 42 is arranged between the first drive member 41 and a rear wall 46 of the housing 21, as illustrated in Fig 10. In this case, the

first and second drive members 41, 42 are arranged side by side with a rear face 41b of the first drive member 41 facing a front face 42a of the second drive member 42. In the illustrated example, the second drive member 42 is rotatably mounted to a shaft 47, which is fixed to the first drive member 41 and extends rearwardly from the rear face 41b thereof. The second drive member 42 could as an alternative be rotatably connected to the twisting head 22 in any other suitable manner, for instance by being mounted to a shaft that forms part of the twisting head 22.

[0045] In the illustrated embodiment, the unit formed by the twisting head 22 and the two drive members 41, 42 is rotatably mounted to the housing 21 by means of a first rolling bearing 48a, for instance in the form of a ball bearing, provided at the front end of the twisting head 22 and a second rolling bearing 48b, for instance in the form of a ball bearing, provided between the rear wall 46 of the housing 21 and a shaft 49 that is fixed to the second drive member 42 and extends rearwardly from the rear face 42b thereof.

[0046] A motion transferring mechanism is configured to transfer a rotary movement of the second drive member 42 in relation to the twisting head 22 from the above-mentioned rotary starting position to above-mentioned rotary end position into sequential movements of the second gripping member 27b and the first gripping member 27a from its wire releasing position to its wire gripping position. The first and second gripping members 27a, 27b are both configured to be in the wire releasing position when the second drive member 42 is in the rotary starting position in relation to the twisting head 22, wherein the motion transferring mechanism is configured:

- to move the second gripping member 27b from its wire releasing position to its wire gripping position and allow the first gripping member 27a to remain its wire releasing position when the second drive member 42 is rotated in relation to the twisting head 22 by the second electric motor 44 from said rotary starting position to an intermediate rotary position between the rotary starting position and said rotary end position, and
- to move the first gripping member 27a from its wire releasing position to its wire gripping position and keep the second gripping member 27b in its wire gripping position when the second drive member 42 is rotated in relation to the twisting head 22 by the second electric motor 44 from said intermediate rotary position to said rotary end position.

[0047] In the illustrated embodiment, the motion transferring mechanism comprises:

- a cam member 50, which is non-rotatably fixed to the second drive member 42;
- a first cam follower 51a, which bears against a first guide surface 53a on the cam member 50 and which

is mounted to the twisting head 22 and connected to the first gripping member 27a; and

- a second cam follower 51b, which bears against a second guide surface 53b on the cam member 50 and which is mounted to the twisting head 22 and connected to the second gripping member 27b.

[0048] The first gripping member 27a is moveable from its wire releasing position to its wire gripping position under the effect of the cam member 50 and the first cam follower 51a, and the second gripping member 27b is moveable from its wire releasing position to its wire gripping position under the effect of the cam member 50 and the second cam follower 51b.

[0049] Each cam follower 51a, 51b is configured to rotate together with the twisting head 22 but is moveably mounted to the twisting head 22 such that it is moveable in relation to the twisting head under the effect of the cam member 50. In the illustrated embodiment, the cam followers 51a, 51b extend through a respective though hole in the first drive member 41 and are partly received in a respective bore in the twisting head 22.

[0050] The illustrated cam member 50 has the form of a ring, wherein the above-mentioned first and second guide surfaces 53a, 53b are provided on a front face of the ring-shaped cam member 50 facing the rear end of the twisting head 22. The cam member 50 may of course also have any other suitable design. In the illustrated example, a first slide bearing 54a in the form of a cylindrical bushing is provided between an outer peripheral surface of the shaft 47 on the first drive member 41 and the inner peripheral surface of the ring-shaped cam member 50 and a second slide bearing 54b in the form of a cylindrical bushing is provided between an outer peripheral surface of the shaft 47 on the first drive member 41 and an inner peripheral surface of the shaft 49 on the second drive member 42.

[0051] Each cam follower 51a, 51b is with advantage provided with a rotatably mounted roller 52, through which the cam follower 51a, 51b is in contact with the associated guide surface 53a, 53b on the cam member and which is configured to roll along this guide surface when the cam member 50 is rotated in relation to the twisting head 22 together with the second drive member 42.

[0052] In the illustrated embodiment, each cam follower 51a, 51b is moveable in relation to the associated gripping member 27a, 27b in the axial direction of the twisting head 22, wherein the motion transferring mechanism comprises a first compression spring 55a acting between the first cam follower 51a and the first gripping member 27a and a second compression spring 55b acting between the second cam follower 51b and the second gripping member 27b. The second cam follower 51b is configured to exert a pushing force on the second gripping member 27b via the second compression spring 55b when the second drive member 42 is moved by the second electric motor 44 from said rotary starting position to

said intermediate rotary position. Thus, the second cam follower 51b will push the second gripping member 27b from its wire releasing position to its wire gripping position via the second compression spring 55b. In a corresponding manner, the first cam follower 51a is configured to exert a pushing force on the first gripping member 27a via the first compression spring 55a when the second drive member 42 is moved by the second electric motor 44 from said intermediate rotary position to said rotary end position. Thus, the first cam follower 51a will push the first gripping member 27a from its wire releasing position to its wire gripping position via the first compression spring 55a.

[0053] In the illustrated example, the first and second gripping members 27a, 27b are identically designed, wherein each gripping member 27a, 27b comprises an elongated shaft 56, a first end piece 57 fixed to the shaft 56 at a front end thereof and a second end piece 58 fixed to the shaft 56 at a rear end thereof. The first end piece 57 is configured to be pressed against the wire 2 in order to clamp the wire in the associated wire guide channel 26a, 26b in the wire gripping position of the gripping member. The shaft 56 is slidably received in a tubular holder 59, which in its turn is fixed in a bore in the twisting head 22. The spring member 28a, 28b associated with the gripping member 27a, 27b is clamped between a shoulder 60 on the holder 59 and an opposite shoulder 61 on the second end piece 58. Each cam follower 51a, 51b comprises an elongated shaft 62, which extends in a direction towards the gripping member 27a, 27b associated with the cam follower. An end piece 63 is slidably mounted to the shaft 62 so as to be slidable in the longitudinal direction thereof. The movement of the end piece 63 in the direction towards the associated gripping member 27a, 27b is restricted by a stop member 64, which is fixed to the shaft 62 by means of a screw 65. The end piece 63 has a first shoulder 66 on a first side and a second shoulder 67 on an opposite second side, wherein the first shoulder 66 is facing the associated gripping member 27a, 27b and the second shoulder 67 is facing away from the associated gripping member 27a, 27b. The compression spring 55a, 55b associated with the cam follower 51a, 51b surrounds the shaft 62 of the cam follower and is clamped between the second shoulder 67 on the end piece 63 and an opposite shoulder 68 on the cam follower. The second end piece 58 of the gripping member 27a, 27b is urged against the first shoulder 66 on the end piece 63 by the spring force from the spring member 28a, 28b, whereas the end piece 63 is urged against the second end piece 58 of the gripping member 27a, 27b by the spring force from the compression spring 55a, 55b.

[0054] In the illustrated embodiment, the first cam follower 51a is biased towards the first guide surface 53a on the cam member 50 by the first spring member 28a, and the second cam follower 51b is biased towards the second guide surface 53b on the cam member 50 by the second spring member 28b.

[0055] In the illustrated embodiment, the twisting de-

vice 20 comprises a third transmission mechanism 70 capable of transmitting torque from the second drive member 42 to the twisting head 22 when the second drive member 42 is in the above-mentioned rotary end position in relation to the twisting head 22, wherein the second electric motor 44, via the second transmission mechanism 40b, the second drive member 42 and the third transmission mechanism 70, is configured to assist the first electric motor 24 in rotating the twisting head 22 at an initial phase of a rotation of the twisting head in relation to the housing 21. Thus, the first and second electric motors 24, 44 are configured to jointly rotate the twisting head 22 during the initial phase of the rotary movement of the twisting head 22 when the cutting of the wire 2 is effected at the interface between the outlet opening 31 of the wire inlet channel 30 in the housing 21 and the inlet opening 29a of the first wire guide channel 26a in the twisting head. When the wire 2 has been cut, the second drive member 42 is to rotate together with the twisting head 22 without exerting any driving torque on the twisting head 22 via the third transmission mechanism 70. During this remaining rotation of the twisting head 22, the second drive member 42 has to rotate together with the twisting head in order to remain in the rotary end position in relation to the twisting head 22 and thereby keep the first and second gripping members 27a, 27b in the wire gripping position. This continued rotation of the second drive member 42 together with the twisting head 22 may for instance be achieved by controlling the second electric motor 44 to rotate the second drive member 42 in synchronization with the twisting head 22 or by disconnecting the second drive member 42 from the second electric motor 44.

[0056] The third transmission mechanism 70 comprises a first torque transmitting member 71 that is fixed to the second drive member 42 and an associated second torque transmitting member 72 that is fixed to the twisting head 22 or to the first drive member 41, wherein the first torque transmitting member 71 is configured to be in torque transmitting contact with the second torque transmitting member 72 only when the second drive member 42 is in said rotary end position in relation to the twisting head 22. In the illustrated embodiment, the first torque transmitting member 71 is formed by a shoulder at an end of a track 73 in the second drive member 42, wherein the second torque transmitting member 72 comprises a projection, for instance in the form of a roller or pin, which is received in and moveable along said track 73 and which comes into contact with said shoulder 71 at the end of the track, as illustrated in Fig 18c, when the second drive member 42 reaches the rotary end position in relation to the twisting head 22. In the illustrated example, the second torque transmitting member 72 is fixed to the first drive member 41 so as to extend from the rear face 41b thereof, whereas the track 73 is provided in the front face 42a of the second drive member 42. As an alternative, the second torque transmitting member could be formed by a shoulder at an end of a track in the rear face

41b of the first drive member 41, wherein the first torque transmitting member comprises a projection, for instance in the form of a roller or pin, which projects from the front face 42a of the second drive member 42 and is received in and moveable along said track and which comes into contact with said shoulder at the end of the track when the second drive member 42 reaches the rotary end position in relation to the twisting head 22.

[0057] The operation of the first and second electric motors 24, 44 is controlled by means of an electronic control device (not shown) included in the wire binding machine 1.

[0058] An operating sequence for securing a loop of metal wire 2 around an object by means of the above-described wire binding machine 1 will be described in the following.

[0059] If the wire 2 is to be bound in a single loop around the object, a moveable guide member (not shown) included in the above-mentioned guiding device 17 is positioned in a first position. At the start of the operating sequence, the second drive member 42 is positioned in the above-mentioned rotary starting position in relation to the twisting head 22, which implies that the first and second gripping members 27a, 27b are in the retracted wire releasing position, wherein the second torque transmitting member 72 is in the position in the track 73 illustrated in Fig 18a and consequently out of contact with the first torque transmitting member 71. In a first step, the motor 6 of the feeding device 5 is operated in a first direction in order to feed a metal wire 2 forwards from a wire coil (not shown), through the first wire guide channel 26a in the twisting head 22 and then further on through the guide groove 35 and into the first guide track 14 of the guide track arrangement 10. The wire 2 is fed forwards in the first guide track 14 in a loop around the space 3. At the end of the first guide track 14, the leading end of the wire 2 is directed by the guiding device 17 into the guide groove 37 and then further on into the second wire guide channel 26b of the twisting head 22, whereupon the leading end of the wire actuates a stop member (not shown) and the motor 6 of the feeding device 5 is stopped. Thereafter, the second electric motor 44 is operated to rotate the second drive member 42 in relation to the twisting head 22 from the rotary starting position to the above-mentioned intermediate rotary position, which implies that the second gripping member 27b is displaced towards the counter member formed by the structural part 34b so that the portion of the wire received in the second wire guide channel 26b is clamped between the second gripping member 27b and this counter member. The leading end of the wire 2 is thereby locked to the twisting head 22. The second torque transmitting member 72 has now assumed the position in the track 73 illustrated in Fig 18b and is consequently still out of contact with the first torque transmitting member 71. An object or a bundle of objects is feed into the space 3, for instance by means of a conveyor (not shown). Thereafter, the motor 6 of the feeding device 5 is reversed in order to pull the wire 2

backwards and thereby tighten the wire around the object. The retainer units 16 are arranged to release the wire 2 consecutively one by one during the tightening of the wire around the object. When the wire 2 has been drawn tightly around the object, the second electric motor 44 is operated to rotate the second drive member 42 in relation to the twisting head 22 from the intermediate rotary position to the above-mentioned rotary end position, which implies that the first gripping member 27a is displaced towards the counter member formed by the structural part 34a so that the portion of the wire received in the first wire guide channel 26a is clamped between the first gripping member 27a and this counter member. The trailing end of the wire loop is thereby locked to the twisting head 22. The second torque transmitting member 72 has now assumed the position in the track 73 illustrated in Fig 18c and is consequently in contact with the first torque transmitting member 71. The first and second electric motors 24, 44 are then operated to jointly rotate the twisting head 22 and thereby effect a cutting of the wire 2 by the cutting edges 32a, 32b at the interface between the first wire guide channel 26a and the wire inlet channel 30. The twisting head 22 is thereafter rotated under the effect of the first electric motor 24, without assistance of the second electric motor 44, in order to bind the wire portions received in the first and second wire guide channels 26a, 26b of the twisting head together by twisting and thereby secure the wire loop to the object. When the rotation of the twisting head has been completed and the first electric motor 24 has been stopped, the second electric motor 44 is operated in a reversed direction in order to rotate the second drive member 42 in relation to the twisting head 22 from the rotary end position to the rotary starting position and thereby allow the first and second gripping members 27a, 27b to return to the wire releasing position, whereupon the wire loop may be released from the twisting head 22.

[0060] 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 wire binding machine comprising:

- a wire guide track arrangement (10), by means of which a wire is guidable in one or more loops around a space (3) configured for receiving one or more objects to be bound;
- a twisting device (20), which comprises a housing (21), a twisting head (22) rotatably mounted in the housing (21) so as to be rotatable in relation to the housing about an axis of rotation (23) and a first electric motor (24) for rotating the

twisting head (22) in relation to the housing (21), the twisting head (22) being rotatable by the first electric motor (24) to bind portions of said wire together by twisting to thereby secure the wire around said one or more objects, wherein the twisting head (22) is provided with:

- a first wire guide channel (26a) that extends through the twisting head at a front end thereof,
- a second wire guide channel (26b) that extends through the twisting head at the front end thereof,
- a first gripping member (27a) for gripping and locking a wire portion received in the first wire guide channel (26a), and
- a second gripping member (27b) for gripping and locking a wire portion received in the second wire guide channel (26b), wherein the first and second gripping members (27a, 27b) are individually moveable in the twisting head (22) from a wire releasing position to a wire gripping position; and

- a feeding device (5) for feeding the wire through the first wire guide channel (26a) in the twisting head, into the wire guide track arrangement (10), along the wire guide track arrangement around said space (3) in one or more loops and into the second wire guide channel (26b) in the twisting head and subsequently retracting the wire to draw it tightly around one or more objects received in said space (3),

characterized in that the twisting device (20) comprises:

- a first drive member (41), which is non-rotatably fixed to the twisting head (22) and which is configured to be rotated by the first electric motor (24) in order to rotate the twisting head (22);
- a first transmission mechanism (40a) for transmitting torque from the first electric motor (24) to the first drive member (41);
- a second drive member (42), which is rotatably mounted in the housing (21) so as to be rotatable in relation to the housing about said axis of rotation (23), wherein the second drive member (42) is rotatable in relation to the twisting head (22) from a rotary starting position to a rotary end position;
- a second electric motor (44) for rotating the second drive member (42) in relation to the twisting head (22) from said rotary starting position to said rotary end position;
- a second transmission mechanism (40b) for transmitting torque from the second electric motor (44) to the second drive member (42); and

- a motion transferring mechanism (50, 51a, 51b), which is configured to transfer a rotary movement of the second drive member (42) in relation to the twisting head (22) from said rotary starting position to said rotary end position into sequential movements of the second gripping member (27b) and the first gripping member (27a) from its wire releasing position to its wire gripping position.

2. A wire binding machine according to claim 1, **characterized in that** the first gripping member (27a) and the second gripping member (27b) are both configured to be in its wire releasing position when the second drive member (42) is in the rotary starting position in relation to the twisting head (22), wherein the motion transferring mechanism (50, 51a, 51b) is configured:

- to move the second gripping member (27b) from its wire releasing position to its wire gripping position and allow the first gripping member (27a) to remain its wire releasing position when the second drive member (42) is rotated in relation to the twisting head (22) by the second electric motor (44) from said rotary starting position to an intermediate rotary position between the rotary starting position and said rotary end position, and

- to move the first gripping member (27a) from its wire releasing position to its wire gripping position and keep the second gripping member (27b) in its wire gripping position when the second drive member (42) is rotated in relation to the twisting head (22) by the second electric motor (44) from said intermediate rotary position to said rotary end position.

3. A wire binding machine according to claim 2, **characterized in:**

- **that** the first wire guide channel (26a) has an inlet opening (29a) that is connected to an outlet opening (31) of a wire inlet channel (30) in the housing (21);
- **that** at least one cutting edge (32a, 32b) is provided at an interface between the outlet opening (31) of the wire inlet channel (30) and the inlet opening (29a) of the first wire guide channel (26a), wherein the at least one cutting edge (32a, 32b) is configured to cut off the wire (2) at this interface when the twisting head (22) is rotated in relation to the housing (21); and
- **that** the twisting device (20) comprises a third transmission mechanism (70) capable of transmitting torque from the second drive member (42) to the twisting head (22) when the second drive member (42) is in said rotary end position

in relation to the twisting head (22), wherein the second electric motor (44), via the second transmission mechanism (40b), the second drive member (42) and the third transmission mechanism (70), is configured to assist the first electric motor (24) in rotating the twisting head (22) at an initial phase of a rotation of the twisting head (22) in relation to the housing (21).

4. A wire binding machine according to claim 3, **characterized in that** the third transmission mechanism (70) comprises a first torque transmitting member (71) that is fixed to the second drive member (42) and an associated second torque transmitting member (72) that is fixed to the twisting head (22) or to the first drive member (41), wherein the first torque transmitting member (71) is configured to be in torque transmitting contact with the second torque transmitting member (72) only when the second drive member (42) is in said rotary end position in relation to the twisting head (22).
5. A wire binding machine according to claim 4, **characterized in that** the first torque transmitting member (71) is formed by a shoulder at an end of a track (73) in the second drive member (42), wherein the second torque transmitting member (72) comprises a projection that is received in and moveable along said track (73).
6. A wire binding machine according to claim 4, **characterized in that** the second torque transmitting member (72) is formed by a shoulder at an end of a track in the twisting head (22) or in first drive member (41), wherein the first torque transmitting member (71) comprises a projection that is received in and moveable along said track.
7. A wire binding machine according to any of claims 1-6, **characterized in:**
 - **that** the first gripping member (27a) is moveable from its wire releasing position to its wire gripping position against the action of a spring force from a first spring member (28a) that is arranged in the twisting head (22); and
 - **that** the second gripping member (27b) is moveable from its wire releasing position to its wire gripping position against the action of a spring force from a second spring member (28b) that is arranged in the twisting head (22).
8. A wire binding machine according to any of claims 1-7, **characterized in:**
 - **that** the first gripping member (27a) is linearly moveable between its wire releasing position and its wire gripping position in the axial direction

of the twisting head (22), wherein the first gripping member (27a) is in a retracted position in the twisting head (22) in its wire releasing position and in an advanced position in the twisting head (22) in its wire gripping position; and
- **that** the second gripping member (27b) is linearly moveable between its wire releasing position and its wire gripping position in the axial direction of the twisting head (22), wherein the second gripping member (27b) is in a retracted position in the twisting head (22) in its wire releasing position and in an advanced position in the twisting head (22) in its wire gripping position.

9. A wire binding machine according to any of claims 1-8, **characterized in that** the motion transferring mechanism comprises:
 - a cam member (50), which is non-rotatably fixed to the second drive member (42);
 - a first cam follower (51a), which bears against a first guide surface (53a) on the cam member (50) and which is mounted to the twisting head (22) and connected to the first gripping member (27a), wherein the first gripping member (27a) is moveable from its wire releasing position to its wire gripping position under the effect of the cam member (50) and the first cam follower (51a); and
 - a second cam follower (51b), which bears against a second guide surface (53b) on the cam member (50) and which is mounted to the twisting head (22) and connected to the second gripping member (27b), wherein the second gripping member (27b) is moveable from its wire releasing position to its wire gripping position under the effect of the cam member (50) and the second cam follower (51b).
10. A wire binding machine according to claim 9 in combination with claim 8, **characterized in:**
 - **that** the first cam follower (51a) is moveable in relation to the first gripping member (27a) in the axial direction of the twisting head (22);
 - **that** the motion transferring mechanism comprises a first compression spring (55a) acting between the first cam follower (51a) and the first gripping member (27a), wherein the first cam follower (51a) is configured to push the first gripping member (27a) from its wire releasing position to its wire gripping position via the first compression spring (55a) when the second drive member (42) is moved by the second electric motor (44) from said intermediate rotary position to said rotary end position;
 - **that** the second cam follower (51b) is moveable

in relation to the second gripping member (27b)
in the axial direction of the twisting head (22);
and

- **that** the motion transferring mechanism comprises a second compression spring (55b) acting between the second cam follower (51b) and the second gripping member (27b), wherein the second cam follower (51b) is configured to push the second gripping member (27b) from its wire releasing position to its wire gripping position via the second compression spring (55b) when the second drive member (42) is moved by the second electric motor (44) from said rotary starting position to said intermediate rotary position.

11. A wire binding machine according to any of claims 1-10, **characterized in that** the first drive member (41) has the form of an externally toothed wheel or ring, wherein the first transmission mechanism (40a) comprises a toothed drive belt or a gear (43a) that is in driving engagement with the first drive member (41).
12. A wire binding machine according to any of claims 1-11, **characterized in that** the second drive member (42) has the form of an externally toothed wheel or ring, wherein the second transmission mechanism (40b) comprises a toothed drive belt or a gear (43b) that is in driving engagement with the second drive member (42).
13. A wire binding machine according to any of claims 1-12, **characterized in that** the second drive member (42) is arranged between a rear end of the twisting head (22) and a rear wall (46) of the housing (21).
14. A wire binding machine according to claim 13, **characterized in that** the first drive member (41) is arranged at the rear end of the twisting head (22), wherein the first and second drive members (41, 42) are arranged side by side with a rear face (41b) of the first drive member (41) facing a front face (42a) of the second drive member (42).
15. A wire binding machine according to claim 13 or 14, **characterized in that** the second drive member (42) is rotatably mounted to a shaft (47) that is fixed to the twisting head (22) or the first drive member (41).

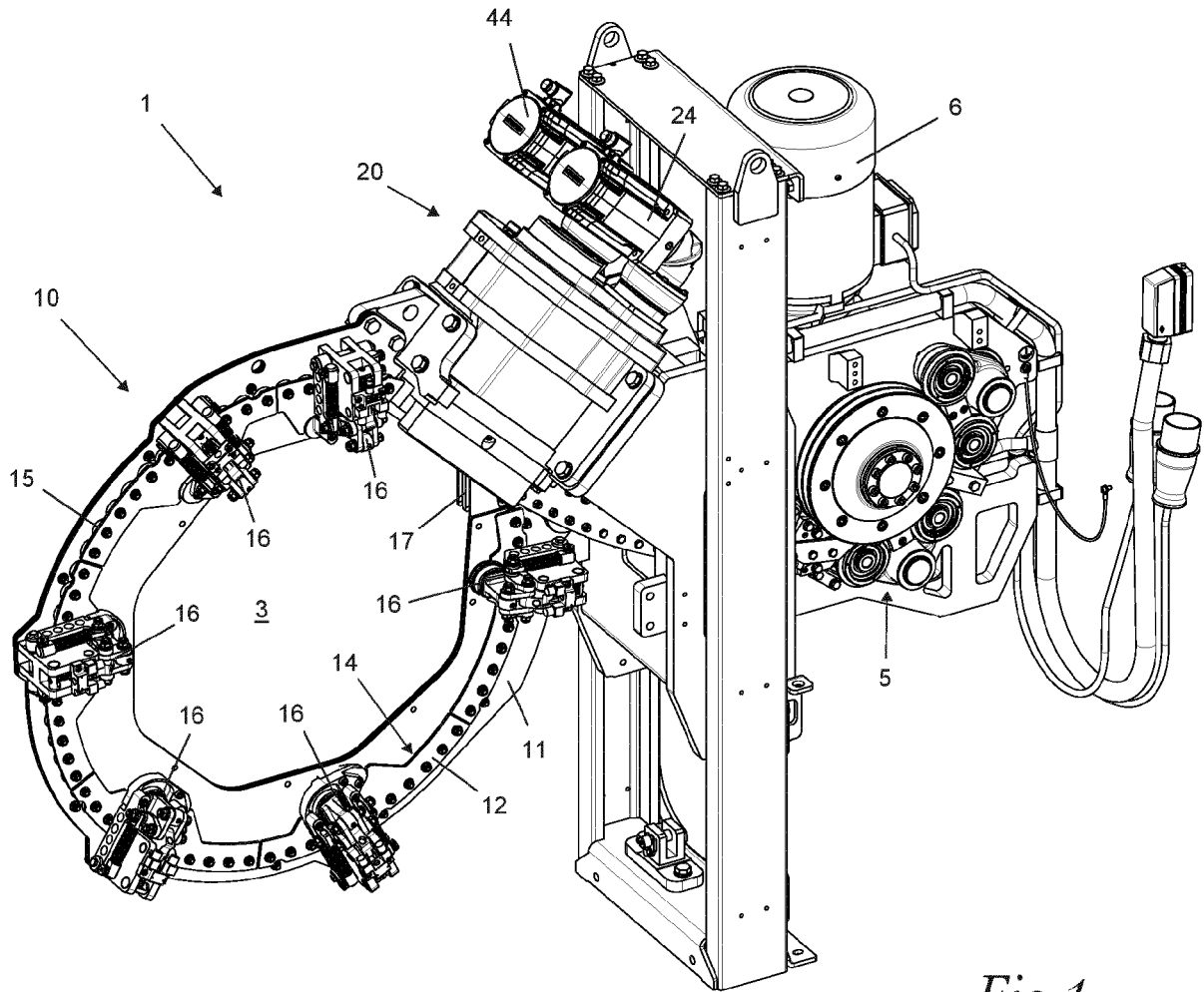


Fig 1

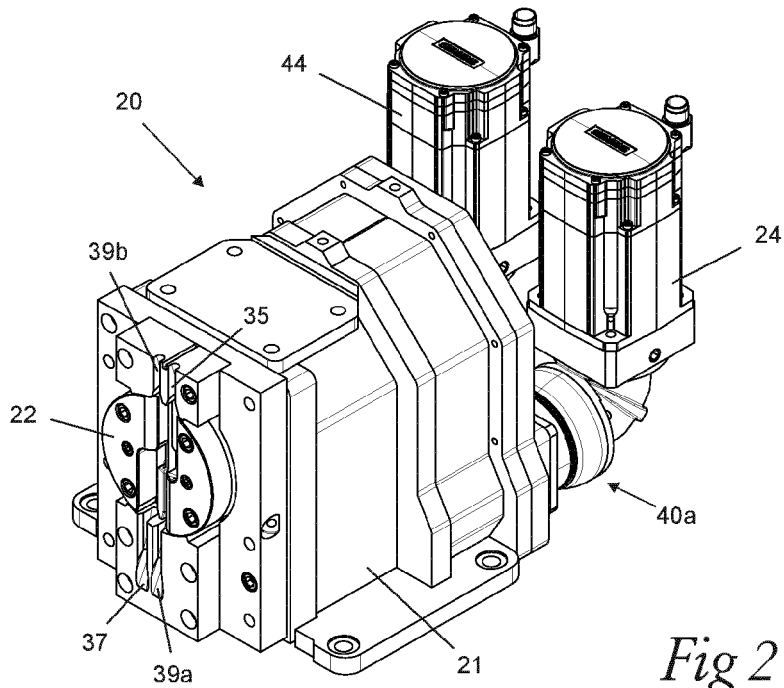


Fig 2

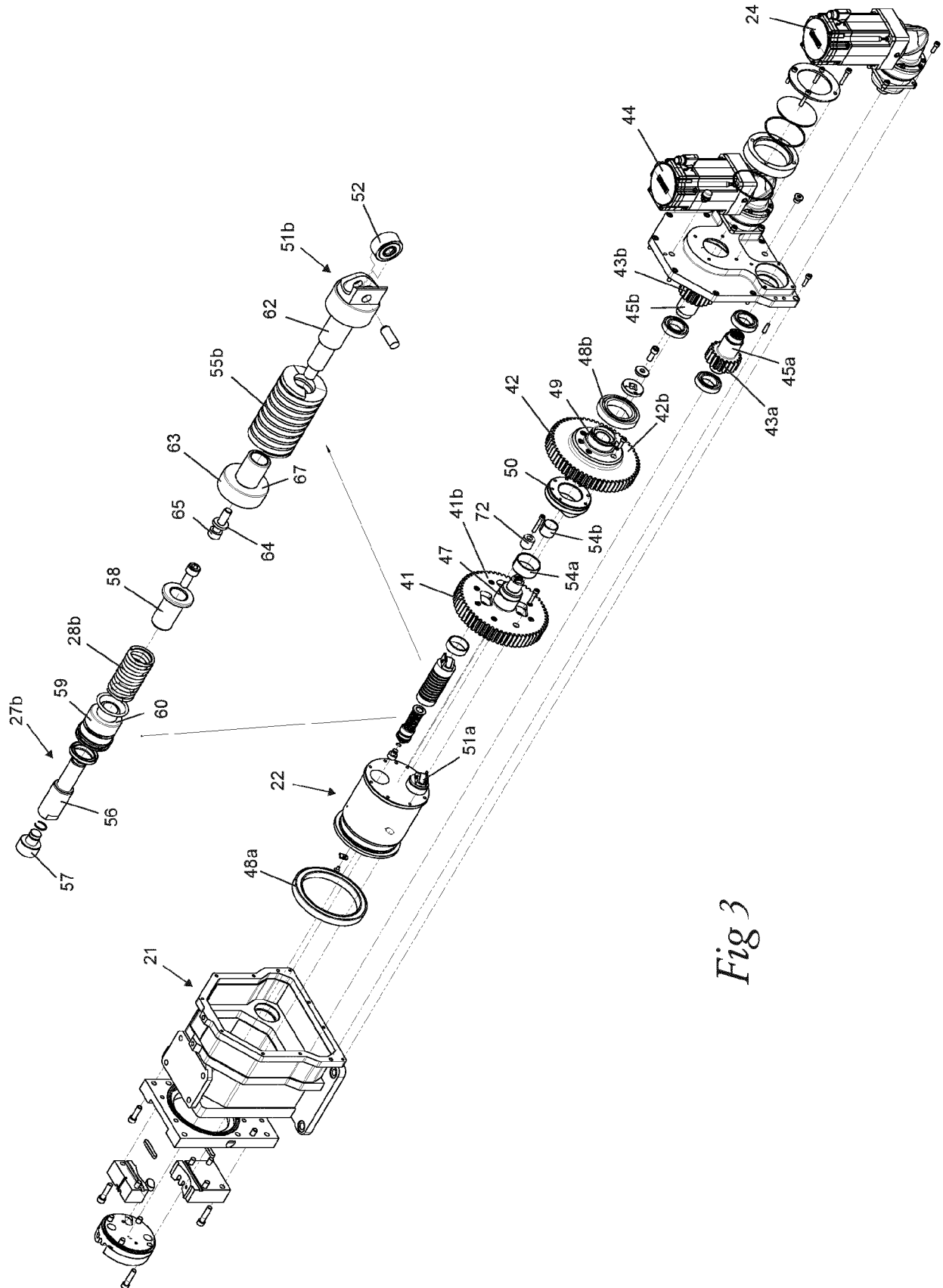
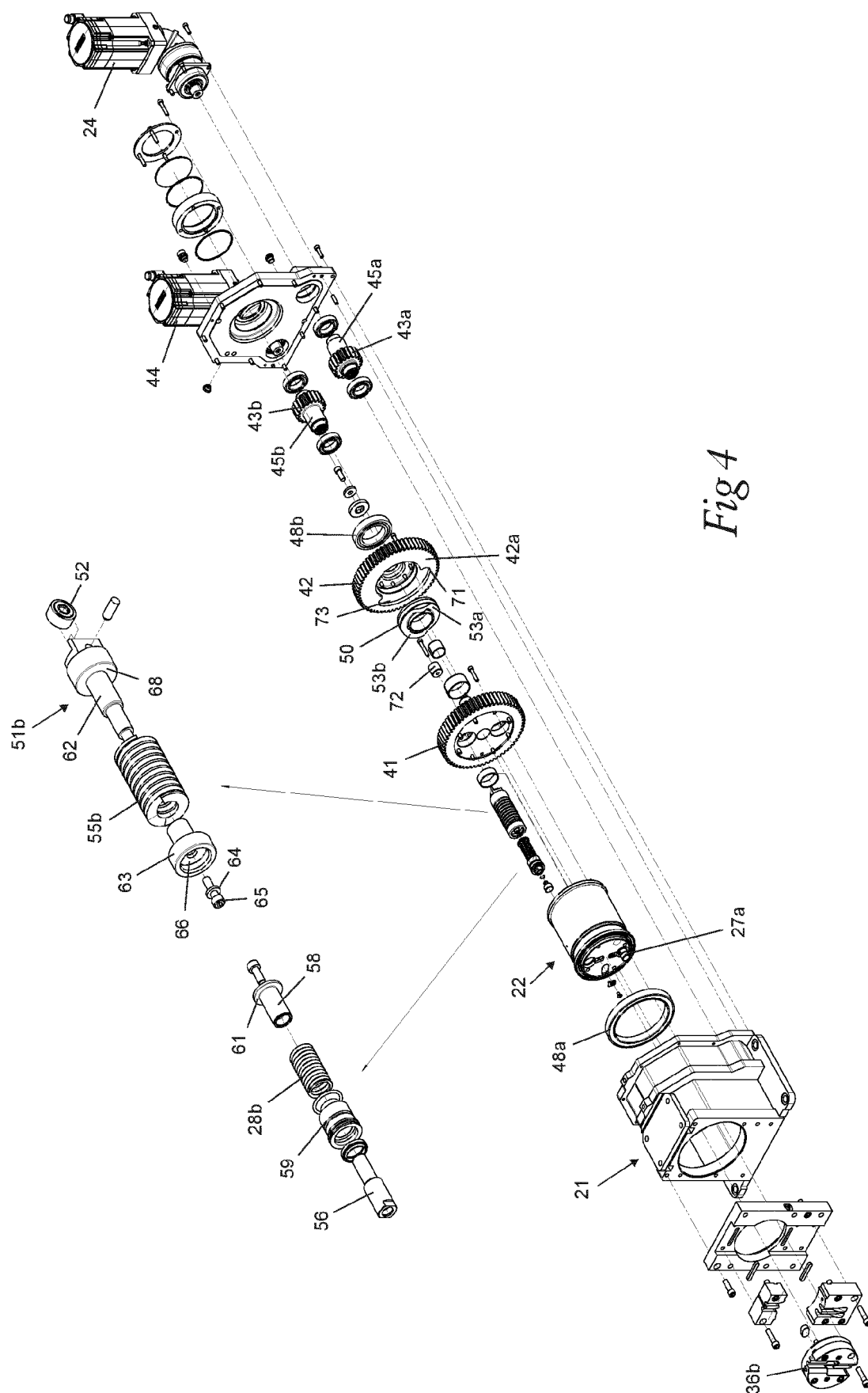


Fig 3



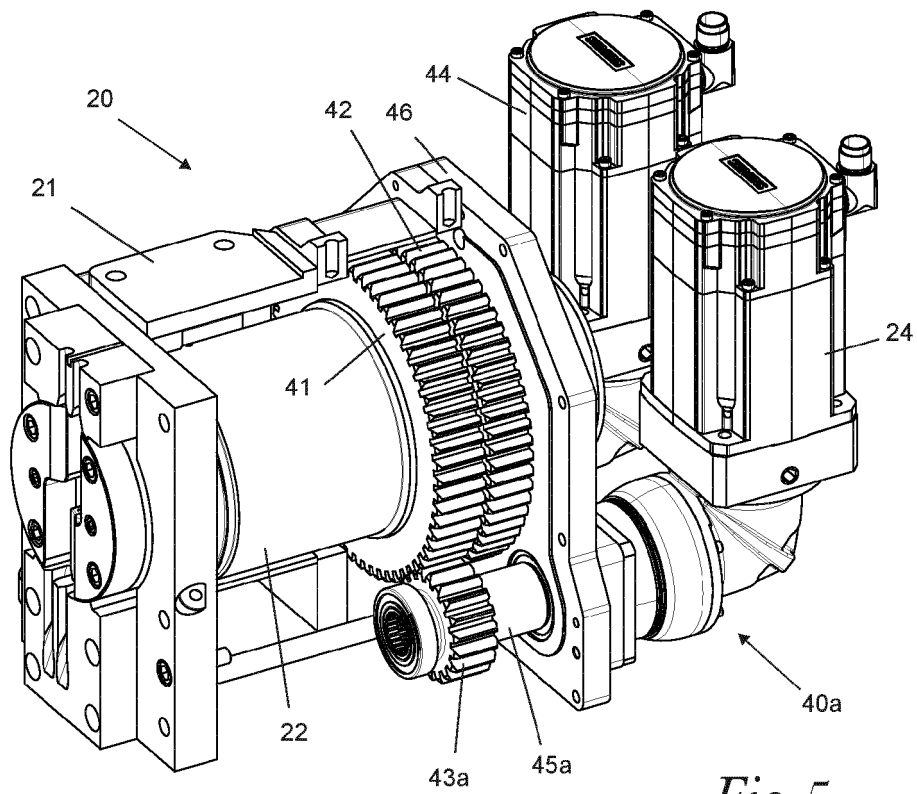


Fig 5

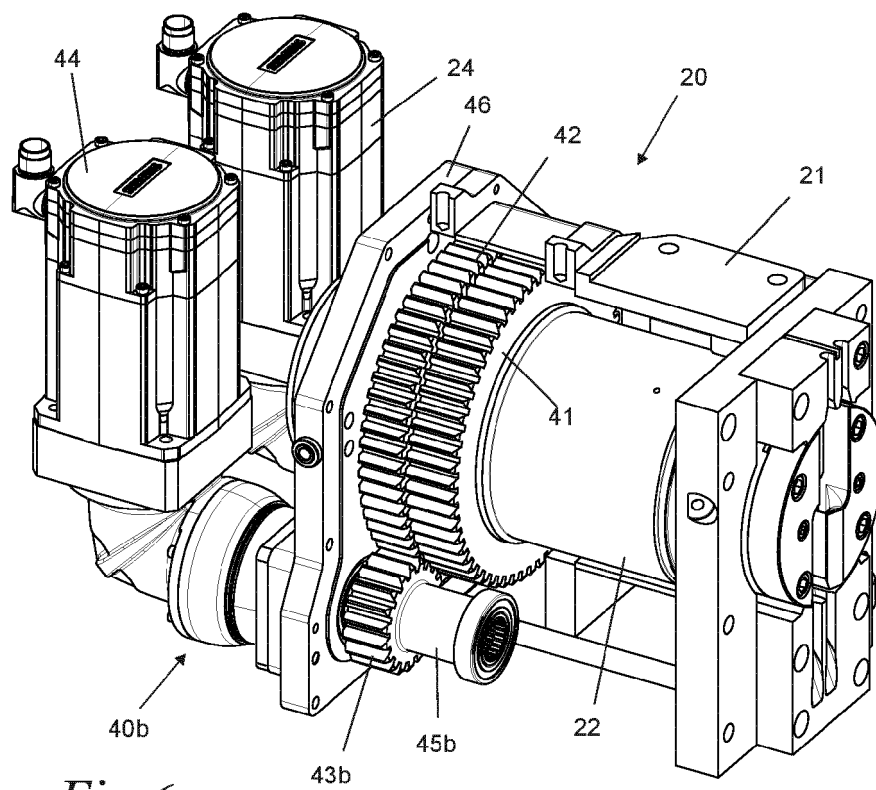


Fig 6

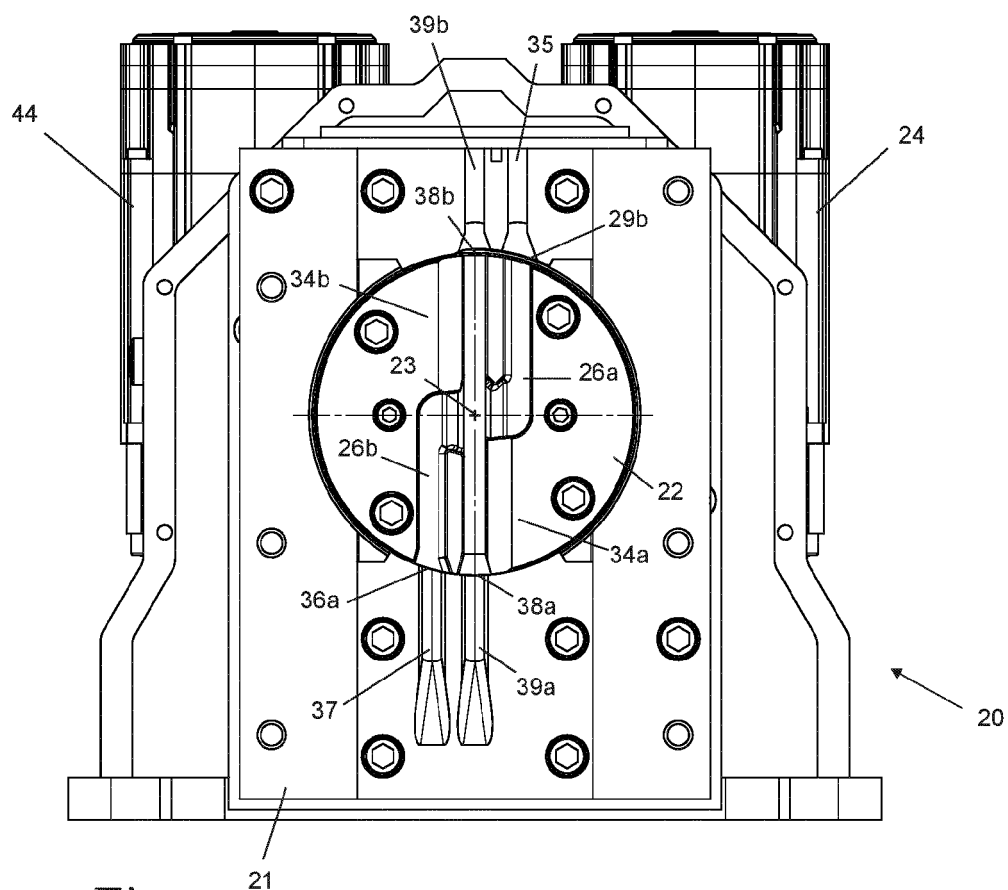


Fig 7

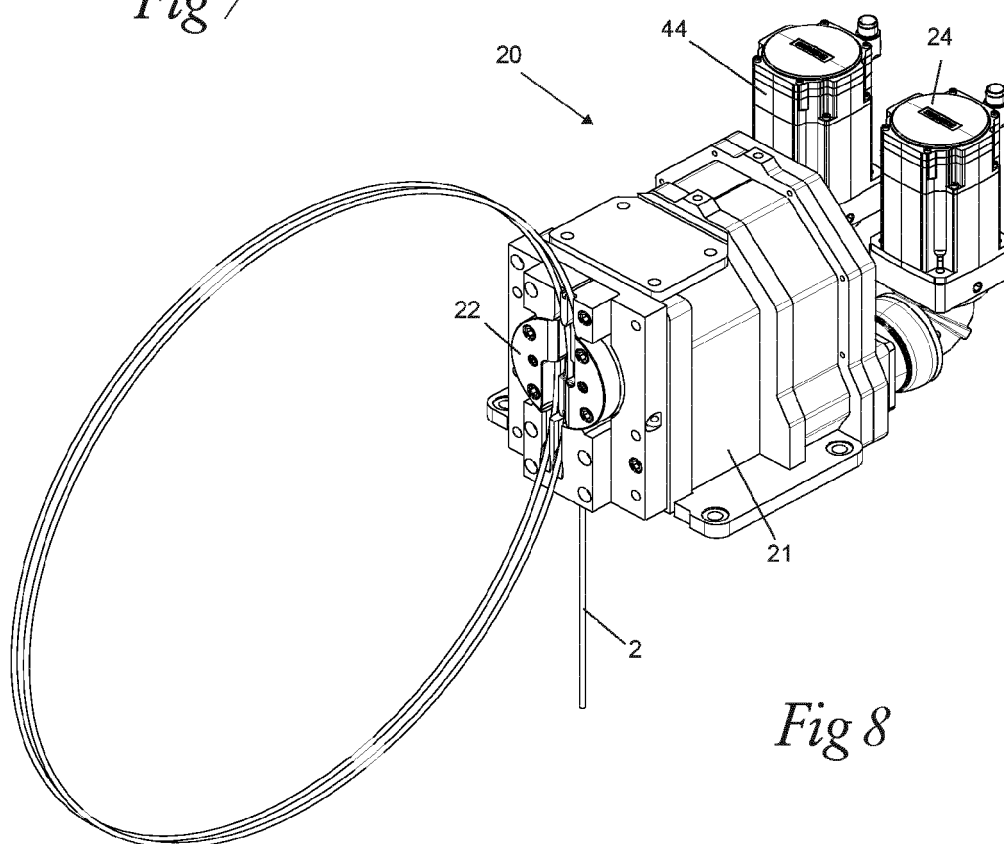


Fig 8

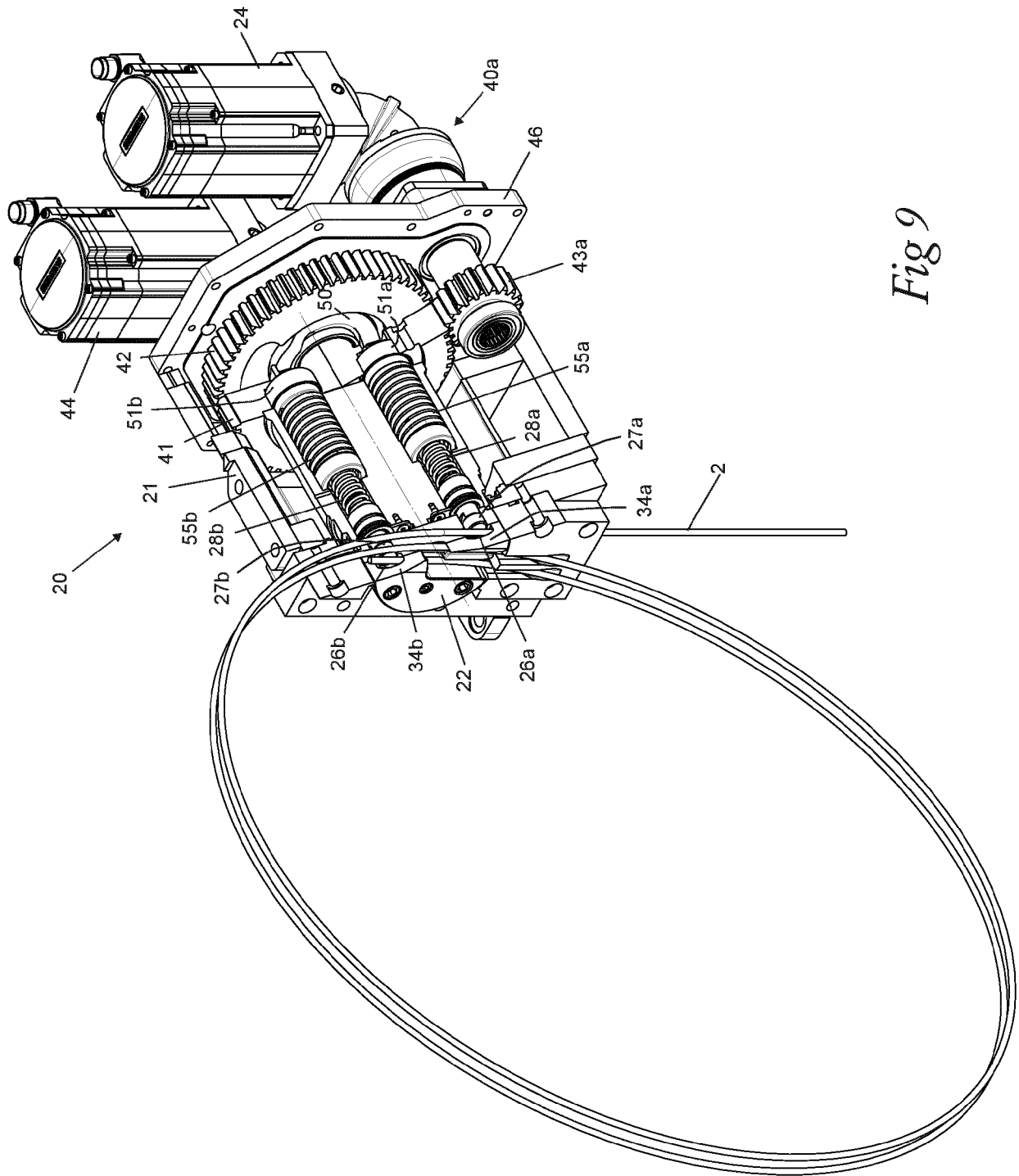
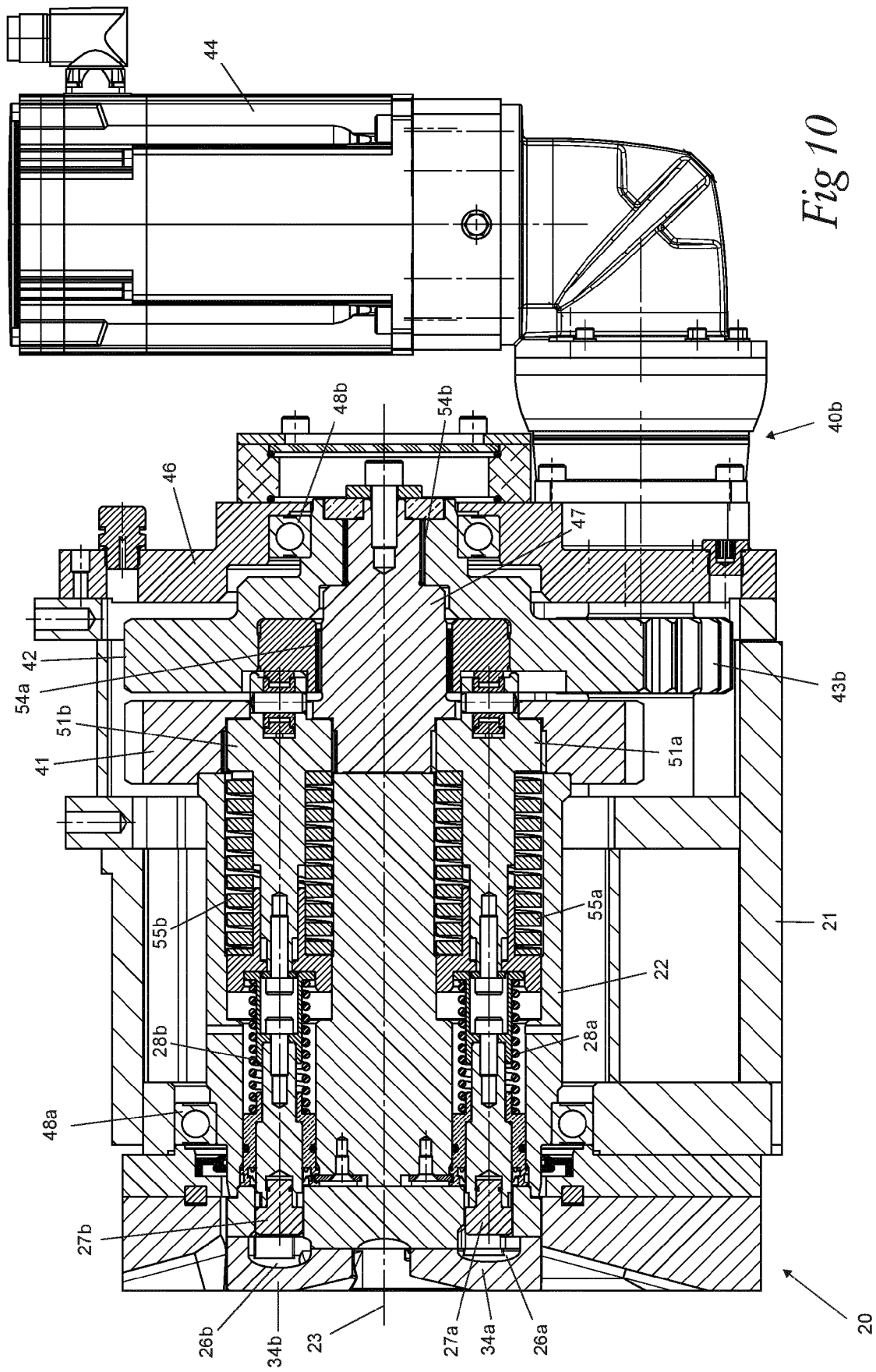


Fig 9



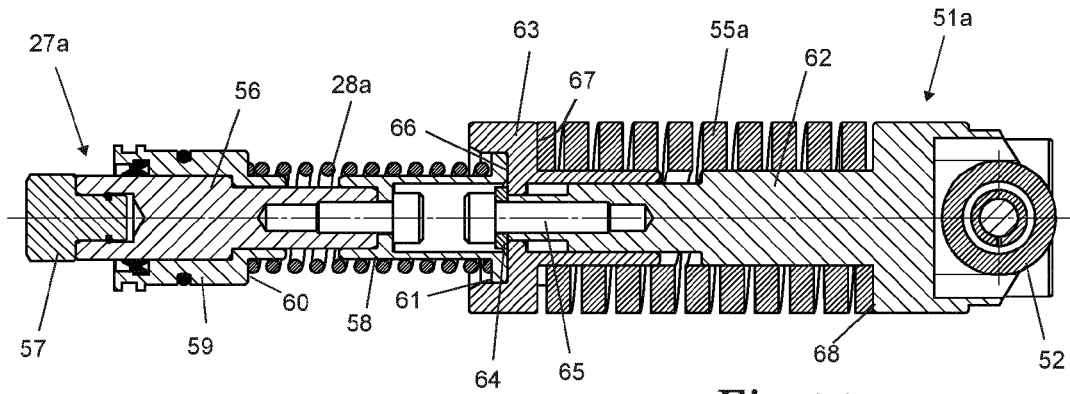


Fig 11

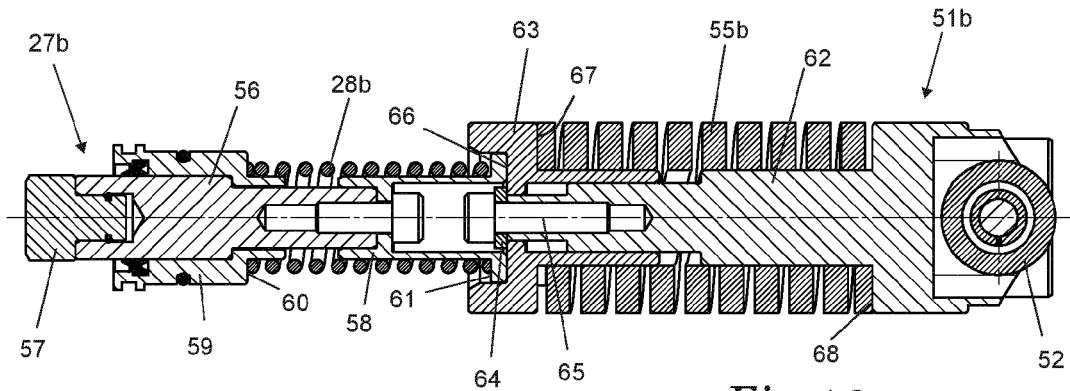


Fig 12

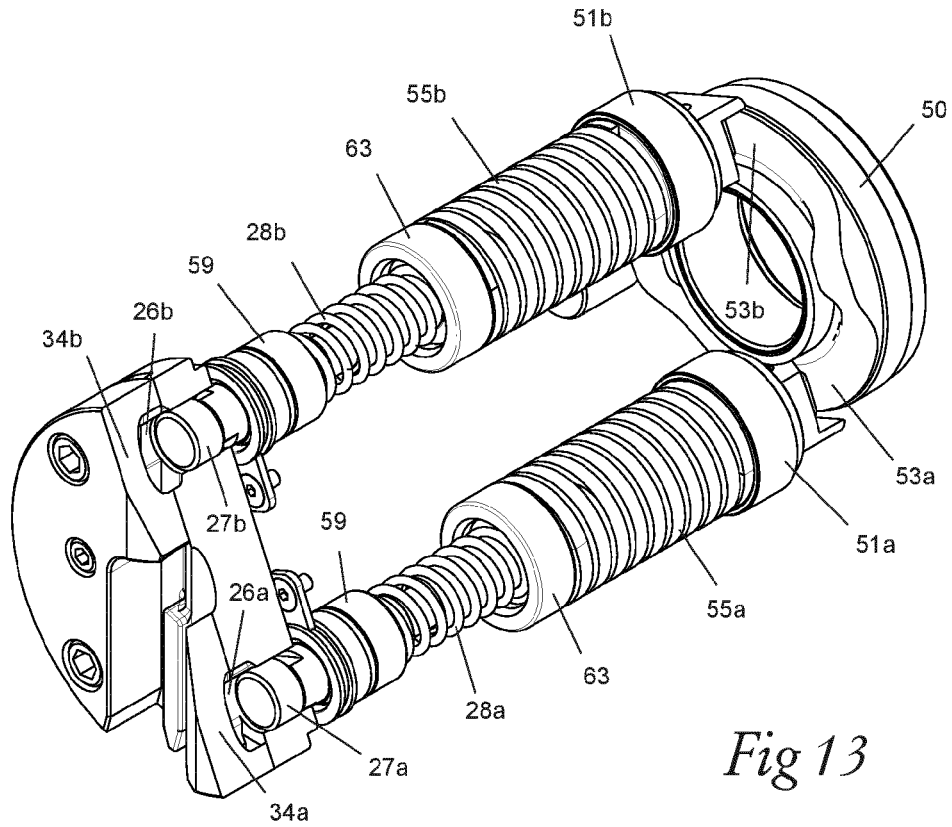


Fig 13

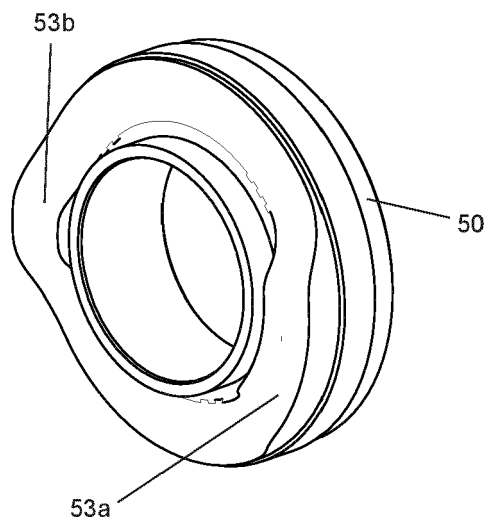


Fig 14

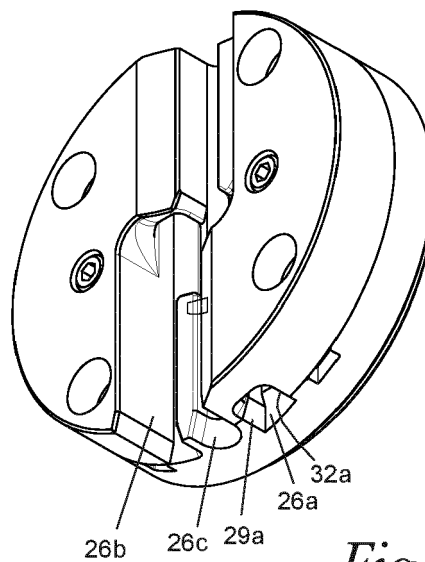


Fig 15

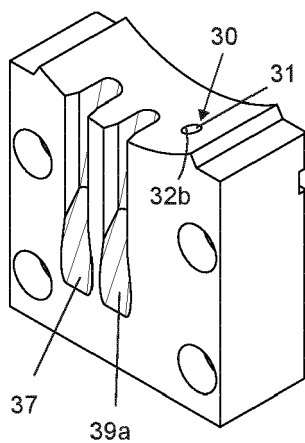


Fig 16

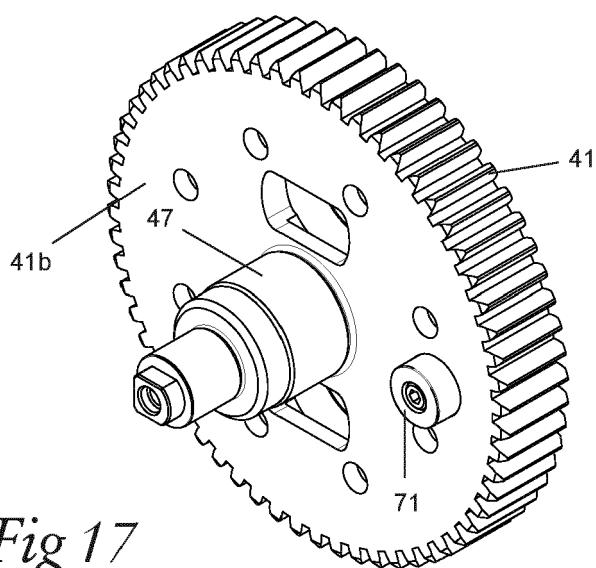
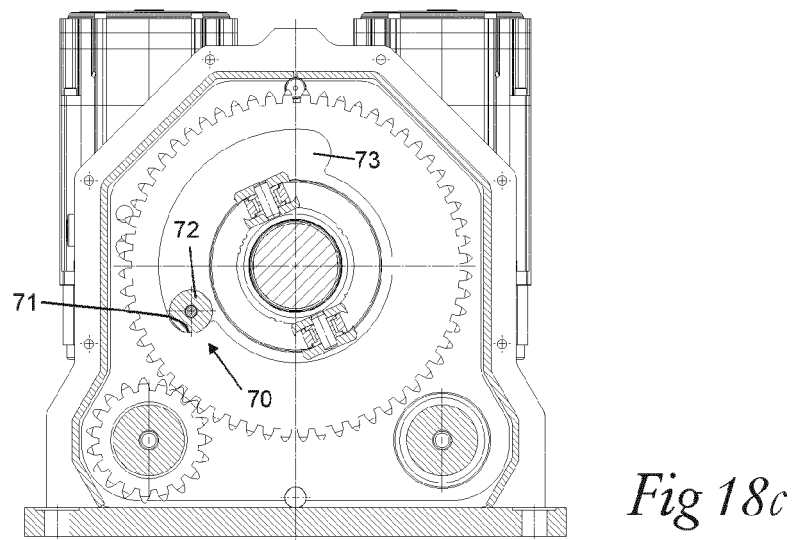
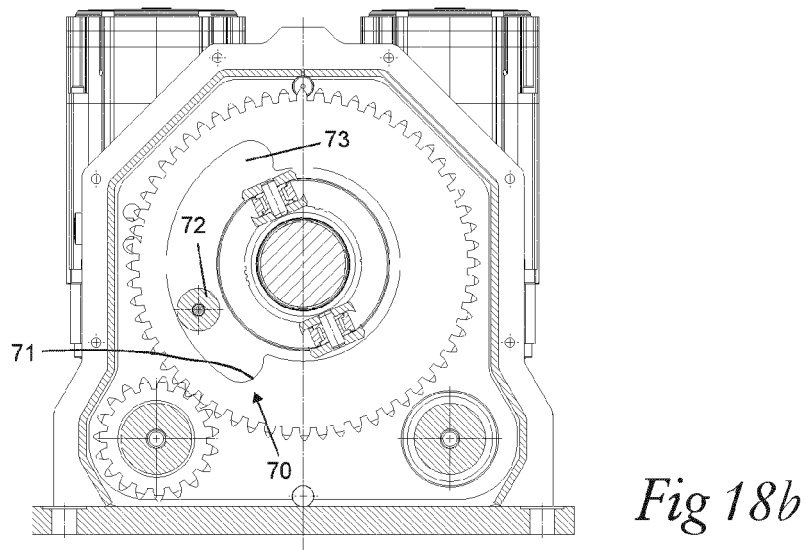
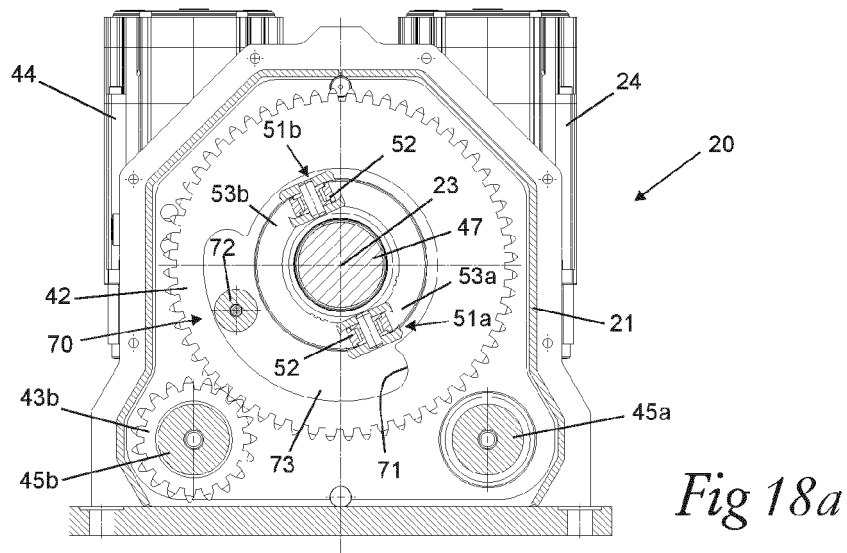


Fig 17





EUROPEAN SEARCH REPORT

Application Number

EP 22 18 3351

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	US 5 121 682 A (PARKER ALEXANDER L [US] ET AL) 16 June 1992 (1992-06-16) * figures 1-14 * * column 6, line 36 - column 7, line 52 * * column 7, lines 1-12 * * column 10, lines 3-65 * * column 11, line 20 - column 13, line 8 * -----	1-15	INV. B65B13/28 B65B13/06 B65B27/10 B65B13/18 B65B65/02
A	US 4 559 977 A (DILLEY GERALD G [US]) 24 December 1985 (1985-12-24) * figures 1-4, 7, 8 * * column 11, line 40 - column 12, line 4 * -----	1-15	
A,D	EP 2 578 498 B1 (SUND BIRSTA AB [SE]) 11 December 2013 (2013-12-11) * figures 1a-8b * * paragraphs [0016] - [0022], [0032], [0033] * -----	1-15	
			TECHNICAL FIELDS SEARCHED (IPC)
			B65B E04G

The present search report has been drawn up for all claims

1

Place of search	Date of completion of the search	Examiner
Munich	8 February 2023	Schmitt, Michel
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document		

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**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 22 18 3351

5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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