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(54) Title: BASE FRAME FOR SUPPORTING AND LIFTING AN INTERNAL COMBUSTION PISTON ENGINE

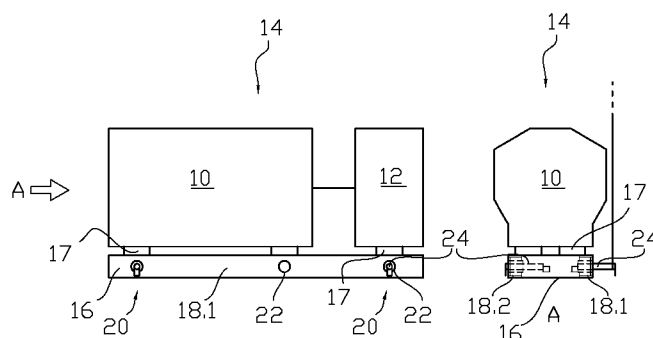


Fig. 1

(57) **Abstract:** Invention relates to a base frame (16) for an internal combustion piston engine (10), comprising a frame body having support means adapted to support the engine on the frame body. The base frame is provided a number of retainers (22) and a lifting tool (24) adapted to the retainer (22). The lifting tool comprises a body (26) removably attached to the base frame (16) of the engine. The body (26) comprises a shaft section (28) having circular cross section which shaft section (28) is provided with a locking member (32) at a first end of the shaft section. The locking member (30) is arranged movable at least to a first position in respect to the body (26) at which the locking member (30) is inside the perimeter of the body (26) and to a second position at which the locking member (30) intersects the perimeter of the body (26). The length of the shaft section of the lifting tool is greater than the length of a cavity arranged to the retainer (22).



Base frame for supporting and lifting an internal combustion piston engine

5 Technical field

[001] The present invention relates to a base frame for supporting and lifting an internal combustion piston engine according to the preamble of claim 1.

10 Background art

[002] Internal combustion engines have traditionally been installed such that the transfer of engine vibrations and noise to the surrounding structures is kept as small as easily possible. Normally this is achieved by mounting the engine by means of resilient rubber mounts on the base
15 frame of the power plant or of the vehicle, be it a stationary assembly, a land vehicle or a marine vessel. When it comes to engines exploited for production of electric power, and heat if so desired, it is customary to install at least an engine and an electric generator on a common base frame called as a generator set. The generator set may be transported
20 and hauled as a one unit.

[003] During transportation and hauling of such an engine or a generator set there often, or almost always, emerge a situation where the engine or the generator set must fitted via or to a confined space. Therefore, it is desirable that no extra space is consumed by the engine or the
25 generator set. On the other hand, the lifting is typically done by attaching necessary lifting ropes to the base frame. And, often the lateral dimensions base frame is less than lateral dimensions of the engine and/or the generator effecting on the lifting possibilities of the engine or the generator set.

[004] An object of the invention is to provide a base frame for an internal combustion piston engine which facilitates successful lifting the engine.

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Disclosure of the Invention

[005] The objects of the invention can be met substantially as is disclosed in the independent claim and in the other claims describing more details of different embodiments of the invention.

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[006] A lifting tool which is adapted for lifting an internal combustion engine by attaching to its base frame comprises a body attachable to the base frame of the engine. The body comprises a shaft section having circular cross section, which shaft section is provided with a locking member at a first end of the shaft section, the locking member is arranged movable at least to a first position in respect to the body where the locking member is inside the perimeter of the body and to a second position where the locking member intersects the perimeter of the body.

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[007] A base frame for an internal combustion piston engine comprises a frame body having support members adapted to support the engine on the frame body, which the base frame is provided a number of retainers and a lifting tool adapted to the retainer, which lifting tool comprises a body removably attached to the retainer of the base frame and the body comprises a shaft section having circular cross section which shaft section is provided with a locking member at a first end of the shaft section, the locking member is arranged movable at least to a first position in respect to the body at which the locking member is inside the perimeter of the body and to a second position at which the locking member intersects the perimeter of the body and the length of the shaft section of the lifting tool is greater than the length of a cavity arranged to the retainer.

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[008] According to an embodiment of the invention the retainer comprises a cylindrical sleeve and the cross section of the body is circular.

- 5 [009] According to an embodiment of the invention the locking member is of circular cross section having diameter smaller or equal to the diameter of the shaft section.

[0010] According to an embodiment of the invention the locking member
10 is rotatably attached to the first end of the shaft section, wherein the rotation axis of the locking member is equally located aside from the central axes of the shaft section and the locking member.

[0011] According to an embodiment of the invention the locking member
15 is slidably attached to the first end of the shaft section by a guide.

[0012] According to an embodiment of the invention guide and the shaft section are parallel directed.

- 20 [0013] According to an embodiment of the invention shaft section comprises a protrusion at its second end, which protrusion intersects the perimeter of the shaft section extending radially outside its perimeter.

[0014] According to an embodiment of the invention the lifting tool the
25 body is composed of the shaft section having circular cross section. The shaft section is provided with a locking member at a first end of the body and a protrusion extending radially outside the perimeter of the shaft section at the second end of the body.

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[0015] According to an embodiment of the invention the retainer comprises a cavity satisfying the following formula

$$L \geq \frac{4 \times A}{P}$$

where L is length of the cavity, A is cross sectional areal of the cavity and P inner perimeter of the cavity.

[0016] According to an embodiment of the invention the lifting tool is arranged movable in the direction of the longitudinal axis of the cavity.

Brief Description of Drawings

[0017] In the following, the invention will be described with reference to the accompanying exemplary, schematic drawings, in which Figure 1 illustrates an internal combustion engine with a lifting arrangement according to the first embodiment of the invention, Figure 2 illustrates a partial view of a base frame according to an embodiment of the invention, Figure 3 illustrates views of a lifting tool in a retainer in a base frame according to an embodiment of the invention, Figure 4 illustrates the lifting tool of figure 3 at different position in a retainer according to an embodiment of the invention, Figure 5 illustrates a lifting tool according to an embodiment of the invention, Figure 6 illustrates a lifting tool according to another embodiment of the invention, and Figure 7 illustrates a lifting tool according to still another embodiment of the invention.

Detailed Description of Drawings

[0018] Figure 1 depicts schematically an internal combustion piston engine 10 which is coupled with an electric generator 12 forming a generator set 14. Figure 1 shows a side view of the generator set 14 and an end

view A of the generator set seen in the direction of the arrow A in the left margin of the figure. The engine 10 and the generator set 12 are supported by a base frame 16 by means of support members 17 adapted to the base frame to receive the forces from the engine 10 and the electric generator 12.

[0019] The base frame 16 may be constructed such that it comprises two parallel longitudinal main beams 18.1, 18.2 which are coupled with each other e.g. by means of cross-beams between the main beams 18.1 18.2 of suitable length providing suitable distance between the parallel beams for supporting the engine and the generator.

[0020] There are one or more lifting arrangements 20 provided in connection with the base frame 16. Such a lifting arrangement 20 comprises firstly a retainer 22 arranged to the base frame 16, and secondly a lifting tool 24 adapted to the retainer 22. The retainer is arranged to open on a side of the base frame and such that it is adapted to receive the lifting tool 24. The form of the retainer 22 and the lifting tool 24 is such that they are compatible for mechanical coupling with each other capable of transmitting the lifting force from the lifting tool 24 via the retainer 22 to the base frame 16. The lifting tool 24 is removably arranged into a cavity of the retainer 22. As is depicted in the view A of the Figure 1 the lifting tool 24 is arranged movably in the cavity. On the right side of generator set in the view A the lifting 24 tool is at its expanded position while on the left side of generator in the view A the lifting tool 24 is at its contracted position. At the expanded position the lifting tool is suitable for using as a lifting device which is shown in the figure by an installed rope, strap or alike. By means of the lifting arrangement 20 according to the invention the lifting may be directed in advantageous manner. In practise this means that the rope may be directed substantially vertically or at least more easily such that the rope is prevented from resting on the engine or the generator. Additionally, when not in use the lifting tool may be moved

into the base frame 16 as is shown on the left side of the view A. Alternatively to lifting tool may be removed from the base frame retainer. Also, the base frame and the lifting tool are compatible with each other.

- 5 [0021] As is shown in the figure 1 the retainers are positioned at proximity to the support members 17 of the engine 10 and the generator 12

[0022] The base frame 16 is generally a planar structure of beam framework. In practical situations the base frame 16 is substantially horizontally aligned. Thus it is advantageous that both the main beams 18.1 and
10 18.2 are provided with retainers 22 whereto the lifting tools 24 are adapted. Thus the engine and the generator arranged on the base frame can be lifted very safely.

- 15 Figure 2 illustrates an embodiment of the retainer 22 arranged to the base frame 16. Advantageously, the base frame 16 is made of steel. In addition, the retainer 22 is also made of steel and welded to the base frame 16. The retainer 22 is arranged to open on the side of the base frame. In this embodiment the retainer comprises a cylindrical sleeve
20 which extends through a wall of the base frame. Thus the internal space of the sleeve forms a cavity with circular cross section into which the lifting tool 24 is removably inserted. Figure 3 illustrate a side view of the retainer 22 and a lifting tool 24 compatible with the retainer shown in figure 2. In this embodiment the lifting tool 24 comprises a body 26 which is at-
25 tachable the base frame 16 of the engine. The body is composed of a shaft section 28 having circular cross section and a locking member at a first end of the body and a protrusion 34 extending radially outside the perimeter of the shaft section at the second end of the body 26. The at-
30 tachment to the base frame 16 is accomplished by the retainer 22 arranged to the base frame 16. The shaft section 28 is of circular cross section having a diameter D. Now, the cylindrical sleeve of the retainer 22 has substantially constant diameter in its longitudinal direction over its

length L, such that the shaft section 28 may be longitudinally moved and rotated in respect to the center axis X of the shaft section 28 in the sleeve without undue burden, preferably manually. In order to provide adequate support, the length L of the sleeve is equal to or greater than the diameter D of the sleeve. The shaft section 28 comprises a protrusion 34 at its second end, which protrusion intersects the perimeter of the shaft section extending radially outside its perimeter. This way the protrusion causes the center of gravity of the shaft section to be located aside from the central axis X. This in turn urges the shaft section towards a position where the protrusion faces down when installed to the cavity.

[0023] The shaft section 28 has a length which is at least equal to the length of the cavity of the sleeve. According to another embodiment of the invention, the longitudinal length of the shaft section 28 with respect to the central axis X is greater than the length L of the sleeve of the retainer 22. Thus the lifting tool 24 is movable in the direction of the longitudinal axis of the cavity. Advantageously, the lifting tool 24 can be moved so that the protrusion 34 is arranged into a close proximity of the beam 18.1 or 18.2 of the base frame 16 so as to save space (as illustrated on the left side of the view A of Figure 1). Then the shaft section 28 extends inwards from the outer edge of the base frame. Thus, the shaft section arranged inside the base frame and under the engine or generator, in practical circumstances.

[0024] The shaft section is provided with a locking member 30 at its first end. The locking member 30 has a circular cross section having a diameter D equal to the diameter of the shaft section 28. The first end is the end which may be first guided through the cavity when installing the lifting tool. The locking member 30 is arranged rotatably at the end of the shaft section by a pin 32 or alike. The pin 32 may be fixed to the shaft section and arranged rotatably in respect to the locking member 30, or vice versa, as long as the locking member is rotatable in respect to the shaft section. The rotational axis of the locking member 30, as well as

the pin 32 or alike is parallel with the center axis X of the shaft section 28, but being located aside from the center axis. Respectively, the rotational axis of the locking member 30 is located aside from the center axis of the locking member. The end view of the lifting tool 24 shown in the right side of the figure 3 illustrates the operation of the locking member 30. The rotational position which is marked with I represent the position where the locking member 30 is at a position preventing the removal of the shaft section 28 from the cavity of the sleeve. This position is also shown in the side view depicted on the left side of the figure 3. Here the pin 32, thus also the rotational axis of the locking member 30, is vertically directly below the central axis X of the shaft section 28. Since the rotational axis of the locking member 30 is located aside from its central axis the locking member is positioned such that its center of gravity is below the central axis X of the shaft section 28. And, since the locking member is diameter equal to the diameter of the shaft section 28, the locking member 30 intersects the perimeter of the shaft section extending radially outside its perimeter, and thus prevents the removal of the lifting tool from the retainer 22. The rotational position which is marked with II represent an intermediate position where the locking member 30 is also at a position preventing the removal of the shaft section 28 from the cavity of the sleeve. Here the pin 32, thus also the rotational axis of the locking member 30, is vertically at the same level as, but on the side of the central axis X of the shaft section 28. Even if the locking member 30 intersects the perimeter of the shaft section extending radially outside its perimeter, and thus prevents the removal of the lifting tool from the retainer 22 this position is meant for intermediate position. The rotational position which is marked with III represent the position where the locking member 30 is at a position allowing the removal of the shaft section 28 from the cavity of the sleeve. Here the pin 32, thus also the rotational axis of the locking member 30, is vertically directly above the central axis X of the shaft section 28. Since the rotational axis of the locking member 30 is located aside from its central axis the locking member is positioned such

that its center of gravity is below the central axis X of the shaft section 28. And, since the locking member is diameter equal to the diameter of the shaft section 28, the locking member 30 is inside the perimeter of the shaft section 28, and thus allows the removal of the lifting tool from the
 5 retainer 22. The removal situation is shown in figure 4.

[0025] Figure 5 depicts an embodiment of the lifting tool 24 otherwise similar to that shown in figure 3 and 4 but here the protrusion 34 is provided with a lifting portion which is located aside from the central axis
 10 opposite to the side of the pin 32. This way applying lifting force maintains the tool at the position preventing from removal from the cavity. Preferably still the protrusion is provided with an end part which extends to opposite direction to that which the lifting portion is directed such that the center of the gravity on the shaft section is on the same side as the
 15 pin 32 in respect to the central axis which urges to maintain the shaft section at the position preventing from removal from the cavity when not loaded.

[0026] Figure 6 shows an embodiment of the invention where the body
 20 26, which is attachable to the retainer 22 in the base frame 16, and the shaft section 28 are separate parts. This means in practice that the shaft section 28 is arranged for operating the locking member 30 rigidly attached to the shaft section 28 and shaft section is rotatably arranged into the body 26. On the other hand the body may be more freely constructed
 25 to comply with requirements of the lifting.

[0027] Here the retainer 22 comprises a cavity in the base frame is satisfying the following formula

$$L \geq \frac{4 \times A}{P}$$

30 where L is length of the cavity, A is cross sectional area of the cavity and P inner perimeter of the cavity.

- [0028] Figure 7 depicts an embodiment of the lifting tool 24 otherwise similar to that shown in figure 3 and 4 but here locking member 30 is arranged movably to the shaft section 28 in slidable manner. The end of the shaft section 28 is provided with guide 32' having two parallel opposite sides and the locking member is provided with respective slot. This way the locking member may translate in the plane perpendicular to the center axis X. The slot and the pin are co-directional with the protrusion 34.
- [0029] While the invention has been described herein by way of examples in connection with what are, at present, considered to be the most preferred embodiments, it is to be understood that the invention is not limited to the disclosed embodiments, but is intended to cover various combinations or modifications of its features, and several other applications included within the scope of the invention, as defined in the appended claims. The details mentioned in connection with any embodiment above may be used in connection with another embodiment when such combination is technically feasible.

Claims

1. A base frame (16) for supporting and lifting an internal combustion piston engine (10), comprising a frame body having support members
5 (17) adapted to support the engine on the frame body, **characterized** in that the base frame is provided a number of retainers (22) and a lifting tool (24) adapted to the retainer (22), which lifting tool comprises a body (26) removably attached to the retainer (22) of the base frame (16), and that the body (26) comprises a shaft section (28) having circular cross
10 section which shaft section (28) is provided with a locking member (32) at a first end of the shaft section, the locking member (30) is arranged movable at least to a first position in respect to the body (26) at which the locking member (30) is inside the perimeter of the body (26) and to a second position at which the locking member (30) intersects the perime-
15 ter of the body (26) and that the length of the shaft section of the lifting tool is greater than the length of a cavity arranged to the retainer (22).

2. A base frame according claim 1, **characterized** in that the retainer comprises a cylindrical sleeve and the cross section of the body (26) is circular.

20 3. A base frame according claim 1, **characterized** in that the retainer comprises a cavity satisfying the following formula

$$L \geq \frac{4 \times A}{P}$$

where L is length of the cavity, A is cross sectional areal of the cavity and P inner perimeter of the cavity.

25 4. A base frame according claim 1, **characterized** in that the lifting tool is arranged movable in the direction of the longitudinal axis of the cavity.

5. A base frame according claim 1, **characterized** in that the body (26) is composed of the shaft section (28) having circular cross section which shaft section (28) is provided with a locking member (32) at a first end of the body and a protrusion (34) extending radially outside the perimeter of the shaft section at the second end of the body (26).

6. A base frame according claim 1, **characterized** in that the locking member (30) is of circular cross section having diameter smaller or equal to the diameter of the shaft section (28).

7. A base frame according claim 1, **characterized** in that the locking member (30) is rotatably attached to the first end of the shaft section (28), wherein the rotation axis of the locking member is equally located aside from the central axes of the shaft section (28) and the locking member (30).

8. A base frame according claim 1, **characterized** in that the locking member (30) is slidably attached to the first end of the shaft section (28) by a guide (32').

9. A base frame according claim 1, **characterized** in that guide (32') and the shaft section (28) are parallel directed.

10. A base frame according claim 1, **characterized** in that the shaft section (28) comprises a protrusion (34) at its second end, which protrusion intersects the perimeter of the shaft section (28) extending radially outside its perimeter.

11. A base frame according claim 1, **characterized** in that the base frame is provided with support members (17) adapted to support the engine (10) and the generator (12) when in use, and that the retainers are positioned at proximity to the support members (17).

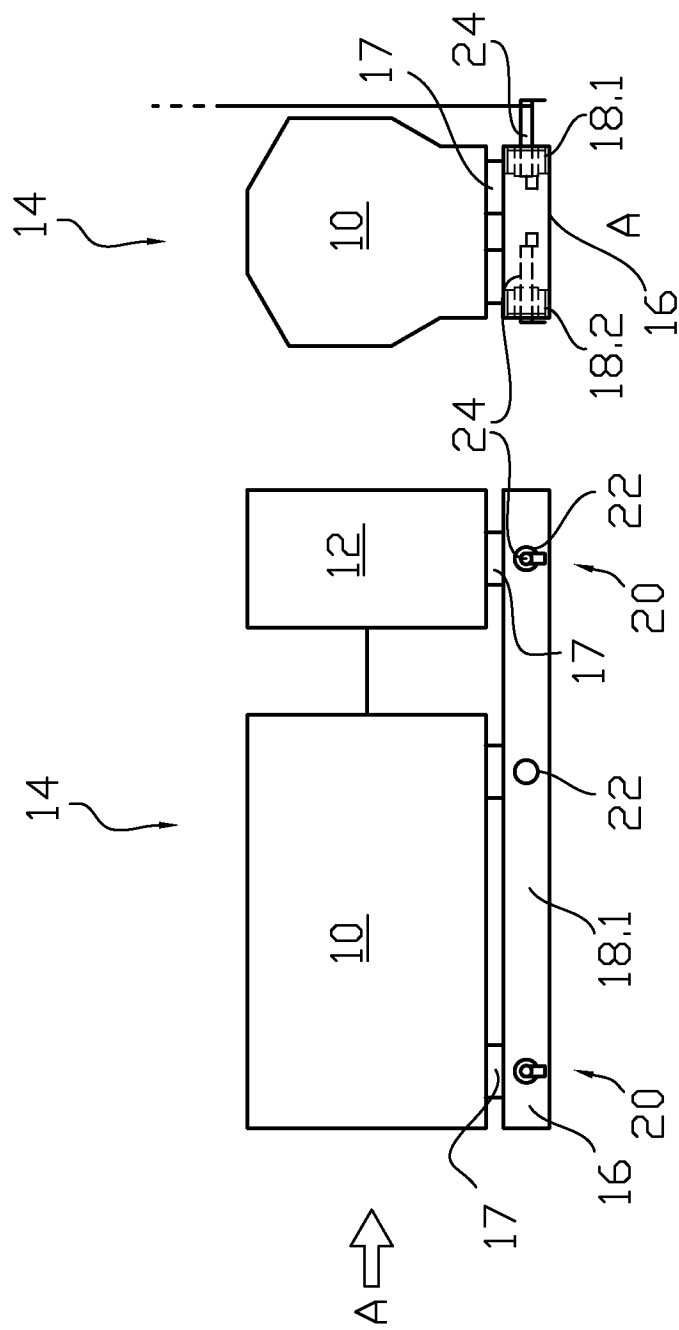


Fig. 1

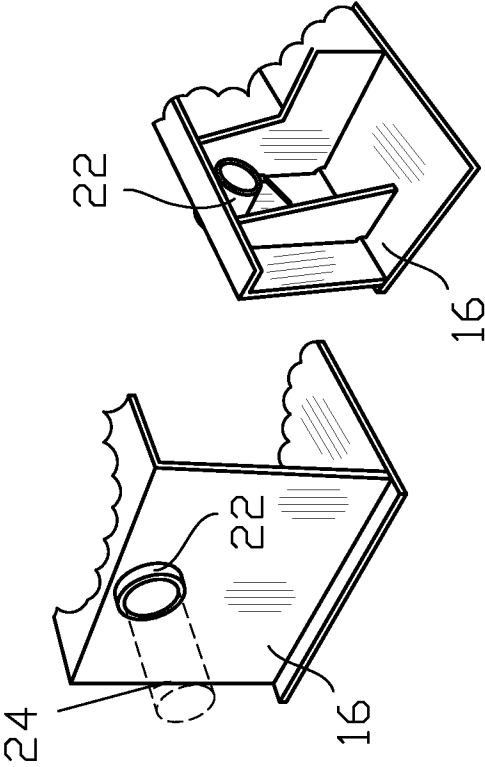


Fig. 2

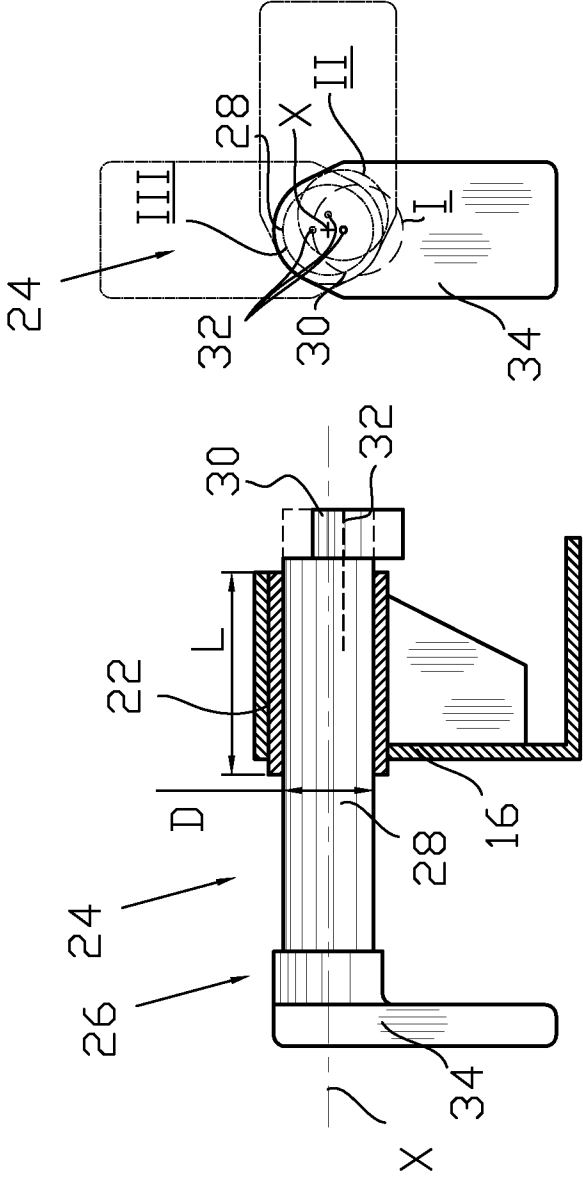


Fig. 3

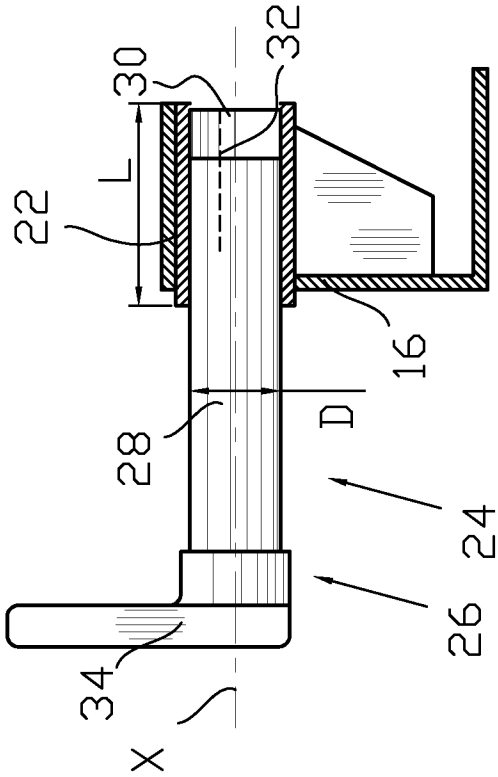


Fig. 4

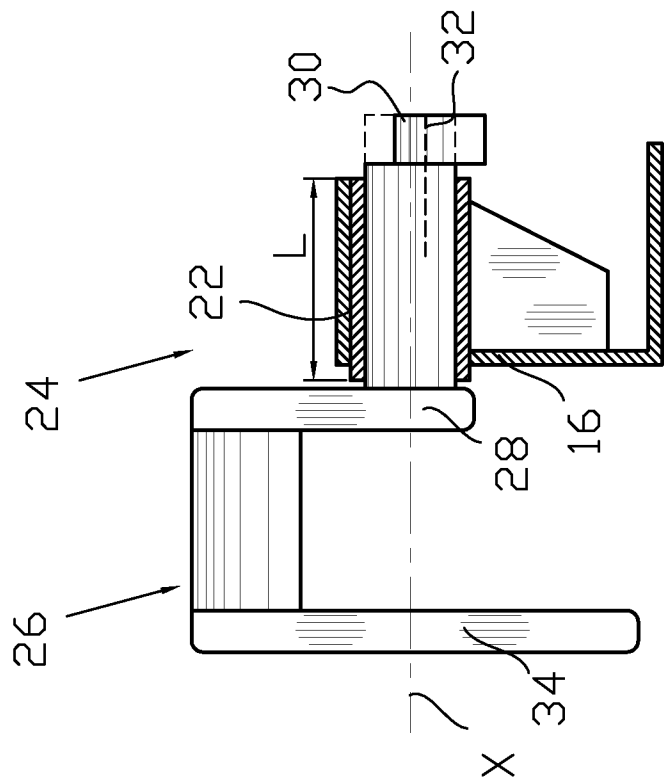


Fig. 5

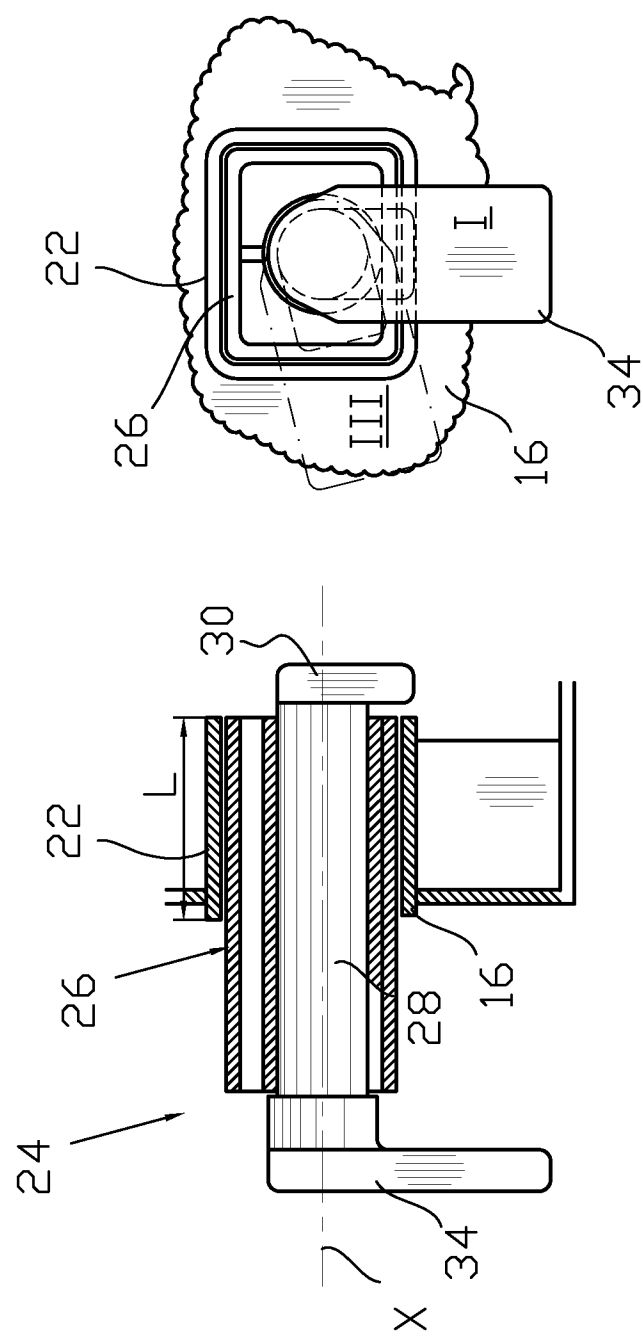


Fig. 6

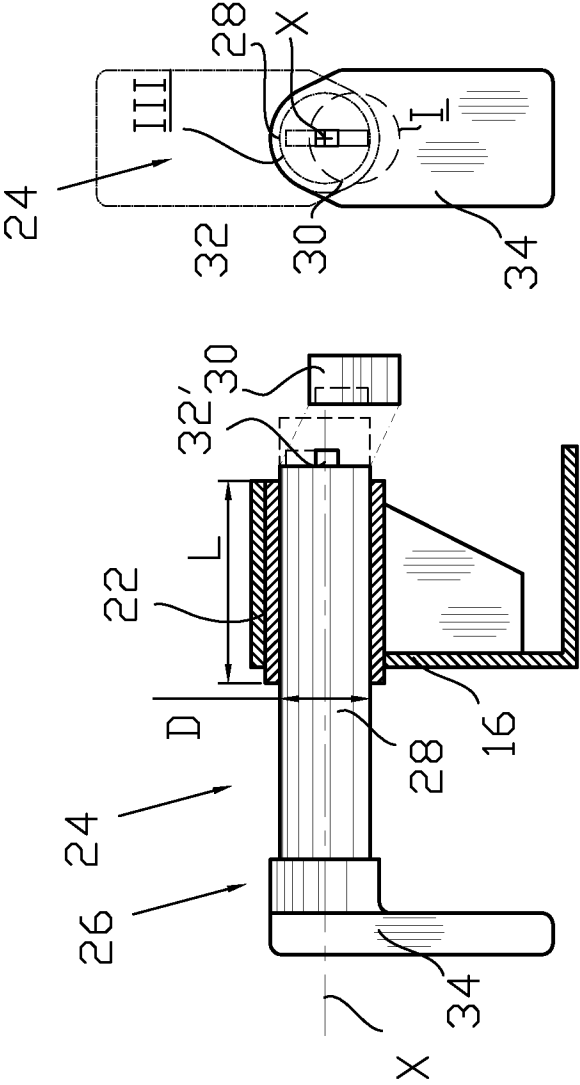


Fig. 7

INTERNATIONAL SEARCH REPORT

International application No

PCT/FI2015/050622

A. CLASSIFICATION OF SUBJECT MATTER

INV. F16M1/00 B66C1/00 F16M7/00 F16M5/00
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

F16M B66C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP H07 206371 A (MARUEI CONCRETE KOGYO KK) 8 August 1995 (1995-08-08) figures 1-4	1-11
X	DE 10 2010 029536 A1 (SGL CARBON SE [DE]) 1 December 2011 (2011-12-01) paragraphs [0001], [0042] - paragraph [0073]; figures 1-9	1-7,9-11
X	CN 103 879 885 A (GUANGXI YUCHAI MACHINERY CO) 25 June 2014 (2014-06-25) abstract; figures 1-10	1-7,9-11
X	JP H10 59673 A (MIZUTA MASAOKI) 3 March 1998 (1998-03-03) figures 1-15	1-7,9-11
	- / - -	

☒ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

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Date of the actual completion of the international search

15 December 2015

Date of mailing of the international search report

23/12/2015

Name and mailing address of the ISA/

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Simens, Mark Phil

INTERNATIONAL SEARCH REPORT

International application No

PCT/FI2015/050622

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2009/111835 A1 (BRIAN INVESTMENTS PTY LTD [AU]; DAVIES BRIAN [AU]) 17 September 2009 (2009-09-17) figures 1-7	1,2,8,10
A	----- US 8 210 488 B2 (SMALL JEREMY [US]) 3 July 2012 (2012-07-03) column 4; figures 1-4 -----	1-11

INTERNATIONAL SEARCH REPORT

Information on patent family members

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PCT/FI2015/050622

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