

(19)



Europäisches Patentamt
European Patent Office
Office européen des brevets



(11)

EP 1 371 600 A2

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:
17.12.2003 Bulletin 2003/51

(51) Int Cl.7: **B66D 3/20, B66D 1/36**

(21) Application number: **03253703.7**

(22) Date of filing: **11.06.2003**

(84) Designated Contracting States:
**AT BE BG CH CY CZ DE DK EE ES FI FR GB GR
HU IE IT LI LU MC NL PT RO SE SI SK TR**
Designated Extension States:
AL LT LV MK

(72) Inventors:
• **Purllant, Neil**
Peterborough, Cambs. PE1 5YB (GB)
• **Eley, Michael John**
Peterborough, Cambs. PE1 5YB (GB)

(30) Priority: **12.06.2002 GB 0213469**

(74) Representative: **Chave, Lynne Fiona et al**
Urquhart-Dykes & Lord,
New Priestgate House,
57 Priestgate
Peterborough, Cambridgeshire PE1 1JX (GB)

(71) Applicant: **Index Gear & Engineering Limited**
Peterborough, Cambs PE1 5YB (GB)

(54) **Winch**

(57) A cable winch (10) for winching one or more objects from a suspension means in relation to a stage. The winch (10) comprises a frame (12) and a winching

arrangement (14) and the frame (12) is adapted to be removably locatable in relation to the suspension means. The winching arrangement (14) is located inside the frame (12).

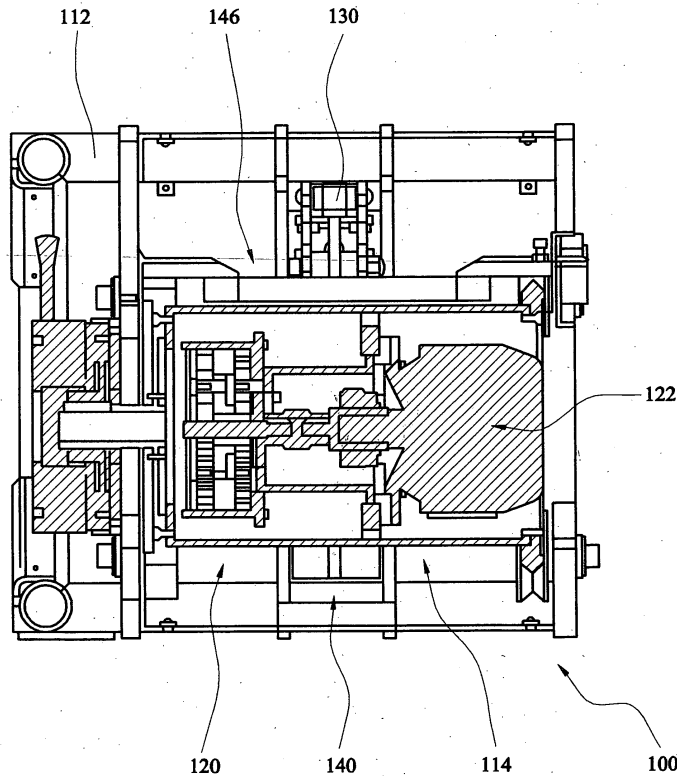


FIG. 3

EP 1 371 600 A2

Description

[0001] The present invention relates to a winch, particularly a cable winch adapted for winching objects, for example, on a stage in a theatre.

[0002] Traditionally, winches are used in theatres and other entertainment applications where there is a need for a quiet wire rope or cable winch for lifting scenery or moving objects across the stage. It is common practice to mount winches fixedly to walls or other support structures, and to lead the winch cables to the desired locations relative to the stage by means of an arrangement of pulleys, blocks, jockey poles and other kinds of cable guide members. The presence of exposed moving cables poses a health and safety hazard not only to the people on stage, but also to other people working behind and around the stage and support structures.

[0003] The winches that are commonly used in theatre applications are bulky and heavy. This restricts their usage to a limited number of locations relative to the stage. Also, the winches are of a complicated construction, and consequently they are generally expensive. Therefore, usually only a few winches are present in a theatre. This obviously limits the number of winching applications which can simultaneously take place on stage.

[0004] The present invention aims to obviate or at least mitigate the above described problems and/or to provide improvements generally.

[0005] According to the invention, there are provided an improved cable winch, and an improved method of providing one or more winchable cables according to any of the accompanying claims.

[0006] In an embodiment of the invention, there is provided a portable cable winch adapted for winching objects relative to a stage, said winch comprising a frame and a winching arrangement, said winching arrangement being located within the frame.

[0007] Preferably, the frame is adapted to be located in a suspension means for stage equipment. The suspension means is usually located over the stage, and comprises a grid-like structure which is adapted to receive stage equipment such as lights, sceneries, and other suitable equipment which can serve as a background or further enhance the performance on stage. These suspension means are usually fixedly located over the stage or they are suspended over the stage. Suitable suspension means may comprise a track such as a drapery track, a truss (also known as a pre-rig), or a grid or any other suitable suspension means that is adapted to receive stage equipment such as lights or scenery.

[0008] The suspension means may comprise one or more suspension elements, and the frame may be adapted to engage with the elements. Usually, a truss comprises one or more of the suspension elements, which form a structure comprising three or four tubes and cross members, which interconnect the tubes. The

frame may be of similar dimensions and structure, such that the frame can engage with one or more suspension members. This allows the cable winch to be conveniently provided within an existing suspension means without any further adaptations to the suspension means.

[0009] In a preferred embodiment of the invention, the frame may be integrally formed with the suspension members.

[0010] The winch is of a light weight construction. To achieve this, lightweight materials such as aluminium and/or titanium are used in the winch construction.

[0011] An important advantage of the present invention is that the winch unit is of an exceptional low weight. This allows the winch unit to be portable and moveable to any desired location. In a preferred embodiment, one or more winch units may be arranged in the suspension means, the winch units each being controllable by means of a winch control means.

[0012] In an embodiment of the invention, the winching arrangement is provided on said frame. Preferably, however, the winching arrangement is provided within said frame. This allows the winch to be of a compact size, and improves the portability of the winch. It also has the additional benefit that the centre of gravity of the winch is located within the frame which improves lifting and hoisting of the winch in relation to the suspension means to mount the winch therein.

[0013] In another embodiment of the invention, the winching arrangement comprises means for winching the cable, a means for driving said winch means and a means for controlling said drive means. The control means may comprise one or more sensing means for sensing the load in the cable, and/or the cable acceleration, and/or the cable position, and/or the cable velocity. In a further embodiment of the invention, the winch comprises a brake for slowing down the cable or for securing the cable in a fixed position. The brake may be controllable by the control means. The winching arrangement may comprise a winch drum. The winch drum preferably comprises grooves for receiving the cable.

[0014] In a further embodiment of the invention, the drive means is provided inside the winch means. This has the important advantage that the overall size of the winch is significantly reduced. In conventional winches, it is not unusual that the size of the drive means is comparable to the size of the winch means. By incorporating the drive means inside the winch means, and more in particular inside the winch drum of the winch means, a very compact winching arrangement is provided. An additional benefit of this construction is that the centre of gravity of the winching arrangement is located inside the winch means. This greatly enhances handling, lifting and hoisting of the cable winch.

[0015] The drive means including the motor, gear box, brake and/or control and sensing equipment may all be located inside the winch drum. The drive means may be cooled by suitable cooling means such as oil cooling. A

further advantage of this arrangement is that the winching arrangement is maintenance free and cannot be damaged easily by mishandling of the winch. Particularly if the winching arrangement is located within the frame, the winch is less prone to damage as the winch is further protected by the frame.

[0016] The winching arrangement may further comprise cable positioning means in the form of a cable arm or a fleet arm for guiding the cable in relation to the drum during winching.

[0017] In another embodiment of the invention, the winching arrangement further comprises a cable braking means for braking the cable. The braking means may brake or slow the cable. The winch may further comprise speed control means for controlling the rate of travel of the cable, and load sensing means. The load sensing means may be suitable for controlling the deceleration and/or acceleration of the cable.

[0018] The braking means may comprise a primary cable brake, the primary cable brake engaging with the winch drum. The primary cable brake may operate independently from the control means. Preferably, the brake only functions in the event of total power failure.

[0019] The primary brake may be fitted with a manual release mechanism. The brake is sufficiently powerful to arrest a 200kg load at maximum velocity. The braking means may further comprise regenerative braking means. The regenerative braking means may comprise the electric motor of the drive means and a resistor bank which may be either mounted on or which may be remote from the winch. The motor may further comprise an internal brake.

[0020] The cable braking means may further comprise a secondary cable brake, the secondary cable brake being adapted to brake the drive means. The secondary brake is provided on the gear box or motor. This has the advantage that a fail safe arrangement is provided whereby braking of the cable can still be conducted if one of the brakes is malfunctioning or failing. Preferably, the secondary brake is a back-up brake in case the primary brakes fail.

[0021] The winching arrangement may further comprise a protection means for protecting the cable from slack (no load) and overload.

[0022] The winching arrangement may also comprise a fleet arm or cable arm, the cable arm being pivotally mounted in relation to the drum such that the pivot axis of the arm is approximately perpendicular to the rotational axis of the drum. This allows the cable arm to swing in relation to the drum. The cable arm may comprise dampening elements, such as cylinders, and/or resilient members, such as springs, to dampen the pivotal movement of the cable arm or fleet arm. The lower mount of the cable arm may be provided on a pivot point, the pivot point comprising a load sensor for sensing the load in the cable to protect the winching arrangement from a slack cable and/or cable overload.

[0023] The winching arrangement may further com-

prise a cable guide member for guiding the cable in relation to the drum. The cable guide member may be slideably arranged in a direction approximately parallel to the axis of rotation of the cable drum. The guide member may comprise a guide member in the form of a pinch roller which presses the cable down onto the cable drum. We have discovered that a guide member having multiple grooves is very effective to position and guide the cable onto and off the drum.

[0024] The winching arrangement may comprise cable guide detection means for detecting the position of the cable guide member relative to the drum. The cable guide detection means may comprise contact sensors for generating a guide control signal when the cable guide is in contact with the contact sensors. If the cable guide is in a position which is outside a predefined range, the cable guide detection means prevent the further operation of the winch.

[0025] The cable guide detection means may take the form of proximity switches which detect the position of the cable guide. The switches may be fully adjustable and may be directly linked to the control means. Plunger type or Reed-type switches may further be provided to provide override protection (dead stop).

[0026] The winching arrangement may comprise cable positioning means, the cable positioning means comprising one or more counters which count the number of revolutions of the drive means via a tachometer. Finally, the cable positioning means may comprise encoder positions which are provided on both the input shaft of the gearbox and the outer ring of the cable drum, both of these may be used to accurately monitor the cable position.

[0027] In yet another embodiment of the invention, the winch may comprise a means for preventing overspill of the cable, the overspill means comprising detection means for detecting overspill of the cable on the drum. Overspill occurs when the cable jumps out of the grooves as provided on the drum or when the cable is not rolled onto the drum in a position immediately adjacent the cable that is already wound onto the drum and a "crossed cable" occurs.

[0028] The overspill detection means may comprise a contact member, the contact member being slidably arranged in relation to the drum, such that when overspill of the cable occurs, the contact member is moved away from the drum. The moving away of the contact member generates a control signal which prevents the winch from further operation. The contact member may comprise contact detection means for detecting movement of the contact member in response to overspill.

[0029] The contact member may comprise a bar running along the top of the drum which is connected to a micro switch. In the event of overspill (i.e. the cable jumps out of the groove), the bar is lifted and the switch is operated. The signal from the switch is either fed back to the control means or directly to the power supply of the drive means. Activation of the drive means is stalled

in case of detected overspill.

[0030] In an alternative embodiment, the overspill means comprises a light source such as a laser which is provided on one end of the cable drum and a light detection member which is provided on the opposite end of the cable drum, the light being approximately parallel to the cable drum and adjacent thereto such that in the event of overspill, the light beam is obstructed which triggers a detection signal to detect overspill of the cable on the cable drum.

[0031] The control means may be adapted to control the drive means and/or cable braking means and/or cable positioning means and/or cable protection means and/or overspill prevention means. The control means preferably operately engages with the brake means and/or monitoring device and/or drive means and/or overspill means and/or load protection means.

[0032] The control means may be suitable for monitoring a wide range of winch parameters. Control parameters may include cable position, winch speed, overspill, overload, slack etc. Preferably, the winch motor comprises a synchronous/asynchronous motor with tachometer and encoder to accurately drive the winch. The control means may be configured such that any type of motor can be applied to the winch. In a preferred embodiment, the control means is programmable by any suitable device such as a computer. The control means may be programmable via a remote link. The control means may also comprise a PLC (programmable logic control unit).

[0033] In addition or alternatively, the control means may comprise a manual controller which allows manual operation of the winch and other parameters such as the cable position, winch speed, etc. Preferably, the slack, overspill and overload protection as described herein before are preset and are not manually controllable. The winch motor in a manually operated winch is preferably an AC motor with inverter. The advantage of this motor is that it is relatively cheap in comparison to synchronous or asynchronous drive motors.

[0034] The main drive means may be provided by any of four different types of main drives: AC motor, synchronous electric motor, asynchronous electric motor and hydraulic motors. The electric motors are preferably controlled via a programmable inverter which is directly linked to a control means such as a PLC. The hydraulic motor may be controlled by basic lever type hand operated valves.

[0035] The control means enable the following functions to be controlled and performed. The winch may comprise an emergency stop which is provided by an upstream contactor which is connected to the control means. If the emergency stop is triggered, this switches off the power to the drive means and enables the brakes to be applied. In addition, the winch may comprise an over current stop. If this is triggered, this switches off the power to the drive means and applies the brakes. The winch also comprises an over speed stop which is trig-

gered when the cable is lowered too quickly. This again results in switching off of the power and instant brake application. Finally, if the temperature of the drive means is over a certain value, the power is also switched off and the brakes are applied. The winch cannot be re-started until the main power supply to the winch is reset.

[0036] All control signals may be monitored and fed back to the control means. The signals can also be recorded. In a further preferred embodiment, the winch unit may comprise a programmable unit for programming the control means.

[0037] In a preferred embodiment the winch is of a lightweight construction and weighs approximately 70 kilograms or less. This allows the winch unit to be located within any truss or crate frame or grid so that the winch unit is conveniently moveable to any desired position, even during performances. Preferably, the winch comprises aluminium. The frame also comprises an aluminium material such as aerospace aluminium alloy, since this greatly reduces the overall weight of the winch, thereby making the winch more portable. This allows the winch to be relocated during stage performances.

[0038] In another embodiment of the invention, there is provided a method for providing one or more winchable cables at a desired location relative to a stage, comprising the steps of providing a suspension means for receiving stage equipment, providing one or more winches adapted to provide said cables, each winch comprising a frame and a winching arrangement, said frame being adapted to be removably locatable in relation to said suspension means, said method further comprising the steps of locating said winch, such that the cable is provided in the desired location. This enables suspension means in the form of a grid or truss to be configured, such that the winch cables are in desired locations relative to the stage. This advantageously obviates the need for any additional pulleys, jockey poles or other equipment necessary for guiding the winch cables to desired locations.

[0039] In another embodiment of the invention there is provided a lightweight winch similar to the winch as hereinbefore described, the winch being suitable for window cleaning. In this particular embodiment, the winch is a portable unit which is used by a window cleaner to position himself relative to the building. In a particular embodiment the winch is provided at ground level, and a pulley or similar device is located at a desired height on the building. The window cleaner can hook himself to the winch cable, which is led over the pulley. The cable winch can be operated by the window cleaner by means of a remote control. In this way the window cleaner may hoist himself/herself to any desired position along the building.

[0040] There is thus provided a cable winch, and a method of providing one or more winchable cables.

[0041] Evidently, the winch as hereinbefore described may be applied to a wide range of applications which

require winching or hoisting or pulling. The lightweight and portable properties of the winch enable the winch to be advantageously suited to any application.

[0042] Embodiments of the invention will now be described as an example only and with reference to the accompanying drawings, in which:

Figure 1A presents a diagrammatic side view of a winch according to an embodiment of the inventions;

Figure 1B presents a diagrammatic cross-sectional view along the line C-C of the winch of Figure 1A;

Figure 2A presents a diagrammatic view of the left hand side of the winch of figure 1A;

Figure 2B presents a diagrammatic cross-sectional view of figure 2A along the line B-B; and

Figure 3 presents a diagrammatic cross-sectional view of a winch according to another embodiment of the invention.

[0043] The winch 10 is adapted for winching objects on a cable (not shown). The winch 10 comprises a frame 12 and a winching arrangement 14 which is arranged inside the frame 12. The frame 12 is adapted to be removably locatable in relation to a grid or truss. Similar to a truss, the frame comprises tubes 16 and cross members 18. The tubes 16 are of a suitable diameter, and are spaced at a suitable distance by the cross members 18 to enable the frame 12 to engage with existing grids or trusses that are widely used in theatre and entertainment applications for suspending stage equipment such as lighting. In this way, the winch 10 can be built into a truss in a modular fashion whereby the winch is integrally formed with the elements of the truss.

[0044] The winch 10 is of an exceptional light weight, which allows the winch to be easily transported to other applications. Due to the light weight of the winch, it is possible to re-locate the winch 10 quietly during performances.

[0045] The winching arrangement 14 comprises means 20 for winching the cable, a means 22 for driving said winch means, and a means for controlling said drive means (not shown). The drive means 22 comprises an electromotor 24. The electromotor 24 drives the winch means 20 by means of gearbox 26. The winch means 20 comprises a cable drum 28 which is rotated by the gearbox 26, and a cable or fleet arm 30 for guiding the cable, which is pivotally arranged perpendicular to the central axis 36 of the cable drum 28. The winch further comprises a primary brake 32 which is engageable with the cable drum 28 and a secondary brake 38 which is directly engageable with the motor 24. The primary brake 32 can be manually operated by handle 39.

[0046] The primary brake 32 may operate independ-

ently from the controller. The brake 32 only functions in the event of total power failure and the brake is fitted with a manual release mechanism 39. The brake 32 is sufficiently powerful to arrest a 200kg load at maximum velocity. The winch 10 further comprises regenerative braking of the electric motor 24 by a resistor bank which is located at a remote location from the winch. The secondary brake 38 is provided in the motor 24.

[0047] The winch 10 further comprises a cable positioning means in the form of a cable guide 40 which guides the cable onto and off the winch drum 28. The cable guide 40 is slidably arranged on a slide 41 in relation to the rotational axis 36 of the winch drum 28 to facilitate guiding of the cable in relation to the winch 28.

Proximity switches or Reed switches or similar (not shown) are provided on the outer edges of the slide 41 to define the range of the guide member 40. If the guide member 40 is out of range, the switches are activated to prevent further operation of the winch 10.

[0048] The fleet arm 30 is provided with a load cell 44 for detecting the load in the cable. The load cell 44 is located at the lower end portion of the fleet arm 30 so as to accurately establish the load of the cable with a sensitivity of 5kgs.

[0049] The overspill means 46 may comprise a contact member in the form of a bar 50 running along the top of the drum 28 which is connected to a micro switch (not shown). In the event of overspill (i.e. the cable jumps out of the groove), the bar 50 is lifted and the switch is operated. The signal from the switch is either fed back to the control means or the switch directly disconnects the power supply to the drive means. Activation of the drive means is immediately stopped in the case of detected overspill.

[0050] The control means comprises sensing means for sensing the load in the cable and/or the velocity of the cable and/or the acceleration of the cable and/or other relevant parameters for controlling the winch 10. The sensing means may comprise positional sensors which can be provided on any of the drive shafts of the gearbox 26 and the electromotor 24 for accurately sensing the position of the cable. These control parameters are necessary to accurately control the winch characteristics of the winch 10.

[0051] The winch 10 is operated as follows. The winch 10 is located in the truss by slotting the truss elements onto the frame 12, whereby the tubes 16 of the frame 12 can engage with the corresponding tubes of the truss elements. In this way, the winch 10 is mounted in the truss, and the winch 10 can be hoisted or suspended in a similar fashion to existing trusses.

[0052] The winch 10 is then operated by means of the control means, which may be connected to a computer or other suitable programmable devices. The cable is rolled on/off the cable drum 28 by means of the drive means 22. The fleet arm 30 guides the cable in relation to the drum 28 whereby the fleet arm 30 is pivotal relative to the drum 28 to support the cable.

[0053] In the event of malfunction, such as overspill of the cable, overload or power failure, the primary and secondary brakes 32, 38 are engaged by the control means and the winching is stopped.

[0054] Figure 3 presents a winch 100 which is essentially similar to the winch 10 as described above. The winch 100 comprises a frame 112 and a winching arrangement 114 which is located inside the frame 112. The winching arrangement 114 comprises means 120 for winching the cable and means 122 for driving the winch means 120. The frame 112 is adapted to be removably locatable in relation to the suspension means. The drive means 122 is provided inside the winch means 120 thereby reducing the overall size of the winch 100 so that the winch 100 is very compact.

[0055] The winch 100 has the same features as the winch 10 including primary and secondary brakes 132,138, control means, overspill means 146, a fleet arm 130 and a cable guide 140. The winch 100 operates in a similar fashion to the winch 10 as shown in Figures 1 and 2.

[0056] Advantageously, the winches 10,100 as herein described are of a low weight and are very compact. This allows the winches to be used in a wide variety of applications which are not limited to applications in theatres or other entertainment venues.

Claims

1. A portable cable winch (10) for winching one or more objects in relation to a stage, the winch (10) comprising a frame (12) and a winching arrangement (14), the winching arrangement (14) comprising means (20) for winching the cable and means (22) for driving the winch means, the frame (12) being adapted to be removably locatable in relation to the stage, wherein said winching arrangement is provided within the frame (12).
2. A winch (10) according to claim 1, wherein the drive means (22) is provided inside the winch means (20) thereby reducing the overall size of the winch (10).
3. A winch (10) according to claim 1 or 2, wherein the winch (10) comprises control means for controlling operation of the winching arrangement (14).
4. A winch (10) according to claim 3, wherein the control means (22) comprises a device for monitoring the operation of the drive means (22).
5. A winch (10) according to any of the preceding claims, wherein the drive means (22) comprises a secondary brake (38) for braking the drive means (22).
6. A winch (10) according to any of the preceding claims, wherein the winch (10) comprises a protection means for protecting the winching arrangement from cable slack and/or overload.
7. A winch (10) according to any of the preceding claims, wherein the winch means (14) comprises a rotatable cable drum (28) for receiving the cable.
8. A winch (10) according to claim 7, wherein the winching arrangement (14) comprises a primary brake (32) for braking movement of the cable drum (28).
9. A winch (10) according to any of claims 7 or 8, wherein the winching arrangement (14) comprises a cable guide member (40) for positioning the cable in relation to the cable drum (28), the guide member (40) being slidably arranged in a direction approximately parallel to the axis of rotation (36) of the cable drum (28).
10. A winch (10) according to any of claims 7 to 9, wherein the winching arrangement (14) comprises a cable arm or fleet arm (30), the cable arm (30) being pivotally mounted in relation to the drum (28) such that the pivot axis (31) of the arm is approximately perpendicular to the rotational axis (36) of the drum (28).
11. A winch (10) according to claim 10, wherein the cable arm comprises a load sensor (44) for sensing the load in the cable so as to provide load protection means to protect the winching arrangement (14) from cable slack and/or overload.
12. A winch (10) according to any of claims 7 to 11, wherein the winch (10) comprises a means (46) for preventing overspill of the cable, the overspill means (46) comprising detection means (48) for detecting overspill of the cable on the drum (28).
13. A winch (10) according to claim 12, wherein the overspill detection means (48) comprises a contact member (50), the contact member (50) being slidably arranged approximately parallel to the central axis (36) of the drum contact member (28) is moved away from the drum (28).
14. A winch (10) according to claim 13, wherein the control means operately engages with the brake means (32,38) and/or monitoring device and/or drive means and/or overspill means (46) and/or load protection means.
15. A winch (10) according to claim any of the preceding claims, wherein the frame (12) is adapted to be located in a suspension means for stage equipment, the suspension means being located over the

stage.

16. A winch (10) according to claim 15, wherein the suspension means comprises one or more suspension elements, the frame (12) being adapted to engage with said elements. 5

17. A suspension means for stage equipment adapted to receive a winch (10) according to any of the preceding claims. 10

18. A method of providing one or more winchable cables at a desired location in relation to a stage comprising the steps of: 15

providing a suspension means for receiving stage equipment;

providing one or more lightweight, portable winches (10) adapted to provide said cables, each winch comprising a frame (12) and a 20

winching arrangement (14), the winching arrangement (14) being provided with the frame (12), the frame (12) being adapted to be removably locatable in relation to said suspension 25

means;

said method further comprising the steps of locating said winch (10) in relation to said suspension means, such that the cable is provided in said desired location in relation to the stage. 30

35

40

45

50

55

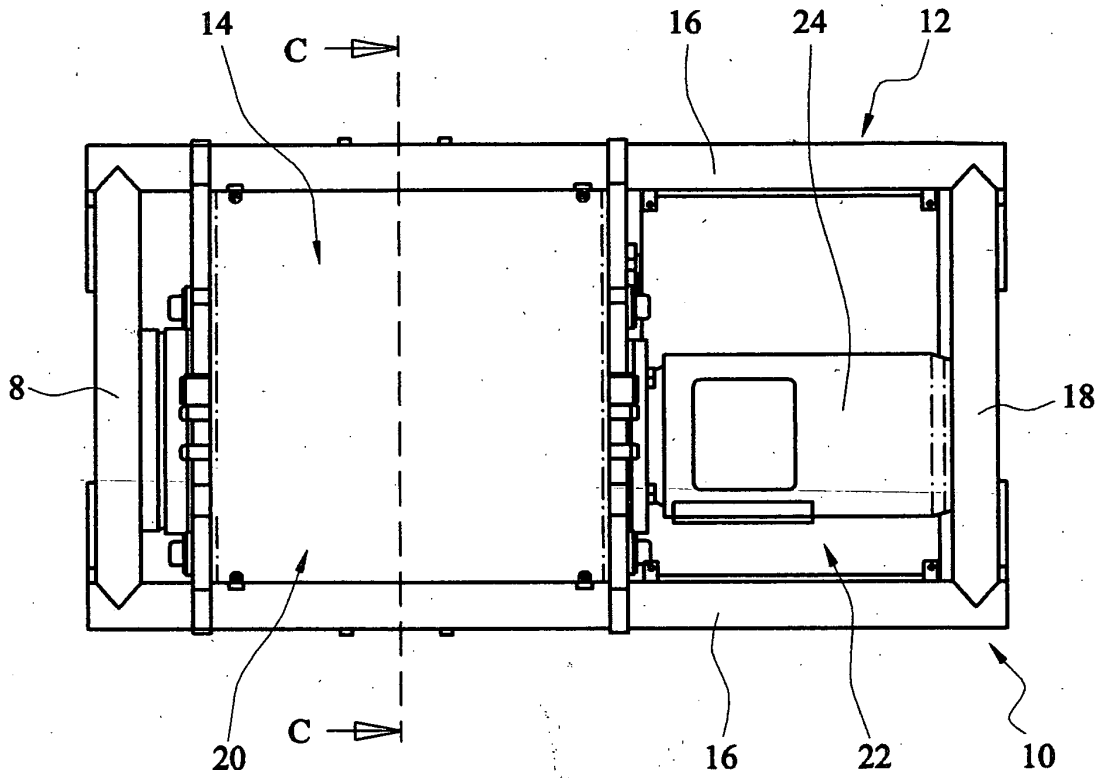


FIG. 1A

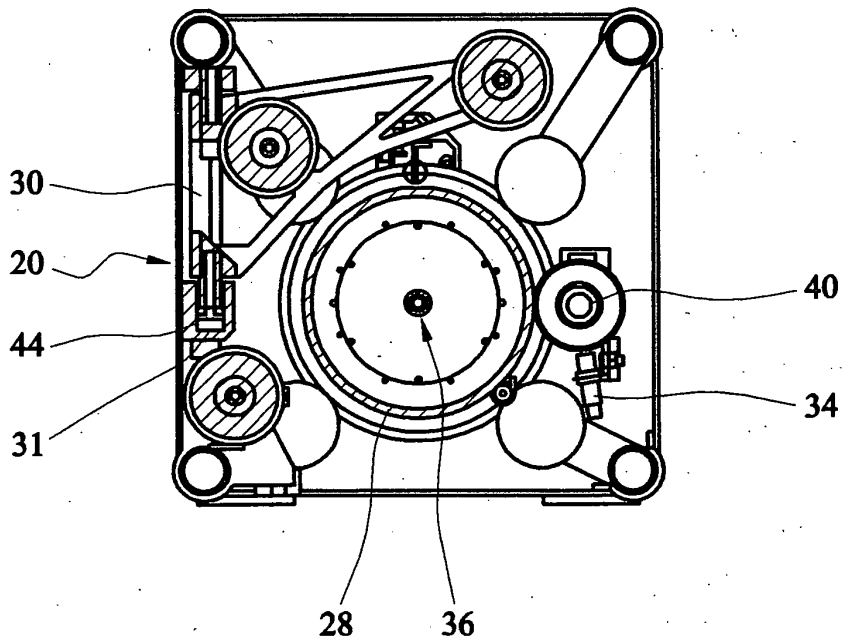


FIG. 1B

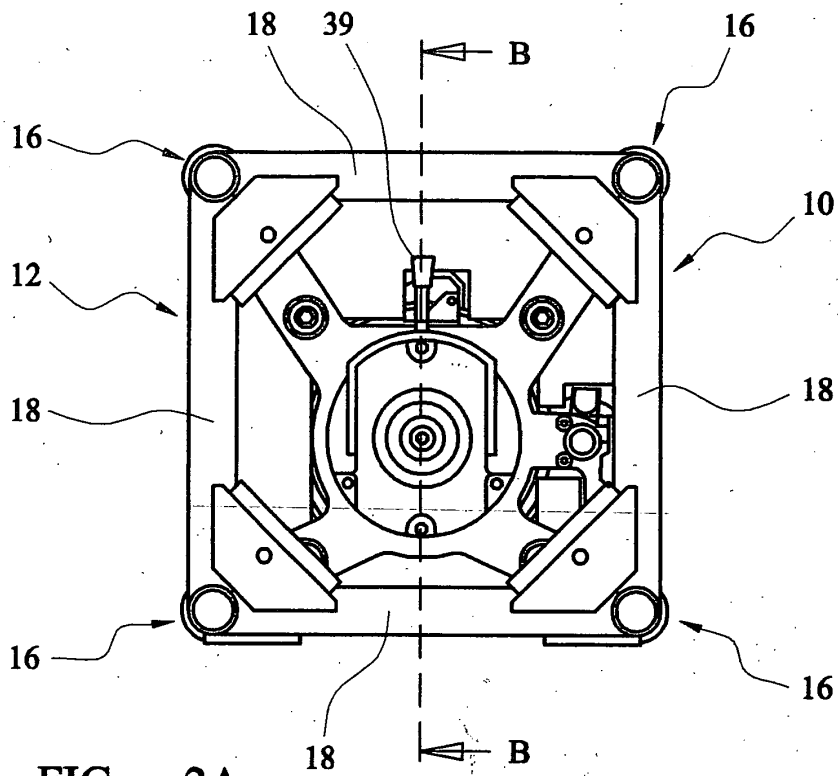


FIG. 2A

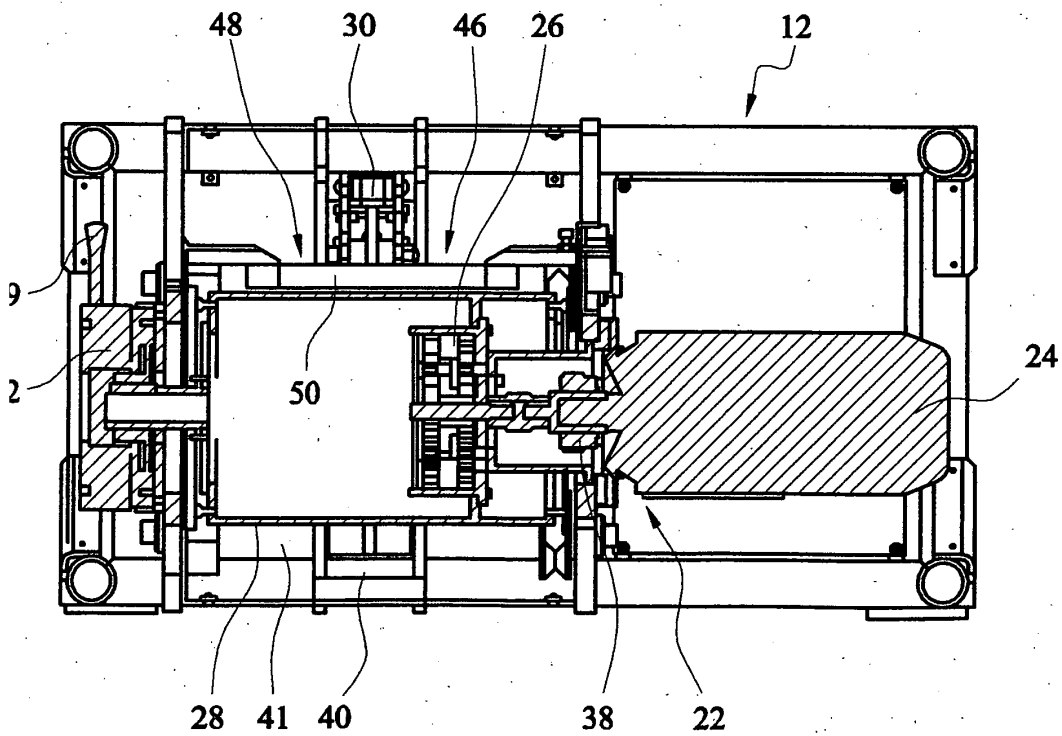


FIG. 2B

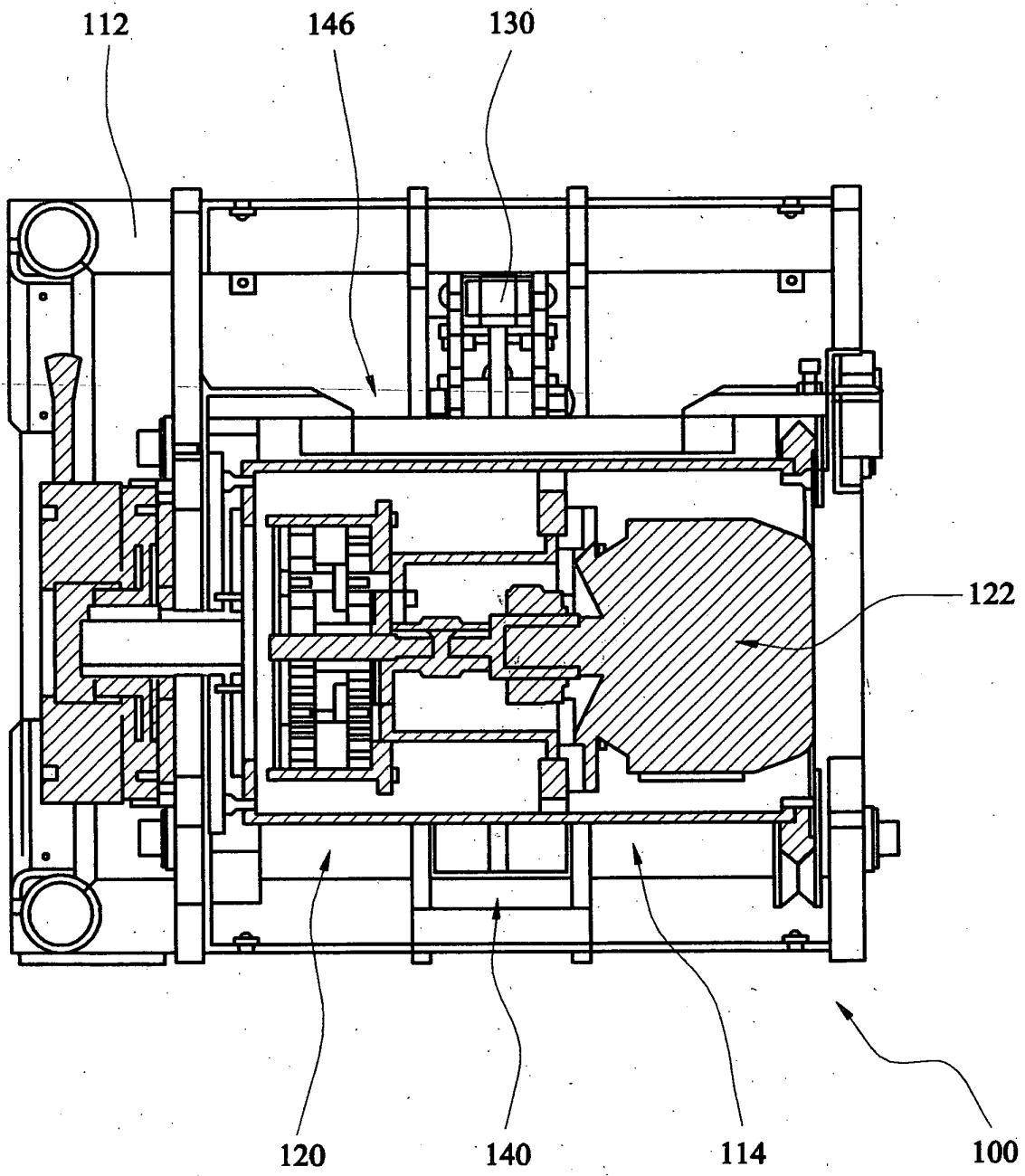


FIG. 3