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

(11) **EP 3 103 728 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
14.12.2016 Bulletin 2016/50

(51) Int Cl.:
B65B 13/20 *(2006.01)* ***B65B 27/06*** *(2006.01)*

(21) Application number: **15171775.8**

(22) Date of filing: **12.06.2015**

(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

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(54) **COMPACTING MACHINE FOR COMPACTING AND BINDING A COIL OF WIRE**

(57) A compacting machine for compacting and binding a coil of wire comprising:
- a foundation (3);
- two compacting elements (4a, 4b) horizontally moveable towards each other by means of a respective power member;
- two pressure frame parts (6a, 6b) provided with mating contact surfaces, wherein the compacting elements are moveably mounted to a respective one of these pressure frame parts; and
- one or more locking devices for releasably securing the pressure frame parts to each other when they abut against each other via said contact surfaces, wherein the pressure frame parts, when secured to each other by means of said locking device, are configured to form a rigid and stiff pressure frame (13) which surrounds a coil of wire (2) received between the compacting elements.

At least one of said pressure frame parts is moveable in relation to the foundation by means of a driving device.

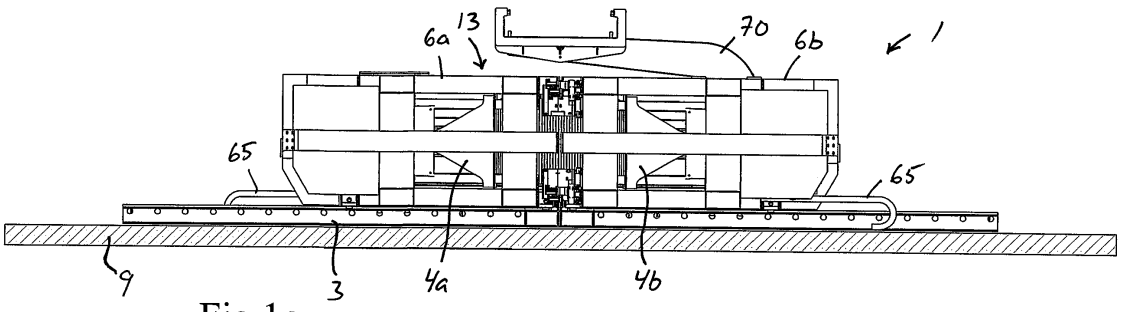

Fig 1c

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Description

FIELD OF THE INVENTION AND PRIOR ART

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

[0002] In this description and the subsequent claims, the term "wire" encompasses metallic wires of thinner type as well as metallic wire rods.

[0003] Metallic wire produced in a rolling mill is normally laid in a rather loose condition in coils of essentially cylindrical configuration, which are then transported between different locations in the rolling mill by means of a hook conveyor with each coil of wire arranged in a horizontal direction hanging on a carrier hook which is axially inserted through the coil. In order to facilitate subsequent storing and transportation of the coils, each coil is normally compacted between two compacting elements of a compacting machine and retained in the compacted condition by applying loops of elongated retaining members in the form of wires or straps around the compacted coil by means of binding devices included in the compacting machine.

[0004] Various forms of compacting machines of the above-mentioned type for compacting and binding a coil of wire have been proposed and come into use. A compacting machine according to the preamble of claim 1 is for instance previously known from US 3 633 492 A. This previously known compacting machine comprises two opposite compacting elements which are horizontally moveable towards each other along guide rails in order to compact a coil of wire received in a space between the compacting elements and thereafter horizontally moveable away from each other along the guide rails in order to release the compacted coil after strapping thereof, wherein each compacting element is moveable along the guide rails by means of a power member in the form of a heavy duty hydraulic cylinder which is fixed to a foundation of the compacting machine. In the compacting machine according to US 3 633 492 A, the strapping of the compacted coil is carried out by means of strapping units, each of which comprising two mating strap track section halves which are moveable towards and away from each other by means of their own hydraulic cylinders independently of the compacting elements. Considerable press forces have to be exerted by the heavy duty hydraulic cylinders in order to compact the coil to a desired extent, and the foundation of a compacting machine of the type disclosed in US 3 633 492 A has to be very strong and robust in order to be capable of taking up the bending moments caused by the press forces exerted by the heavy duty hydraulic cylinders and prevent a mutual offset of the two mating strap track section halves of each strapping unit. If the foundation is not robust enough, the mutual alignment of the two mating strap track section halves of a strapping unit may be impaired to such an extent that the strapping of the coil is failed. Furthermore, the required stroke length of the above-mentioned heavy duty hydraulic cylinders of the compacting machine according to US 3 633 492 A is rather long, which implies that these hydraulic cylinders will be of rather large dimensions requiring a hydraulic system of large size with one or more hydraulic tanks of big volume.

SUMMARY OF THE INVENTION

[0005] The object of the present invention is to provide a compacting machine of new and favourable design for compacting and binding a coil of wire, which in at least some aspect offers an advantage as compared to previously known compacting machines.

[0006] According to the invention, this object is achieved by a compacting machine having the features defined in claim 1.

[0007] The compacting machine according to the invention comprises:

- a foundation;
- a first compacting element and a second compacting element, each of which being horizontally moveable in a first direction towards the other compacting element in order to compact a coil of wire received in a space between the first and second compacting elements and in an opposite direction away from the other compacting element;
- at least one first power member which is connected to the first compacting element and capable of moving the first compacting element in a horizontal direction towards the second compacting element;
- at least one second power member which is connected to the second compacting element and capable of moving the second compacting element in a horizontal direction towards the first compacting element; and
- several binding devices for applying loops of elongated retaining members in the form of wires or straps around a coil of wire compacted between the first and second compacting elements;

wherein the compacting machine is characterized in:

- that the compacting machine comprises a first pressure frame part and an opposite second pressure frame part which are connectable to each other, wherein the first and second pressure frame parts are provided with mating contact surfaces via which the first and second pressure frame parts are configured to abut against each other when connected to each other;
- that said first power member is fixed to the first pressure frame part, and the first compacting element is moveably mounted to the first pressure frame part so as to be horizontally moveable in relation to the first pressure frame part under the effect of the first

power member;

- that said second power member is fixed to the second pressure frame part, and the second compacting element is moveably mounted to the second pressure frame part so as to be horizontally moveable in relation to the second pressure frame part under the effect of the second power member;
- that the compacting machine comprises one or more locking devices for releasably securing the first and second pressure frame parts to each other when they abut against each other via said contact surfaces, wherein the first and second pressure frame parts, when secured to each other by means of said locking devices, are configured to form a rigid and stiff pressure frame which surrounds a coil of wire received between the first and second compacting elements;
- that the first pressure frame part is moveably mounted to the foundation so as to allow the first pressure frame part to be horizontally moved in relation to the foundation between a retracted position, in which the first pressure frame part is at a distance from the second pressure frame part, and an advanced position, in which the first pressure frame part abuts against the second pressure frame part via said contact surfaces; and
- that the compacting machine comprises a driving device for moving the first pressure frame part between said retracted and advanced positions.

[0008] With the compacting machine of the present invention, the bending moments caused by the first and second power members will be taken up by the rigid and stiff pressure frame formed by the two mating pressure frame parts, and the foundation of the compacting machine is therefore not subjected to these bending moments. Hereby, a foundation of reduced strength and cost may be used without detrimentally influencing the required alignment of any mating guide track sections included in the binding devices of the compacting machine. Furthermore, the moveable pressure frame part makes it possible to bring the compacting elements into contact with a coil of wire by before the first and second power members are actuated in order to achieve the final compacting of the coil. Hereby, the required stroke length of the first and second power members is reduced, which in its turn implies that the dimensions of the power members may be reduced. If power members in the form of hydraulic cylinders are used, the reduced dimensions of the power members also implies that the size of the associated hydraulic system may be reduced.

[0009] According to an embodiment of the invention, the first compacting element is configured to be in an advanced starting position on the first pressure frame part when the first pressure frame part is moved from the retracted position forwards towards a non-compacted coil of wire received in the space between the first and second compacting elements, wherein the first compacting element is configured to move rearwards in relation to the first pressure frame part from said starting position, under the effect of a rearwardly directed force on the first compacting element from the coil of wire and against the action of a forwardly directed force on the first compacting element from said first power member, during a final part of the movement of the first pressure frame part from the retracted position to the advanced position. Hereby, the first compacting element does not have to be moved rearwards in relation to the first pressure frame part by means of the first power member before starting a new compacting cycle. On the contrary, the advanced starting position of the first compacting element may correspond to the final position reached by the first compacting element during the latest performed compacting cycle, and the time required for performing a compacting cycle may thereby be reduced. Furthermore, during the movement of the first pressure frame part from the retracted position to the advanced position, the coil of wire will be somewhat compacted with a smaller compacting force under the effect of said forwardly directed force on the first compacting element from the first power member. This initial compacting, in the following denominated precompacting, of the coil of wire implies that the required stroke length of the first and second power members for achieving the desired compacting of the coil is further reduced. By allowing the first compacting element to move rearwards in relation to the first pressure frame part in the above-mentioned manner, it is also made sure that said precompacting of a coil of wire may be achieved during the movement of the first pressure frame part towards the advanced position without jeopardizing the ability of the driving device to move the first pressure frame part into proper contact with the second pressure frame part.

[0010] According to another embodiment of the invention, the driving device comprises an electric drive motor for effecting the movement of the first pressure frame part between said retracted and advanced positions. Hereby, the movements of the first pressure frame part may be achieved in a very rapid manner and the time required for performing a compacting cycle may thereby be reduced.

[0011] Another embodiment of the invention is characterized in:

- that the drive motor is mounted to the first pressure frame part;
- that the driving device comprises a sprocket wheel which is rotatably mounted to the first pressure frame part and configured to be driven in rotation by the drive motor;
- that the driving device comprises a drive chain which has a first end and an opposite second end, wherein the drive chain extends along a part of the foundation and is fixed to the foundation at its first and second ends; and
- that the sprocket wheel is in engagement with the drive chain so as to allow the first pressure frame

part to move along the drive chain in a first direction towards the second pressure frame part when the sprocket wheel is rotated in a first rotary direction under the effect of the drive motor, and in a second direction away from the second pressure frame part when the sprocket wheel is rotated in an opposite second rotary direction under the effect of the drive motor.

[0012] Hereby, the movement of the first pressure frame part may be achieved in a simple and reliable manner.

[0013] According to another embodiment of the invention, the first and second pressure frame parts are provided with corresponding alignment members, which are configured to come into contact with each other in order to align the first pressure frame part with the second pressure frame part when the first pressure frame part is moved into contact with the second pressure frame part. The alignment members will make sure that the first and second pressure frame parts are correctly positioned in relation to each other when they are brought into contact with each other.

[0014] Another embodiment of the invention is characterized in:

- that also the second pressure frame part is moveably mounted to the foundation so as to allow the second pressure frame part to be horizontally moved in relation to the foundation between a retracted position, in which the second pressure frame part is at a distance from the first pressure frame part, and an advanced position, in which the second pressure frame part abuts against the first pressure frame part via said contact surfaces; and
- that the compacting machine comprises a further driving device, here denominated second driving device, for moving the second pressure frame part between said retracted and advanced positions.

[0015] Hereby, the above-mentioned precompacting may be achieved by simultaneously moving the first and second pressure frame parts towards each other in a synchronized manner, and the time required for performing the precompacting may thereby be reduced, which in its turn implies a further reduction of the time required for performing a complete compacting cycle.

[0016] According to another embodiment of the invention, the second compacting element is configured to be in an advanced starting position on the second pressure frame part when the second pressure frame part is moved from the retracted position forwards towards a non-compacted coil of wire received in the space between the first and second compacting elements, wherein the second compacting element is configured to move rearwards in relation to the second pressure frame part from said starting position, under the effect of a rearwardly directed force on the second compacting element from the coil of wire and against the action of a forwardly directed force on the second compacting element from said second power member, during a final part of the movement of the second pressure frame part from the retracted position to the advanced position. Hereby, the second compacting element does not have to be moved rearwards in relation to the second pressure frame part by means of the second power member before starting a new compacting cycle. On the contrary, the advanced starting position of the second compacting element may correspond to the final position reached by the second compacting element during the latest performed compacting cycle, and the time required for performing a compacting cycle may thereby be further reduced.

[0017] Further advantages as well as advantageous features of the compacting machine according to the present invention will appear from the following description and the dependent claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0018] With reference to the appended drawings, a specific description of preferred embodiments of the invention cited as examples follows below. In the drawings:

Fig 1a-1f	are lateral views of a compacting machine according to an embodiment of the present invention, as seen at different stages during a compacting cycle,
Figs 2a-2d	are partly cut lateral views of the compacting machine of Figs 1a-1f, as seen at the stages illustrated in Figs 1a-1d,
Fig 3	is a longitudinal section through the compacting machine of Figs 1a-1f, as seen at the stage illustrated in Fig 1d and with a part of the machine shown in a detail enlargement,
Fig 4	is a cross-sectional view according to the line G-G in Fig 1e,
Fig 5	is a perspective view of the compacting machine of Figs 1a-1f, as seen at the stage illustrated in Fig 1d,
Figs 6 and 7	are perspective views from different directions of the compacting machine of Figs 1a-1f, with the pressure frame parts in retracted positions,
Fig 8	is a perspective view of a compacting element included in the compacting machine of Figs 1a-1f,
Fig 9	is a partly cut perspective view of the compacting machine of Figs 1a-1f, as

seen at the stage illustrated in Fig 1d and with a part of the machine shown in a detail enlargement, and

Fig 10a-10c are cut lateral views of a part of the compacting machine of Figs 1a-1f illustrating the operation of a locking device included in the machine.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS OF THE INVENTION

[0019] Figs 1-10 show a compacting machine 1 according to an embodiment of the present invention for compacting and binding a coil of wire 2. The compacting machine 1 comprises a foundation 3, a first compacting element 4a and a second compacting element 4b. Each compacting element 4a, 4b is horizontally moveable in relation to the foundation 3 in a first direction towards the other compacting element in order to compact a coil of wire 2 received in a space between the compacting elements 4a, 4b and in an opposite direction away from the other compacting element. A first power member 5a (see Fig 3) is connected to the first compacting element 4a and a second power member 5b is connected to the second compacting element 4b.

[0020] The foundation 3 may for instance be fixed to a floor 9, as illustrated in Figs 1-7, or fixed to any other suitable supporting structure. In the illustrated embodiment, the foundation 3 comprises two longitudinal beams 3a (see Figs 4 and 5) which are arranged in parallel with each other and a number of crossbeams 3b which are fixed to and extend between the longitudinal beams 3a.

[0021] The compacting machine 1 further comprises a first pressure frame part 6a and an opposite second pressure frame part 6b, wherein the first and second pressure frame parts 6a, 6b are connectable to each other. The first and second pressure frame parts 6a, 6b are provided with mating contact surfaces 7a, 7b, 8a, 8b via which they are configured to abut against each other when connected to each other. The first and second pressure frame parts 6a, 6b are with advantage identically designed.

[0022] The first power member 5a is fixed to the first pressure frame part 6a, and the first compacting element 4a is moveably mounted to the first pressure frame part 6a so as to be moveable in relation to the first pressure frame part 6a in a horizontal direction towards the second compacting element 4b under the effect of the first power member 5a. The second power member 5b is fixed to the second pressure frame part 6b, and the second compacting element 4b is moveably mounted to the second pressure frame part 6b so as to be moveable in relation to the second pressure frame part 6b in a horizontal direction towards the first compacting element 4a under the effect of the second power member 5b.

[0023] In the illustrated embodiment, each power member 5a, 5b has the form of a hydraulic cylinder which comprises a cylinder part 10, a piston (not shown) displaceably received inside the cylinder part and a piston rod 11 fixed to the piston. In the illustrated example, the first power member 5a has its cylinder part 10 fixed to the first compacting element 4a and its piston rod 11 fixed to the first pressure frame part 6a, whereas the second power member 5b has its cylinder part 10 fixed to the second compacting element 4b and its piston rod 11 fixed to the second pressure frame part 6b. Each power member 5a, 5b could of course also be mounted in the opposite direction. As an alternative to hydraulic cylinders, each power member 5a, 5b could consist of an electric or hydraulic motor configured to move the associated compacting element 4a, 4b via a screw rod in the form of a ball screw or slide screw.

[0024] The first and second pressure frame parts 6a, 6b are releasably securable to each other by means of one or more locking devices 12 (see Figs 10a-10c) when they abut against each other via the above-mentioned contact surfaces 7a, 7b, 8a, 8b. When secured to each other by means of said locking devices 12, the first and second pressure frame parts 6a, 6b form a rigid and stiff pressure frame 13 (see Figs 1c, 1d and 5) which surrounds a coil of wire 2 received between the first and second compacting elements 4a, 4b. This pressure frame 13 will, in a symmetrical manner, take up the forces exerted by the first and second power members 5a, 5b during the compacting of a coil of wire 2. In the illustrated embodiment, the compacting machine 1 comprises two locking devices 12 which are arranged opposite each other on either side of the pressure frame 13.

[0025] A possible design of the above-mentioned locking devices 12 is illustrated in Figs 10a-10c. Each locking device 12 comprises a first locking member 14 in the form of a hook and a second locking member 15 in the form of a horizontally extending rod or the similar, wherein the first locking member 14 is mounted at the end of a frame member 16 included in one of the pressure frame parts 6a, 6b and the second locking member 15 is fixed at the end of an opposite frame member 17 included in the other pressure frame part. The frame members 16, 17 are configured to abut against each other via contact surfaces 8a, 8b at their outer ends when the first and second pressure frame parts 6a, 6b are connected to each other. The first locking member 14 extends through an opening 18 (see Fig 9) provided at the end of the associated frame member 16 and the opposite frame member 17 is provided with an opening 19 (see Fig 6) for receiving the outer end of the first locking member 14 when the frame members 16, 17 are in contact with each other. The first locking member 14 is pivotally mounted to the frame member 16 so as to be pivotable about a horizontal pivot axis 20 between an unlocking position (see Figs 10a and 10b) and a locking position (see Fig 10c) under the effect of a power member 21. In the illustrated example, this power member 21 has the form of a hydraulic cylinder. When the pressure frame parts 6a, 6b are being moved into contact with each other, the first locking member 14

is kept in the unlocking position so as to allow the outer end of the first locking member 14 to be moved horizontally into a position above the second locking member 15. When the pressure frame parts 6a, 6b have come into contact with each other, the first locking member 14 is then pivoted downwards into engagement with the second locking member 15 to thereby secure the frame members 16, 17 to each other and prevent a separation of the pressure frame parts 6a, 6b. The locking devices 12 may of course also have any other suitable design.

[0026] In the illustrated embodiment, the first and second compacting elements 4a, 4b are identically designed. Each compacting element 4a, 4b comprises a body 22 (see Fig 8), which is moveably mounted to the associated pressure frame part 6a, 6b, and a vertical pressure plate 23, which is fixed to the body 22 at an end thereof and configured to come into contact with a coil of wire 2 to be compacted between the compacting elements 4a, 4b. In the illustrated example, wheels 24, 25 are rotatably mounted to the body 22 on opposite sides thereof and these wheels 24, 25 are received in guide tracks 26 (see Figs 6 and 7) provided in the associated pressure frame part 6a, 6b so as to allow the body 22 to move along these guide tracks 26.

[0027] The first pressure frame part 6a is moveably mounted to the foundation 3 so as to allow the first pressure frame part 6a to be horizontally moved in relation to the foundation 3 between a retracted position (see e. g. Fig 1a), in which the first pressure frame part 6a is at a distance from the second pressure frame part 6b, and an advanced position (see e.g. Fig 1c), in which the first pressure frame part 6a abuts against the second pressure frame part 6b via the above-mentioned contact surfaces 7a, 7b, 8a, 8b. In the illustrated embodiment, also the second pressure frame part 6b is moveably mounted to the foundation 3 so as to allow the second pressure frame part 6b to be horizontally moved in relation to the foundation 3 between a retracted position (see e.g. Fig 1a), in which the second pressure frame part 6b is at a distance from the first pressure frame part 6a, and an advanced position (see e.g. Fig 1c), in which the second pressure frame part 6b abuts against the first pressure frame part 6a. As an alternative, the second pressure frame part 6b could be fixedly mounted to the foundation 3, i.e. stationary.

[0028] Each pressure frame part 6a, 6b is moveable along one guide rail or two or more mutually parallel guide rails 30 (see Figs 4 and 5) provided on the foundation 3. In the illustrated embodiment, two such guide rails 30 are arranged on the foundation 3, wherein the guide rails 30 are mounted to a respective one of the longitudinal beams 3a of the foundation. Each pressure frame part 6a, 6b rests on the foundation 3 via rollers or wheels 31 (see Fig 4) which are rotatably mounted to the pressure frame part 6a, 6b. In the illustrated embodiment, each roller/wheel 31 is in contact with an upper surface of a guide track 30 and each roller/wheel 31 is associated with a pair of guide rollers 32 which are in contact with the guide rail 30 on opposite sides thereof in order to prevent the associated pressure frame part 6a, 6b from moving laterally in relation to the guide rails 30. Each guide roller 32 is rotatably mounted to the associated pressure frame part 6a, 6b.

[0029] The compacting machine 1 comprises a first driving device 33a (see Fig 3) for moving the first pressure frame part 6a between its retracted and advanced positions and a second driving device 33b for moving the second pressure frame part 6b between its retracted and advanced positions. In the illustrated embodiment, each driving device 33a, 33b comprises an electric drive motor 34a, 34b which is mounted to the associated pressure frame part 6a, 6b and configured to effect the movement of the pressure frame part between the retracted and advanced positions. Each driving device 33a, 33b further comprises a sprocket wheel 35a, 35b, which is rotatably mounted to the associated pressure frame part 6a, 6b and configured to be driven in rotation by the drive motor 34a, 34b, and a drive chain 36a, 36b, which has a first end 37 and an opposite second end 38. The drive chain 36a, 36b of each driving device 33a, 33b extends along a part of the foundation 3 and is fixed to the foundation at its first and second ends 37, 38. The sprocket wheel 35a, 35b of each driving device 33a, 33b is in engagement with the associated drive chain 36a, 36b so as to allow the associated pressure frame part 6a, 6b to move along the drive chain 36a, 36b in a first direction towards the other pressure frame part when the sprocket wheel 35a, 35b is rotated in a first rotary direction under the effect of the drive motor 34a, 34b and in a second direction away from the other pressure frame part when the sprocket wheel 35a, 35b is rotated in an opposite second rotary direction under the effect of the drive motor 34a, 34b. Each drive chain 36a, 36b also runs over two non-driven deflection pulleys 39 which are rotatably mounted to the associated pressure frame part 6a, 6b. The driving devices 33a, 33b could of course also have any other suitable configuration, and could for instance be provided with hydraulic cylinders for effecting the movements of the pressure frame parts between the retracted and advanced positions.

[0030] The first and second pressure frame parts 6a, 6b are provided with corresponding alignment members 40a, 40b (see Figs 6 and 7), which are configured to come into contact with each other in order to align the first pressure frame part 6a with the second pressure frame part 6b when the first and second pressure frame parts are moved into contact with each other. In the illustrated embodiment, the compacting machine 1 comprises two pairs of alignment members, wherein each such pair comprises a female-like alignment member 40a which is fixed to one of the pressure frame parts 6a, 6b and a male-like alignment member 40b which is fixed to the other pressure frame part and configured to be received in the female-like alignment member 40a when the pressure frame parts 6a, 6b are moved into contact with each other. Furthermore, the compacting machine

1 comprises a stop member 41 which is fixed to the foundation 3 and which defines the advanced position of the pressure frame parts 6a, 6b. This stop member 41 will at the same time function as an alignment member and is provided with a hole 42 configured to receive, from one direction, a male-like alignment member 43 (see Fig 6) fixed to the first pressure frame part 6a and, from the opposite direction, a male-like alignment member 44 (see Fig 2a) fixed to the second pressure frame part 6b.

[0031] The compacting machine 1 comprises several binding devices for applying loops of elongated retaining members 51 (see Figs 1e and 1f) in the form of wires or straps around a coil of wire 2 compacted between the first and second compacting elements 4a, 4b. In the illustrated embodiment, the compacting machine 1 is provided with four such binding devices evenly distributed about a centre axis of the pressure frame 13 formed by the pressure frame parts 6a, 6b. Each binding device may comprise a wire feeding unit (not shown) and a binding head 52 of conventional and previously known types or, alternatively, a strap feeding unit and a strapping head of conventional and previously known types. A binding head 52 is provided with a twisting member for making a twisted knot at mutually overlapping ends of a retaining member 51 in the form of a metallic wire applied in a loop around a coil of wire 2, whereas a strapping head is provided with punching members for punching locking seals and a securing seal at mutually overlapping ends of a retaining member in the form of a metallic strap applied in a loop around a coil of wire 2.

[0032] Each binding device comprises a guide track for guiding a retaining member 51 in a loop around a coil of wire 2 compacted between the first and second compacting elements 4a, 4b, wherein this guide track comprises a guide track section 53a (see Figs 6 and 7) mounted to the first pressure frame part 6a and a mating guide track section 53b mounted to the second pressure frame part 6b. Each guide track section 53a, 53b is configured to guide a retaining member 51 in half a loop around a coil of wire 2 compacted between the first and second compacting elements 4a, 4b and the two guide track sections 53a, 53b of each binding device are configured to be in alignment with each other when the first and second pressure frame parts 6a, 6b have been connected to each other so that a leading end of a retaining member may first pass through a channel in the binding head 52, from an outlet of said channel into an inlet of the first guide track section 53a, along the first guide track section 53a, from an outlet of the first guide track section 53a into an inlet of the second guide track section 53b and finally from an outlet of the second guide track section back into the channel in the binding head 52. In the illustrated embodiment, each guide track section 53a, 53b is fixedly mounted to the associated pressure frame part 6a, 6b in such a manner that it extends through a radial slot 27 (see Fig 8) provided in the pressure plate 23 of the compacting element 4a, 4b mounted to the pressure frame part.

[0033] The compacting machine 1 further comprises a lifting device 60 which is mounted to the foundation 3 and provided with one or more vertically moveable support members 61 for supporting, from below, a coil of wire 2 received in the space between the first and second compacting elements 4a, 4b. The lifting device 60 comprises a power member 62 (see Fig 3), for instance in the form of a hydraulic cylinder, for effecting a movement of the support members 61 between a lowered position (see e.g. Fig 1f) and a raised position (see e.g. Fig 1e).

[0034] In the illustrated embodiment, each pressure frame part 6a, 6b is associated with a flexible cable track 65 which at one end is fixed to the pressure frame part and at the other end is fixed to the foundation 3, wherein electric cables for supplying electric power to electric equipment on the pressure frame part 6a, 6b and electric cables for transmitting electrical signals between an electronic control unit (not shown) and electric equipment and sensors on the pressure frame part 6a, 6b extend in a protected manner through the cable track 65.

[0035] The compacting machine 1 is configured to cooperate with a hook conveyor of a conventional and previously known type, which comprises a track (not shown) and several carrier hooks 70 which are moveable along the track. A coil of wire 2 to be compacted is suspended by a carrier hook 70 with the coil 2 hanging essentially horizontally on a lower longitudinal part 71 of the carrier hook. Said longitudinal part 71 is inserted axially through the centre of the coil 2. In the illustrated embodiment, the second pressure frame part 6b and the second compacting element 4b is provided with a respective recess 72, 28 for receiving a rear end 73 of the longitudinal part 71 of a carrier hook, whereas the first compacting element 4a is provided with a recess 28 for receiving a front end 74 of the longitudinal part 71 of a carrier hook to thereby allow a coil of wire 2 to remain on a carrier hook 70 when the coil 2 is compacted between the compacting elements 4a, 4b.

[0036] A compacting cycle performed by the above-described compacting machine 1 will now be described with reference to Figs 1a-1f and Figs 2a-2d.

[0037] At the beginning of the compacting cycle, the first and second pressure frame parts 6a, 6b are in their retracted positions and the first and second compacting elements 4a, 4b are in an advanced starting position on the respective pressure frame part, as illustrated in Figs 1 a and 2a. A coil of wire 2 to be compacted is moved into the space between the first and second pressure frame parts 6a, 6b by means of a carrier hook 70 and positioned right between them and above the support members 61 of the lifting device 60. Thereafter, the support members 61 are lifted upwards into contact with the coil 2 in order to make sure that the coil 2 is correctly positioned in relation to the compacting elements 4a, 4b. The pressure frame parts 6a, 6b are then moved towards each other in a synchronized manner under the effect of the drive motors 34a, 34b of the first and second driving devices 33a, 33b so that the compacting elements 4a,

4b come into contact with a respective end of the coil, as illustrated in Figs 1b and 2b. The compacting elements 4a, 4b remain in their advanced starting positions on the respective pressure frame part 6a, 6b until they come into contact with the coil 2, and during the further movement of the pressure frame parts 6a, 6b towards each other each compacting element 4a, 4b will be moved rearwards in relation to the associated pressure frame part 6a, 6b by being pressed against the coil 2 under the effect of the forwardly directed motion of the pressure frame part 6a, 6b. When the compacting elements 4a, 4b are moved rearwards in relation to the respective pressure frame part 6a, 6b, a hydraulic pressure is developed in the power members 5a, 5b, and under the effect of this hydraulic pressure the compacting elements 4a, 4b will achieve a precompacting of the coil 2 during the movement of the pressure frame parts 6a, 6b from the position illustrated in Figs 1b and 2b to the advanced position illustrated in Figs 1c and 2c. Each power member 5a, 5b is connected to a pressure limiter (not shown) which makes sure the hydraulic pressure developed in the power member 5a, 5b during the movement of the pressure frame parts 6a, 6b towards each other is limited to such a level that the drive motors 34a, 34b of the first and second driving devices 33a, 33b will always be capable of moving the pressure frame parts 6a, 6b into proper contact with each other. When the pressure frame parts 6a, 6b have reached their advanced positions (see Figs 1c and 2c) and abut against each other via the above-mentioned contact surfaces 7a, 7b, 8a, 8b, the locking devices 12 are actuated in order to secure the pressure frame parts 6a, 6b to each other for the formation of a rigid and stiff pressure frame 13 around the coil 2. In the next step, the first and second power members 5a, 5b are actuated in order to push the compacting elements 4a, 4b towards the coil 2 in a synchronized manner with a high press force in order to achieve a final compacting of the coil 2, as illustrated in Figs 1d and 2d, and retaining members 51 are feed forwards through the guide track sections 53a, 53b of the binding devices in loops around the coil 2, whereupon the retaining members 51 are drawn tightly against the coil and the binding heads 52 are actuated to secure the retaining members 51 to the coil 2. Thereafter, the locking devices 12 are actuated in order to release the pressure frame parts 6a, 6b from each other and the pressure frame parts are then moved back to their retracted positions under the effect of the drive motors 34a, 34b of the first and second driving devices 33a, 33b, as illustrated in Fig 1e. During this rearward movement of the pressure frame parts 6a, 6b, each compacting element 4a, 4b is kept in its advanced final position on the associated pressure frame part 6a, 6b reached during the final compacting of the coil 2, and this position will constitute the starting position of the compacting element 4a, 4b in the next compacting cycle. Finally, the support members 61 of the lifting device 60 are lowered, as illustrated in Fig 1f, and the compacted coil 1 is moved away from the compacting machine 1 by means of the carrier hook 70 and the compacting machine 1 is then ready for the performance of a new compacting cycle.

[0038] 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 compacting machine for compacting and binding a coil of wire comprising:

- a foundation (3);
- a first compacting element (4a) and a second compacting element (4b), each of which being horizontally moveable in a first direction towards the other compacting element in order to compact a coil of wire (2) received in a space between the first and second compacting elements (4a, 4b) and in an opposite direction away from the other compacting element;
- at least one first power member (5a) which is connected to the first compacting element (4a) and capable of moving the first compacting element (4a) in a horizontal direction towards the second compacting element (4b);
- at least one second power member (5b) which is connected to the second compacting element (4b) and capable of moving the second compacting element (4b) in a horizontal direction towards the first compacting element (4a); and
- several binding devices (52, 53a, 53b) for applying loops of elongated retaining members (51) in the form of wires or straps around a coil of wire (2) compacted between the first and second compacting elements (4a, 4b),

characterized in:

- **that** the compacting machine (1) comprises a first pressure frame part (6a) and an opposite second pressure frame part (6b) which are connectable to each other, wherein the first and second pressure frame parts (6a, 6b) are provided with mating contact surfaces (7a, 7b, 8a, 8b) via which the first and second pressure frame parts (6a, 6b) are configured to abut against each other when connected to each other;
- **that** said first power member (5a) is fixed to the first pressure frame part (6a), and the first compacting element (4a) is moveably mounted to the first pressure frame part (6a) so as to be horizontally moveable in relation to the first pressure frame part (6a) under the effect of the first

power member (5a);
- **that** said second power member (5b) is fixed to the second pressure frame part (6b), and the second compacting element (4b) is moveably mounted to the second pressure frame part (6b) so as to be horizontally moveable in relation to the second pressure frame part (6b) under the effect of the second power member (5b);
- **that** the compacting machine (1) comprises one or more locking devices (12) for releasably securing the first and second pressure frame parts (6a, 6b) to each other when they abut against each other via said contact surfaces (7a, 7b, 8a, 8b), wherein the first and second pressure frame parts (6a, 6b), when secured to each other by means of said locking devices (12), are configured to form a rigid and stiff pressure frame (13) which surrounds a coil of wire (2) received between the first and second compacting elements (4a, 4b);
- **that** the first pressure frame part (6a) is moveably mounted to the foundation (3) so as to allow the first pressure frame part (6a) to be horizontally moved in relation to the foundation (3) between a retracted position, in which the first pressure frame part (6a) is at a distance from the second pressure frame part (6b), and an advanced position, in which the first pressure frame part (6a) abuts against the second pressure frame part (6b) via said contact surfaces (7a, 7b, 8a, 8b); and
- **that** the compacting machine (1) comprises a driving device (33a) for moving the first pressure frame part (6a) between said retracted and advanced positions.

2. A compacting machine according to claim 1, **characterized in:**

- **that** the first compacting element (4a) is configured to be in an advanced starting position on the first pressure frame part (6a) when the first pressure frame part (6a) is moved from the retracted position forwards towards a non-compacted coil of wire (2) received in the space between the first and second compacting elements (4a, 4b); and
- **that** the first compacting element (4a) is configured to move rearwards in relation to the first pressure frame part (6a) from said starting position, under the effect of a rearwardly directed force on the first compacting element (4a) from the coil of wire (2) and against the action of a forwardly directed force on the first compacting element (4a) from said first power member (5a), during a final part of the movement of the first pressure frame part (6a) from the retracted position to the advanced position.

3. A compacting machine according to claim 1 or 2, **characterized in that** the driving device (33a) comprises an electric drive motor (34a) for effecting the movement of the first pressure frame part (6a) between said retracted and advanced positions.

4. A compacting machine according to claim 3, **characterized in:**

- **that** the drive motor (34a) is mounted to the first pressure frame part (6a);
- **that** the driving device (33a) comprises a sprocket wheel (35a) which is rotatably mounted to the first pressure frame part (6a) and configured to be driven in rotation by the drive motor (34a);
- **that** the driving device (33a) comprises a drive chain (36a) which has a first end (37) and an opposite second end (38), wherein the drive chain (36a) extends along a part of the foundation (3) and is fixed to the foundation at its first and second ends (37, 38); and
- **that** the sprocket wheel (35a) is in engagement with the drive chain (36a) so as to allow the first pressure frame part (6a) to move along the drive chain (36a) in a first direction towards the second pressure frame part (6b) when the sprocket wheel (35a) is rotated in a first rotary direction under the effect of the drive motor (34a), and in a second direction away from the second pressure frame part (6b) when the sprocket wheel (35a) is rotated in an opposite second rotary direction under the effect of the drive motor (34a).

5. A compacting machine according to any of claims 1-4, **characterized in that** said first power member (5a) is a hydraulic cylinder.

6. A compacting machine according to any of claims 1-5, **characterized in that** the first and second pressure frame parts (6a, 6b) are provided with corresponding alignment members (40a, 40b), which are configured to come into contact with each other in order to align the first pressure frame part (6a) with the second pressure frame part (6b) when the first pressure frame part (6a) is moved into contact with the second pressure frame part (6b).

7. A compacting machine according to any of claims 1-6, **characterized in:**

- **that** also the second pressure frame part (6b) is moveably mounted to the foundation (3) so as to allow the second pressure frame part (6b) to be horizontally moved in relation to the foundation (3) between a retracted position, in which the second pressure frame part (6b) is at a distance from the first pressure frame part (6a), and

an advanced position, in which the second pressure frame part (6b) abuts against the first pressure frame part (6a) via said contact surfaces (7a, 7b, 8a, 8b); and

- **that** the compacting machine (1) comprises a further driving device (33b), here denominated second driving device, for moving the second pressure frame part (6b) between said retracted and advanced positions.

8. A compacting machine according to claim 7, **characterized in:**

- **that** the second compacting element (4b) is configured to be in an advanced starting position on the second pressure frame part (6b) when the second pressure frame part (6b) is moved from the retracted position forwards towards a non-compacted coil of wire (2) received in the space between the first and second compacting elements (4a, 4b); and
- **that** the second compacting element (4b) is configured to move rearwards in relation to the second pressure frame part (6b) from said starting position, under the effect of a rearwardly directed force on the second compacting element (4b) from the coil of wire (2) and against the action of a forwardly directed force on the second compacting element (4b) from said second power member (5b), during a final part of the movement of the second pressure frame part (6b) from the retracted position to the advanced position.

9. A compacting machine according to claim 7 or 8, **characterized in that** the second driving device (33b) comprises an electric drive motor (34b) for effecting the movement of the second pressure frame part (6b) between said retracted and advanced positions.

10. A compacting machine according to claim 9, **characterized in:**

- **that** the drive motor (34b) of the second driving device (33b) is mounted to the second pressure frame part (6b);
- **that** the second driving device (33b) comprises a sprocket wheel (35b) which is rotatably mounted to the second pressure frame part (6b) and configured to be driven in rotation by the drive motor (34b) of the second driving device;
- **that** the second driving device (33b) comprises a drive chain (36b) which has a first end (37) and an opposite second end (38), wherein this drive chain (36b) extends along a part of the foundation (3) and is fixed to the foundation at its first and second ends (37, 38); and
- **that** the sprocket wheel (35b) of the second driving device is in engagement with the drive chain (36b) of the second driving device so as to allow the second pressure frame part (6b) to move along the drive chain (36b) in a first direction towards the first pressure frame part (6a) when the sprocket wheel (35b) is rotated in a first rotary direction under the effect of the drive motor (34b) of the second driving device, and in a second direction away from the first pressure frame part (6a) when the sprocket wheel (35b) is rotated in an opposite second rotary direction under the effect of the drive motor (34b) of the second driving device.

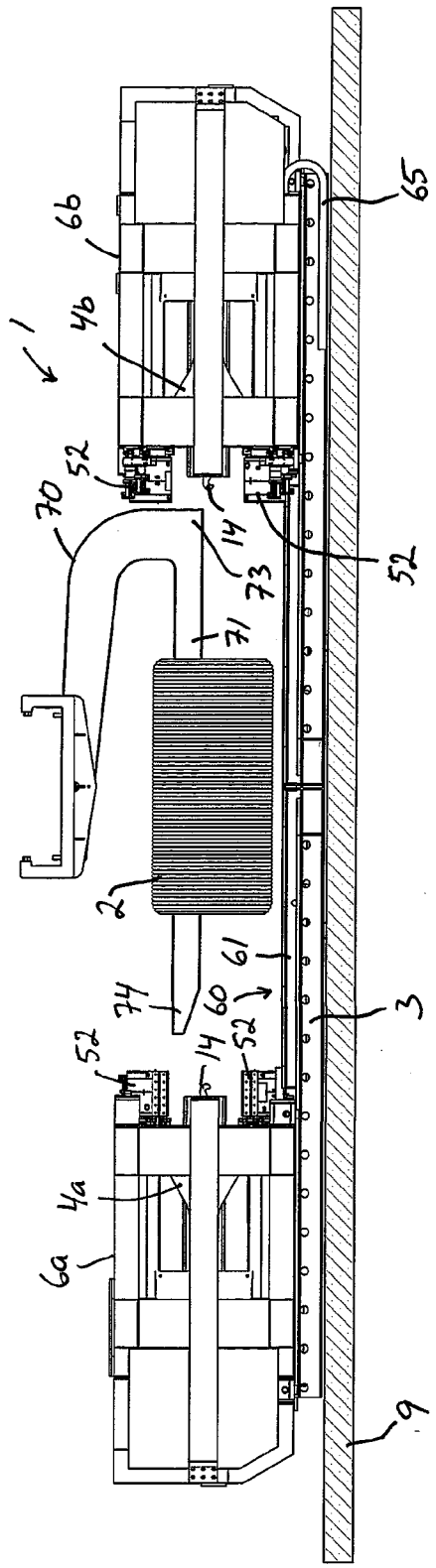
11. A compacting machine according to any of claims 7-10, **characterized in that** each pressure frame part (6a, 6b) rests on the foundation (3) via rollers or wheels (31) which are rotatably mounted to the pressure frame part (6a, 6b).

12. A compacting machine according to any of claims 7-11, **characterized in that** each pressure frame part (6a, 6b) is moveable along one guide rail or two or more mutually parallel guide rails (30) provided on the foundation (3).

13. A compacting machine according to any of claims 1-12, **characterized in that** said second power member (5b) is a hydraulic cylinder.

14. A compacting machine according to any of claims 1-13, **characterized in that** each binding device comprises a guide track for guiding a retaining member in a loop around a coil of wire (2) compacted between the first and second compacting elements (4a, 4b), wherein this guide track comprises a guide track section (53a) mounted to the first pressure frame part (6a) and a mating guide track section (53b) mounted to the second pressure frame part (6b).

15. A compacting machine according to any of claims 1-14, **characterized in that** the compacting machine (1) comprises a lifting device (60) which is mounted to the foundation (3) and provided with one or more vertically moveable support members (61) for supporting, from below, a coil of wire (2) received in the space between the first and second compacting elements (4a, 4b).


1
6b
4b
65
52
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73
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2
74
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60
3
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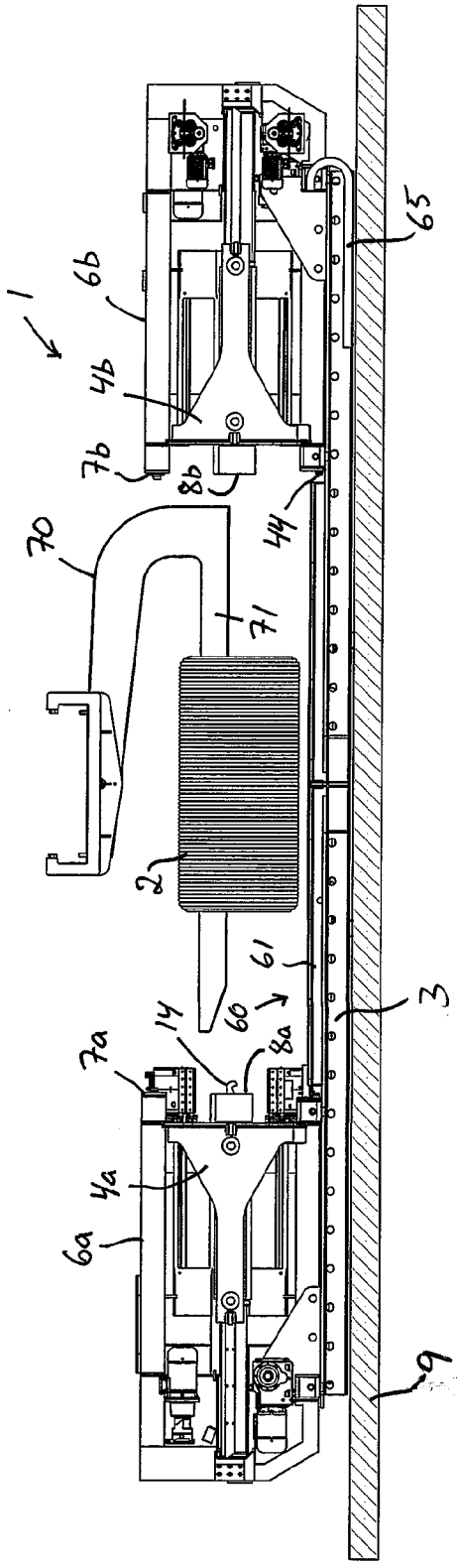
14
52
4a
6a
9

Fig 1a


1
6b
4b
65
7b
8b
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70
71
2
61
60
14
3
7a
8a
4a
6a
9

Fig 2a

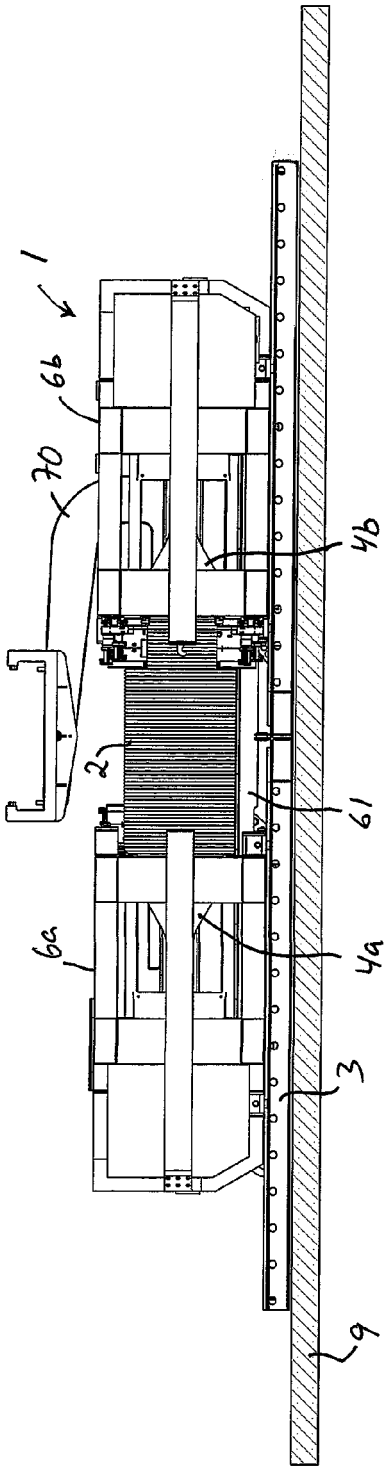


Fig 1b

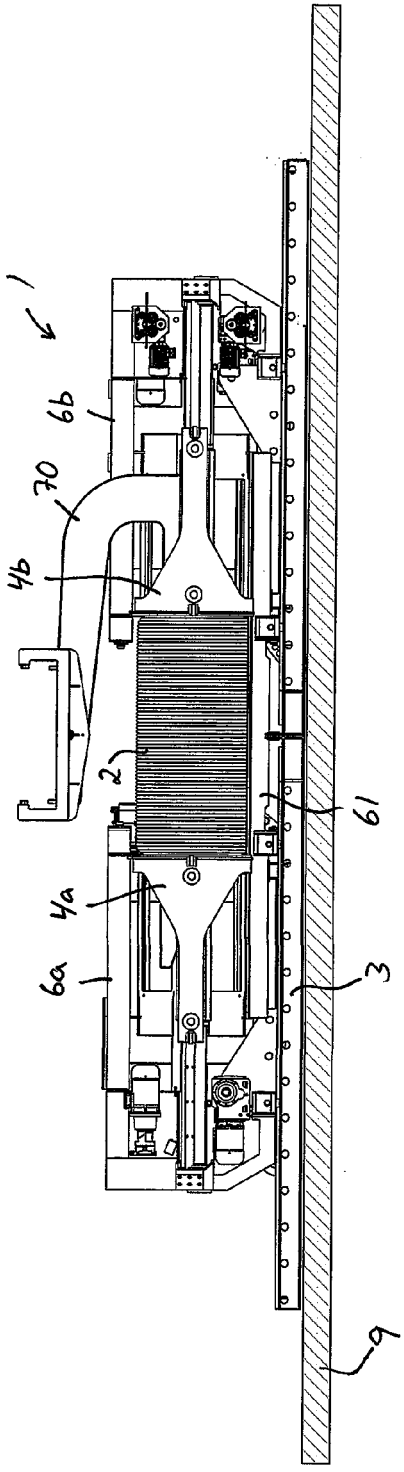


Fig 2b

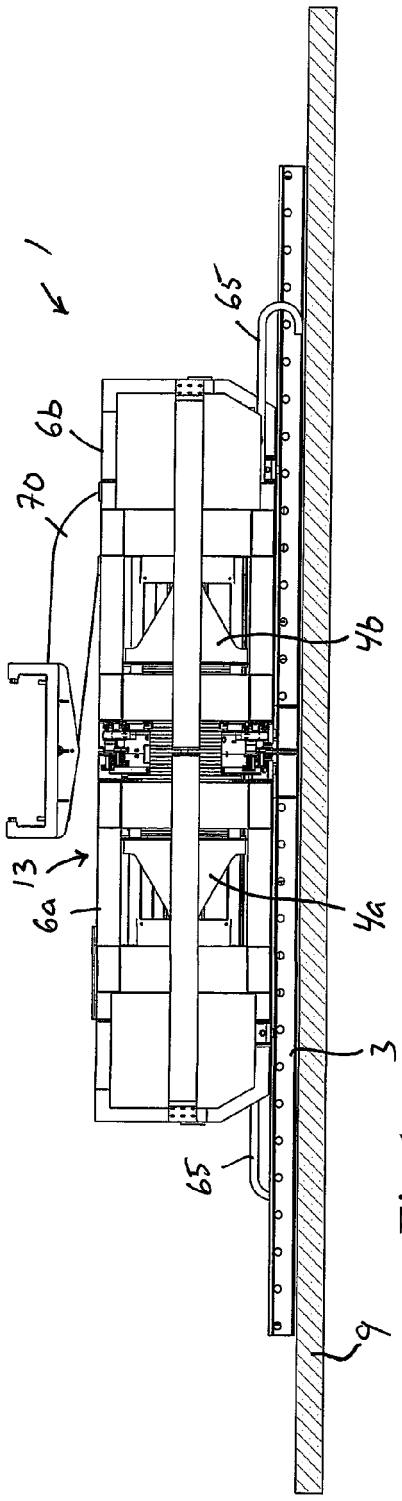


Fig 1c

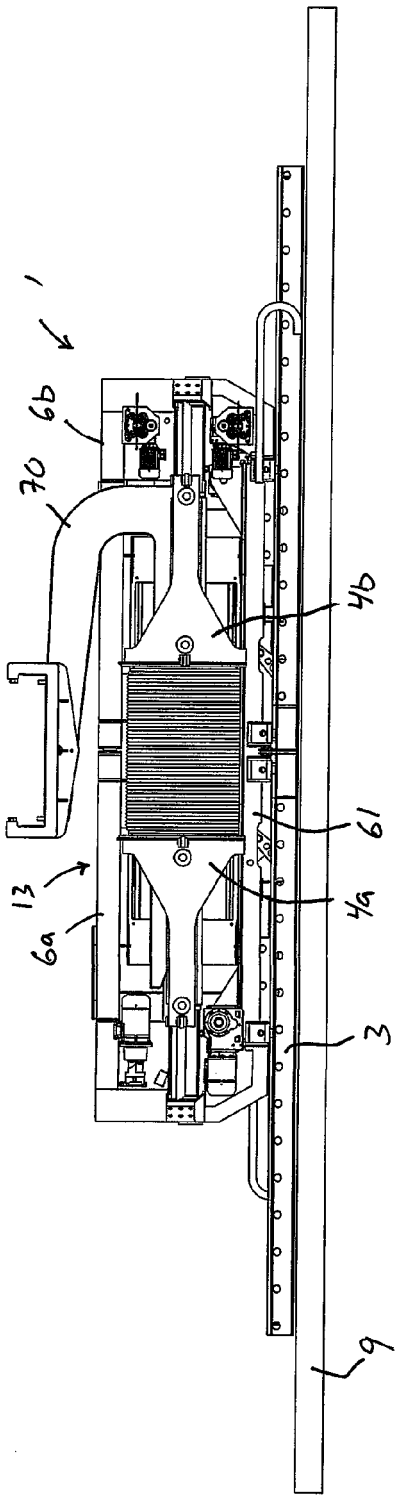


Fig 2c

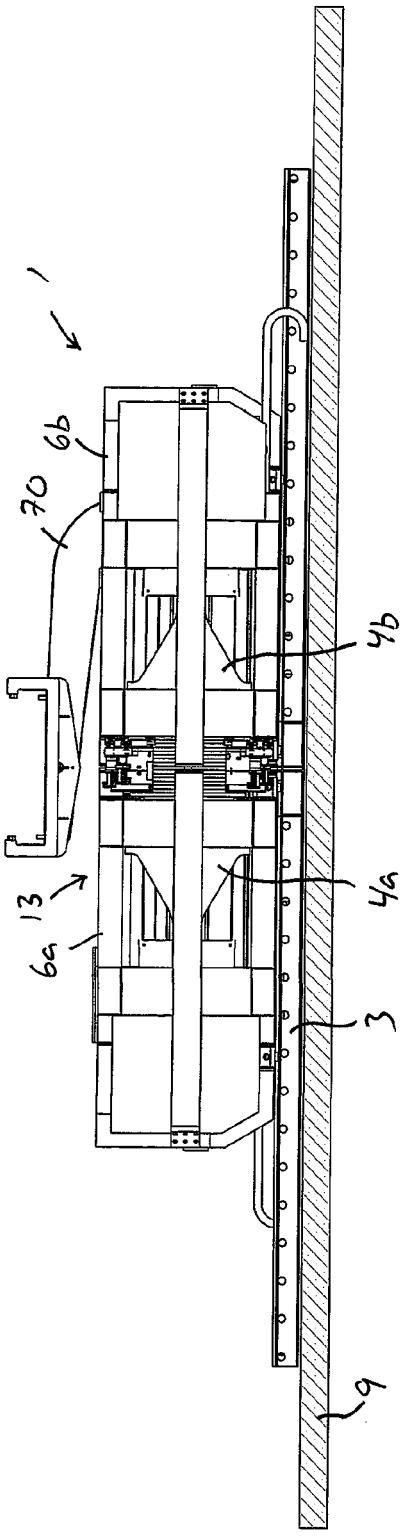


Fig 1d

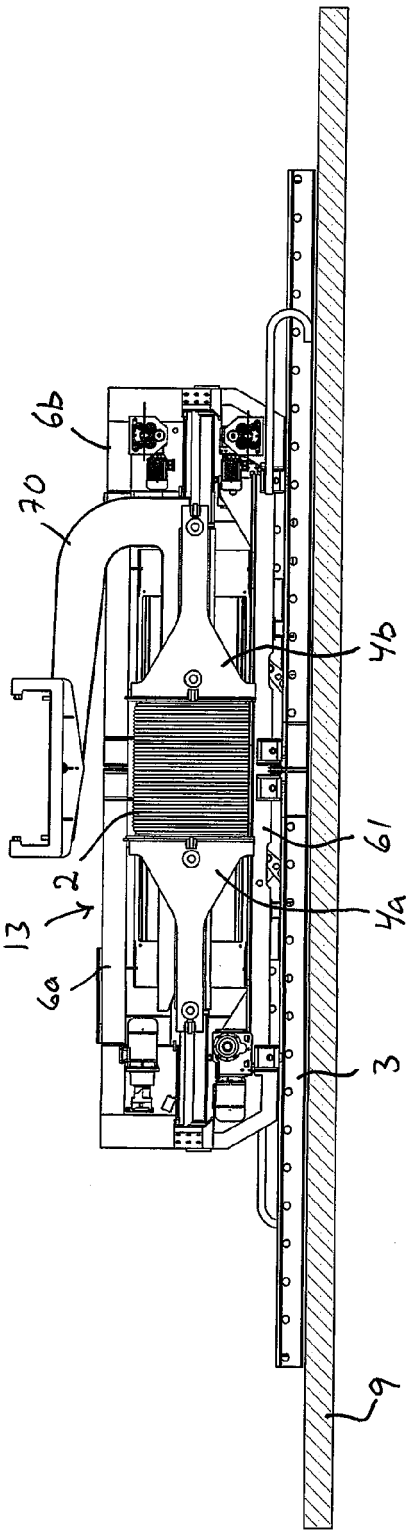


Fig 2d

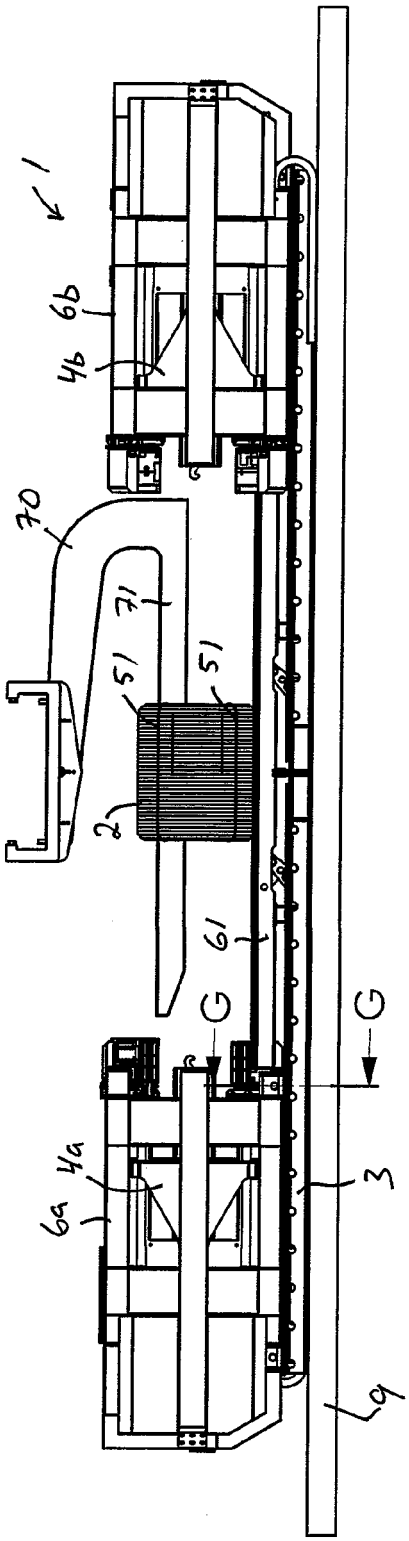


Fig 1e

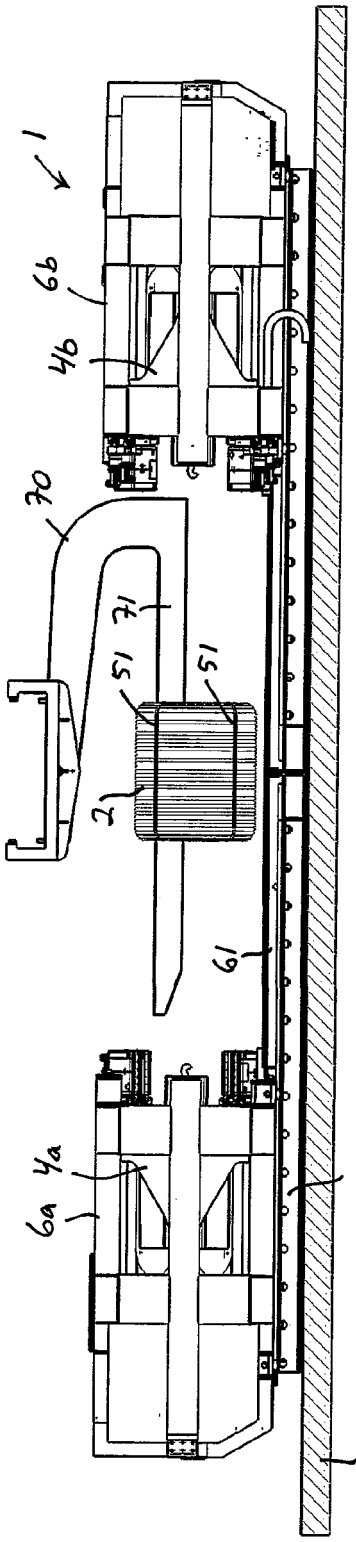
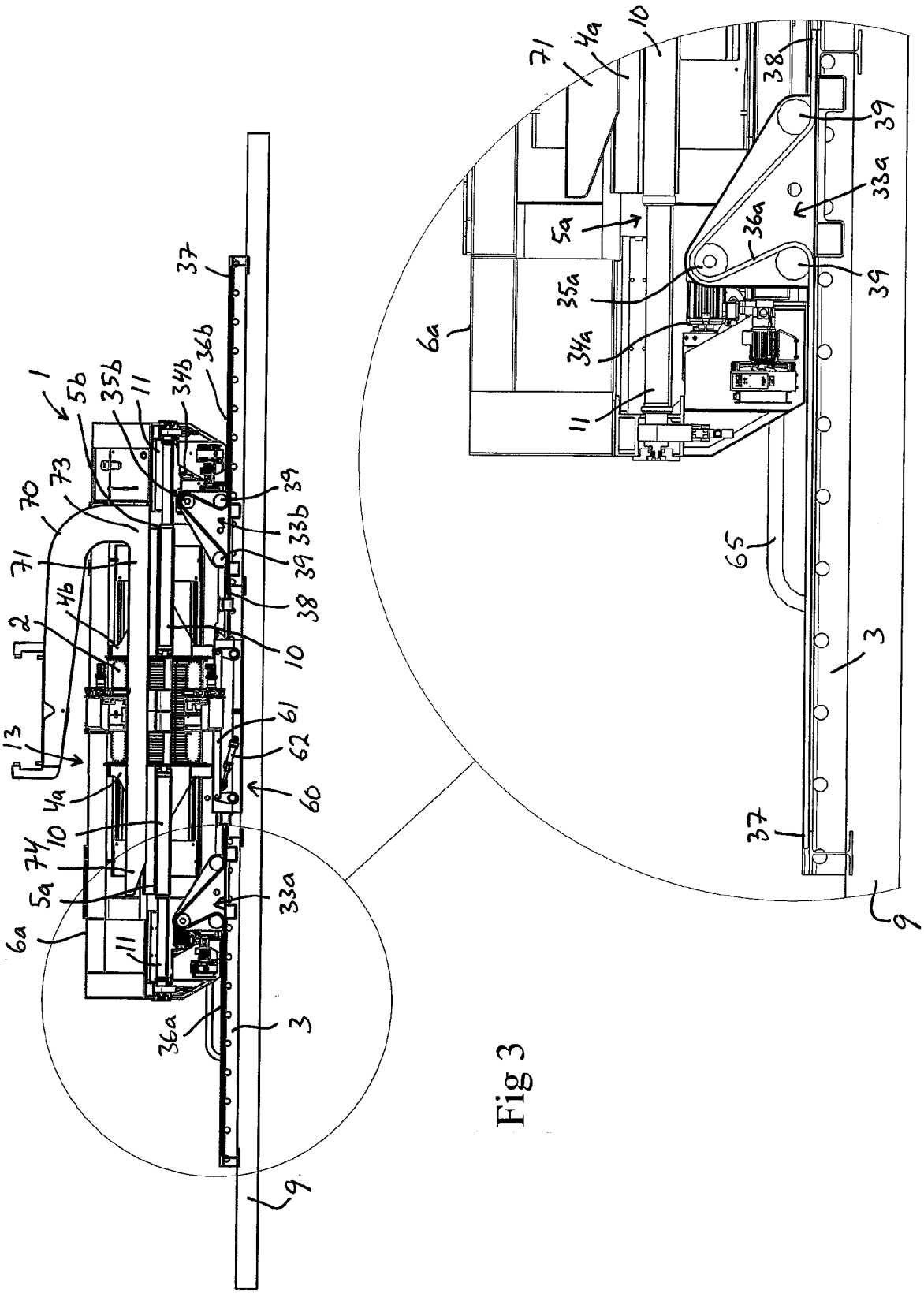


Fig 1f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2
3
4a
4b
5a
5b
6a
9
10
11
13
33a
33b
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35b
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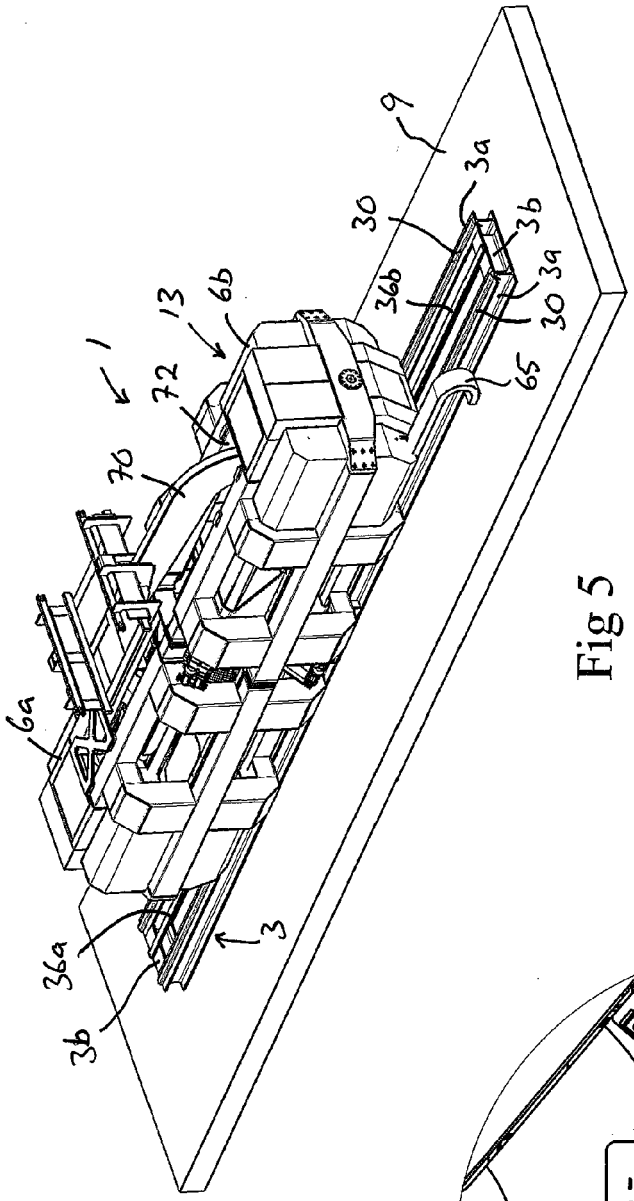
74

Fig 3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36b
3a
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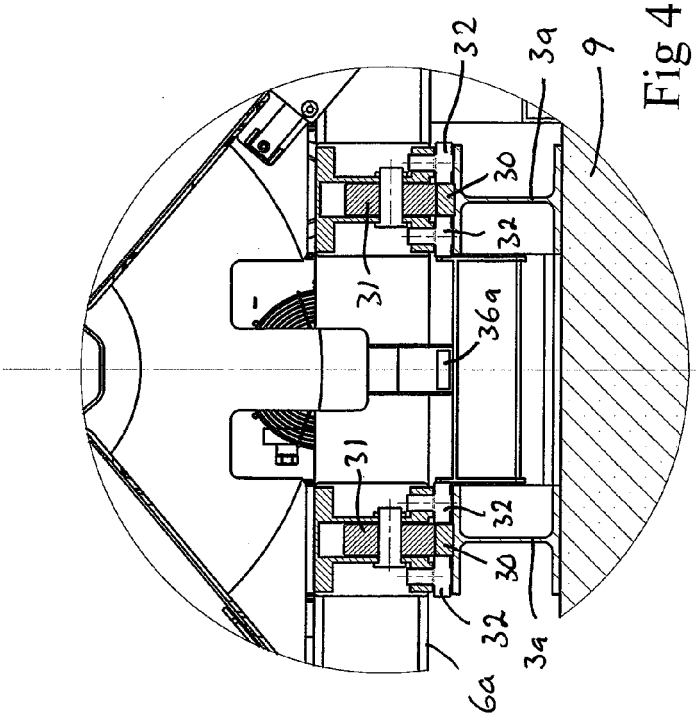
65
13
6b
1
72
70
6a
36a
3b
3

Fig 5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3a
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36a
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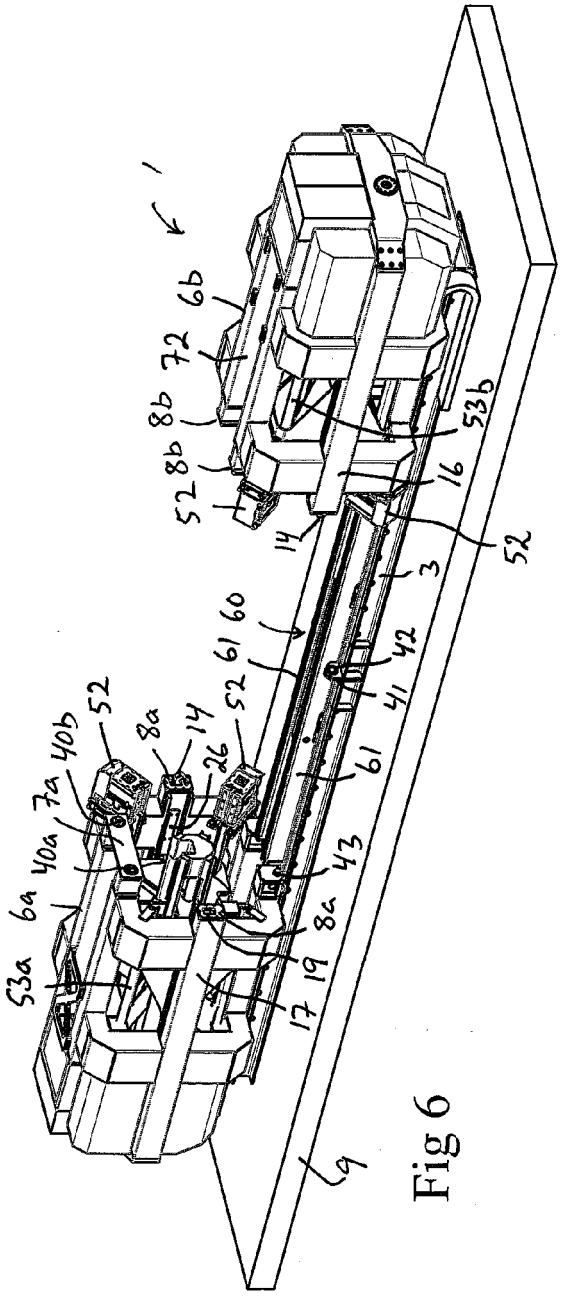
32
6a
3a

Fig 4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6b
72
8b
52
8b
14
53b
16
52
3
61
60
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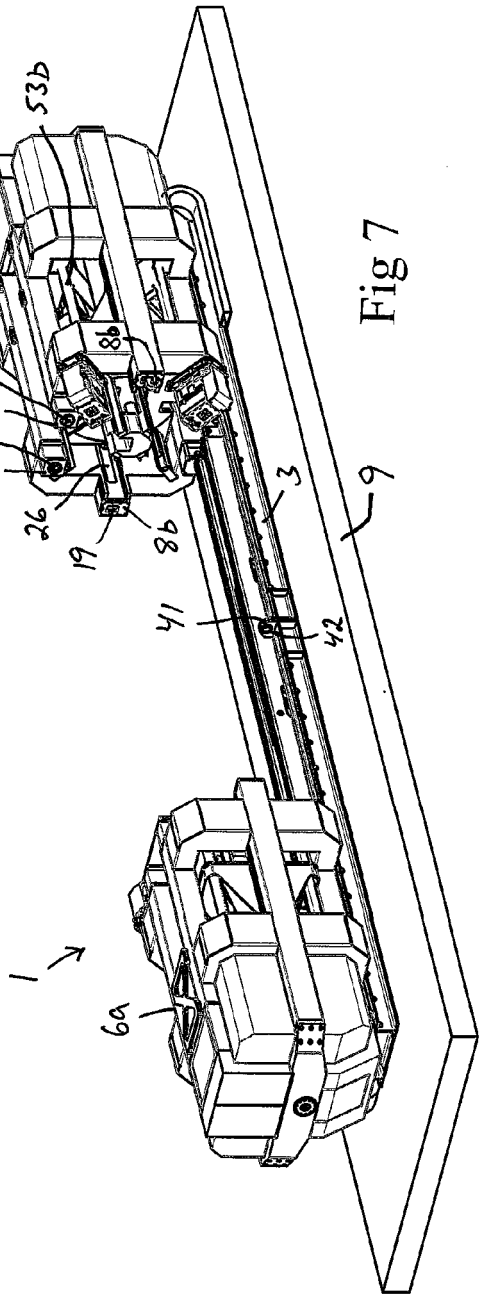
40b
52
8a
14
26
52
9

Fig 6


53b
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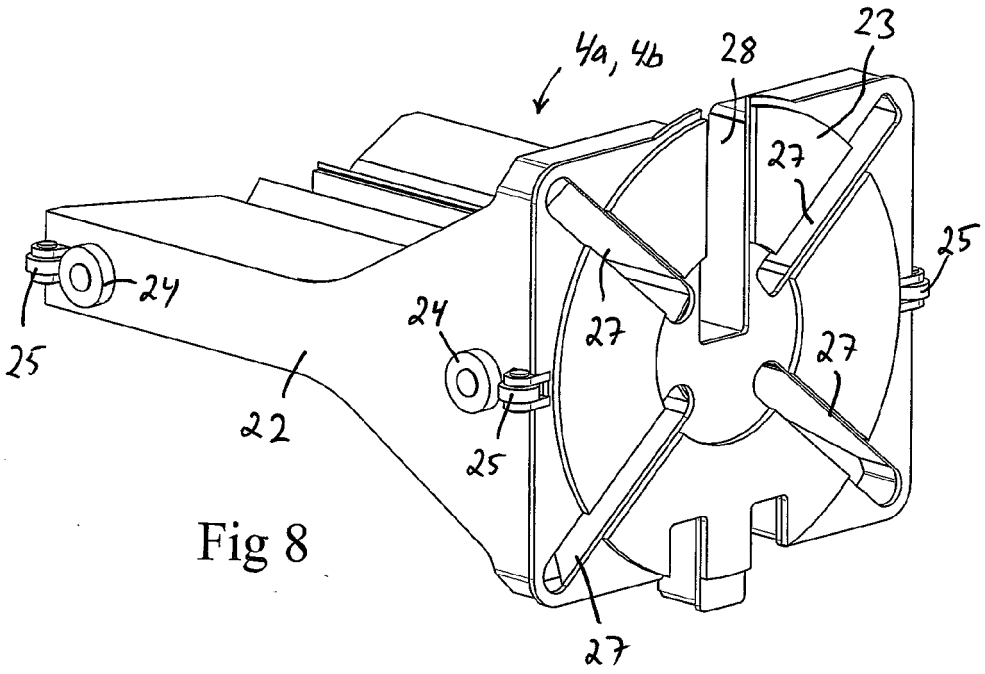
40b
40a
7b
7b
26
19
8b
8b
3
41
42
9
1
6a

Fig 7


4a, 4b
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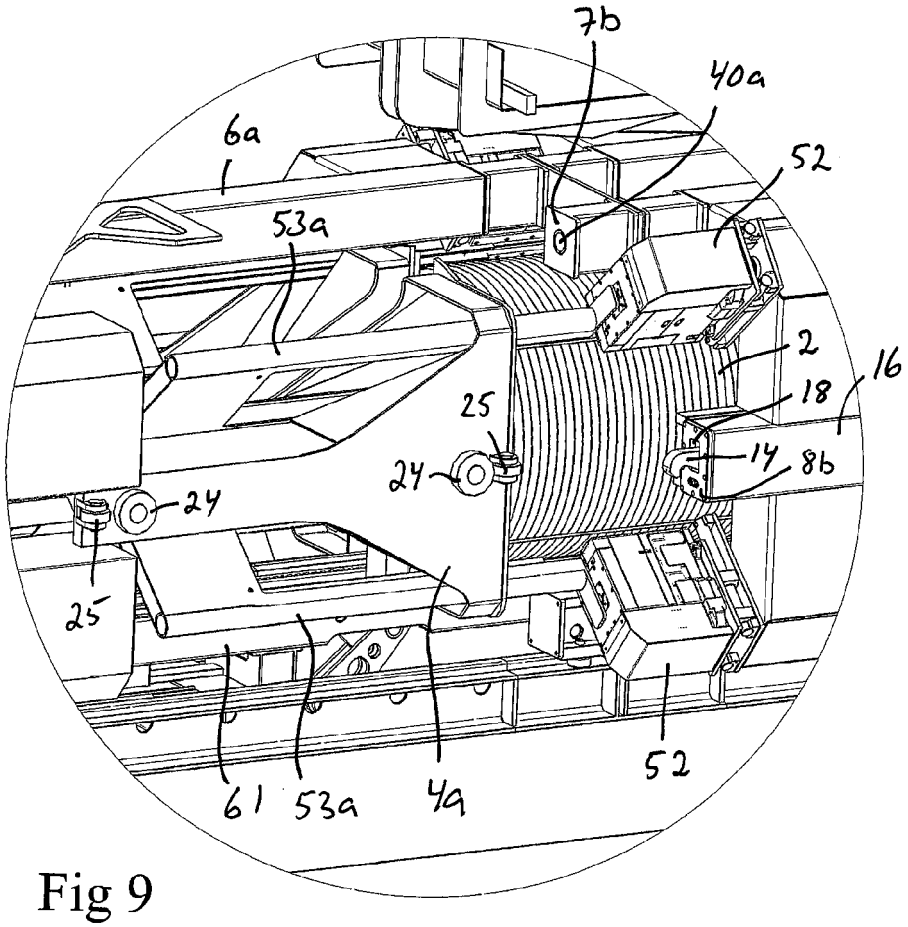
22
25
27

Fig 8


7b
40a
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25
24
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24
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61
53a
4a
52

Fig 9

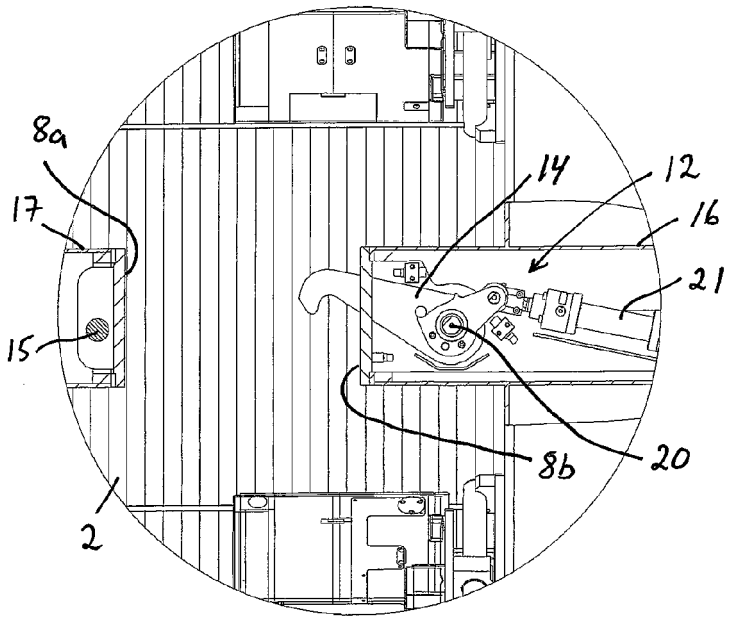

Fig 10a

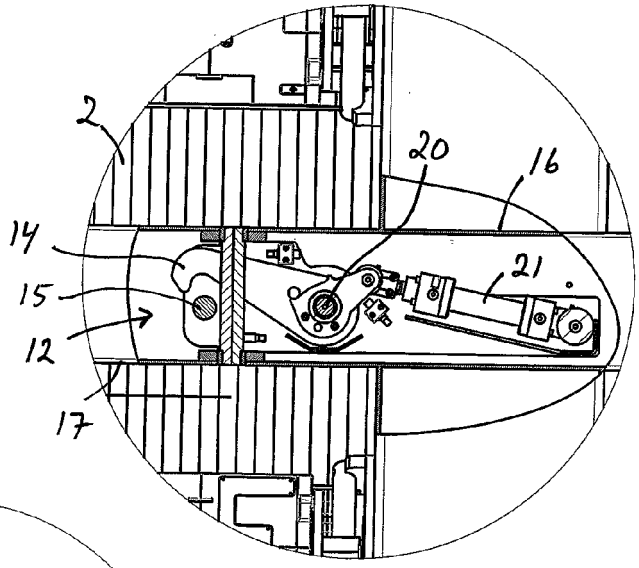

Fig 10b

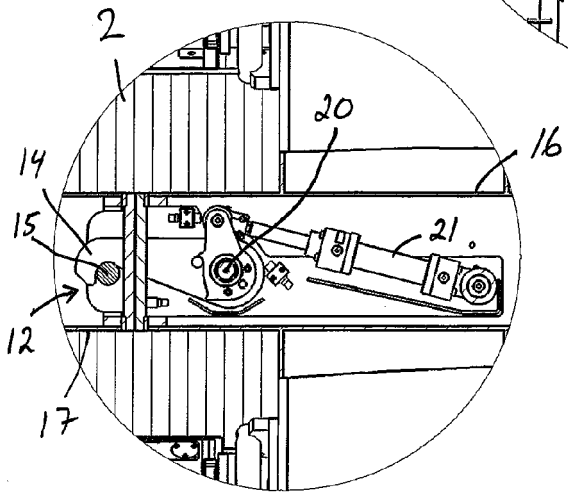

Fig 10c

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EUROPEAN SEARCH REPORT

Application Number
EP 15 17 1775

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,D	US 3 633 492 A (GILVAR MARTIN) 11 January 1972 (1972-01-11) * column 2, line 55 - column 3, line 57; figures *	1-15	INV. B65B13/20 B65B27/06
A	DE 100 17 908 A1 (SCHMITZ SOEHNE GMBH MASCHF [DE]) 8 November 2001 (2001-11-08) * the whole document *	1-15	
A	JP S51 121769 A (DAIFUKU MACHINERY WORKS; GADELIUS CO LTD) 25 October 1976 (1976-10-25) * the whole document *	1-15	

TECHNICAL FIELDS SEARCHED (IPC)

B65B
B21C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	30 October 2015	Lawder, M

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30-10-2015

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