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(54) Title: JACKING DEVICE

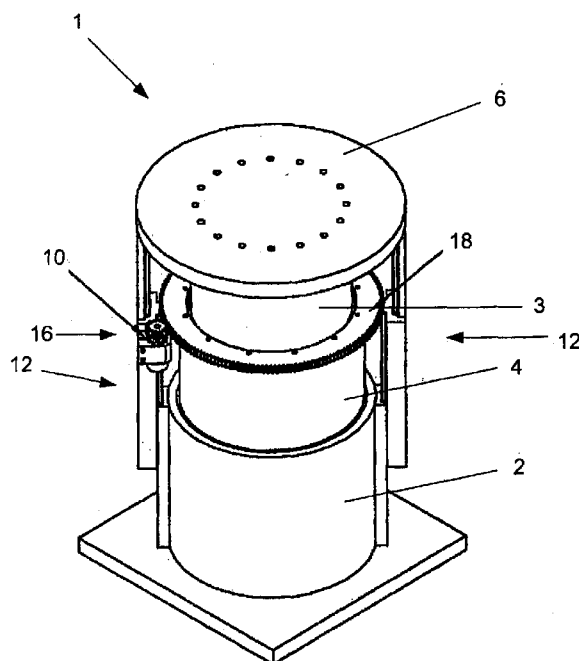


FIG. 1

(57) Abstract: A jacking device (1) includes a base member (2), an upper member (3), and, at least one intermediate member (4). Each member includes screw threads adapted to engage a respective screw thread of an adjacent member. Drive means is included to permit movement of the members, and to thereby raise or lower an upper surface (6) of the jacking device (1). The intermediate member (4) may rotate as the drive means operates, but the upper and lower surfaces are preferably prevented from undergoing rotational movement. A plurality of such jacking devices (1) may be operated simultaneously to raise or lower a load or other object.

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JACKING DEVICE

BACKGROUND OF THE INVENTION

[0001] The present invention relates to a jacking device, and in particular, to a propping or jacking device which can prop or jack a load or object above a substrate surface and then retain it in an elevated position.

[0002] The present invention has particular application to lifting heavy objects, such as vehicles or other machinery and in particular, mining and earthmoving equipment, which are traditionally initially jacked up and then packing material is typically supplied thereunder, such that persons or other equipment may thereafter work below the elevated surface machinery or other load, with a relative degree of safety.

DESCRIPTION OF THE PRIOR ART

[0003] The reference in this specification to any prior publication (or information derived from it), or to any matter which is known, is not, and should not be taken as, an acknowledgement or admission or any form of suggestion that prior publication (or information derived from it) or known matter forms part of the common general knowledge in the field of endeavour to which this specification relates.

[0004] At present, to perform maintenance and repair of heavy machinery, such as in earthmoving and mining applications, when it is necessary for a person and or service equipment to access the underside of the machinery to be repaired, jacks are normally used.

[0005] Such jacks are typically hydraulic or pneumatic jacks, which rely on fluid being maintained under constant high pressure. Once the equipment is jacked up, maintenance personnel typically move under the machinery to carry out the required repair work.

[0006] Such hydraulic systems are known to occasionally fail, or leak, which can result in a slow or sudden failure of the system, with potentially catastrophic effects.

[0007] This can have occupational health and safety implications, and in many situations, can be quite dangerous. In some situations, maintenance and repair personnel may spend considerable time, typically hours, in this hazardous environment below a heavy load, with only a hydraulic system keeping the machinery in place. The risk can be further increased

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in many outdoor environments, for example in windy situations, where the machinery is at a fairly high risk of being blown, slipping, or otherwise falling over.

[0008] In some situations, this risk may be somewhat minimised, by using packing. That is, after the one or more jack initially lifts the huge machinery to the required elevation, a packing material may be installed thereunder. The packing material suspends the equipment in the elevated position, such that service personnel and maintenance equipment may move about under the elevated equipment. The aforementioned risk is therefore minimised somewhat, as the personnel are only in high danger for as long as it takes them to install the packing material.

[0009] Once the maintenance or repair work is completed, the jacks then re-elevate machinery, such that personnel can then remove the packing material, and the equipment may then be lowered to its normal operational position. The personnel are therefore again placed at risk during this packing removal operation.

[0010] The Applicant of the present invention has hereinbefore invented a device which overcomes many of the described disadvantages of the prior art. The Applicant's earlier device is described in International Application No. PCT/AU2008/001218, the entire contents of which should be considered to be incorporated herein by this reference thereto.

[0011] The Applicant's earlier device provides a jacking device, including:

- a base member, adapted to engage a substrate surface;

- a movable member, movable relative to said base member, having an upper surface adapted to engage an object to be raised or lowered;

- a threaded shaft associated with either said base member or said movable member;

- a guide means associated with the other of said base member or said movable member, said guide means including a threaded surface which is adapted to cooperate with said threaded shaft; and

- drive means, adapted to rotate said threaded shaft and/or said guide means such that said movable member is permitted to be moved relative to said base member to thereby raise or lower said upper surface.

SUMMARY OF THE INVENTION

[0012] The present invention seeks to overcome the disadvantages of the prior art or at least provide an alternative to the prior art devices.

[0013] The present invention seeks to provide a jacking device which includes added safety features.

[0014] The present invention also seeks to provide a telescoping device which may be compactly stored, and which may elevate a load to a relatively high elevation.

[0015] In one broad form, the present invention provides a jacking device, including:

- a base member, including a base surface adapted to engage a substrate surface, and, a base screw thread;

- an upper member, having an upper surface adapted to engage an object to be raised or lowered, including a screw thread,

- at least one intermediate member, positioned between said base member and said upper member, each intermediate member including first and second screw threads adapted to engage a respective screw thread of an adjacent member; and

- drive means, adapted to permit movement of at least one of said members relative to its adjacent member to thereby raise or lower said upper surface.

[0016] Preferably, said drive means includes a primary drive means and a backup drive means, each drive means being selected from an electric drive motor, a hydraulic or pneumatic cylinder and/or other drive means.

[0017] Also preferably, said device is substantially tubular in shape, wherein said base screw thread is provided on an inner surface of said base member, wherein said upper screw thread is provided on an outer surface of said upper member, and, wherein said first and second screw threads are provided on the inner and outer surfaces of the or each intermediate member.

[0018] Preferably, the jacking device further includes a linear bearing which substantially prevents rotational movement of said upper and base members as said drive means is operated.

[0019] Preferably, the jacking device also further includes a gear device, adapted to permit rotation of said intermediate member as said drive means is operated.

[0020] Preferably, said gear device includes:

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a first gear wheel operatively attached to said linear bearing, and adapted to be driven by said drive means; and,

a second gear wheel operatively attached to said intermediate member, and operatively engaged with said first gear wheel, which is adapted to permit rotation of said intermediate member as said drive means is rotated.

[0021] Also preferably, the jacking device is embodied wherein said gear device is driven by an electric drive means.

[0022] Also preferably, the jacking device includes a hydraulic cylinder drive means to substantially vertically raise/lower said upper surface relative to said base surface.

[0023] The jacking device further preferably also includes a controller, operable by a user, to control the raising/lowering of said jacking device and to operate said drive means.

[0024] Preferably, said controller controls the simultaneous operation of a pair of drive means to thereby effect substantially vertically movement of said upper surface relative to said base surface via a first drive means, and, permit cooperative rotational movement of said intermediate member via a second drive means.

[0025] Preferably also, said first drive means includes a hydraulic cylinder and said second drive means includes an electric drive motor.

[0026] Preferably, when said upper surface is moved to a final position, said hydraulic cylinder retracts slightly such that said screw threads substantially support any load on said jacking device.

[0027] Also preferably, when said upper surface is to be moved, said hydraulic cylinder is raised slightly to relieve any load provided on said screw threads, and then said hydraulic cylinder and said drive motor are substantially simultaneously operated to effect raising/lowering of said jacking device.

[0028] Preferably, said controller is operable by said user via a keyboard, PDA or other input device operatively connected to said controller via a communications channel, including via a wired or wireless channel provided either locally to or remotely from said jacking device.

[0029] Also preferably, said jacking device is operatively connected to at least one other jacking device, the jacking devices being controlled to separately or simultaneously operate to lift a load.

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[0030] In a further broad form, the present invention provides a method of operating a jacking device.

[0031] The method preferably includes

positioning at least one jacking device, as claimed in any one of claims 1 to 15, intermediate a substrate surface and said load;

operating a controller to control the raising or lowering of an upper surface and thereby raise or lower said load.

[0032] Also preferably, a plurality of jacking devices are positioned intermediate the substrate surface and said load, and, wherein said controller receives input information from a user and each of said plurality of jacking devices to control the raising or lowering of said load.

BRIEF DESCRIPTION OF THE DRAWINGS

[0033] The present invention will become more fully understood from the following description of preferred but non-limiting embodiments thereof, described in connection with the accompanying drawings wherein:

Fig. 1 illustrates an isometric view of the jacking device in accordance with a preferred embodiment of the present invention in an extended position;

Fig. 2 illustrates the device shown in Fig. 1 but in the retracted position;

Fig. 3 illustrates an elevational view of the device of Fig. 1;

Fig. 4 illustrates an elevational view of the device of Fig. 2 in the compressed position;

Fig. 5 shows a sectional view of the device;

Fig. 6 shows an exploded view of the device of the present invention;

Fig. 7 shows a diagram of the controller to operate the jacking device; and,

Fig. 8 shows a diagram showing the control of a plurality of jacking devices.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0034] Throughout the drawings, like numerals will be used to identify similar features, except where expressly otherwise indicated.

[0035] The jacking device 1, which is typically substantially tubular/cylindrical in shape,

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includes a base member 2, an upper member 3, and, at least one intermediate member 4.

[0036] The base member 1 includes a base surface 19 adapted to engage a substrate surface 5, and includes a screw thread 6, which is shown to be provided on an inner surface of the base member 2.

[0037] The upper member 3 has an upper surface 6 which is adapted to engage a load or object to be raised or lowered. The upper member 3 is shown to be provided with a screw thread 7 on its outer surface.

[0038] An intermediate member 4 is provided between the base member 2 and the upper member 3. Additional intermediate members 4 could optionally be provided. Each intermediate member 4 includes screw threads 8 and 9, provided on the outer and inner surfaces of the intermediate member 4, to engage with and cooperate with the screw threads of the adjacent members.

[0039] In the drawings, screw thread 8 on the outer surface of intermediate member 4 engages and cooperates with screw thread 6 on the inner surface of base member 2. Also, screw thread 9 on the inner surface of intermediate member 4 engages and cooperates with screw thread 7 on the outer surface of upper member 3.

[0040] Drive means permits movement of each member 2, 3 and 4 relative to its adjacent member. For example, intermediate member 4 is adapted to rotate and move upwards or downwards relative to base member 2. Upper member 3 is adapted to move upwards and downwards relative to intermediate member 4. Upper member 3 is preferably restricted from rotating axially as it is raised or lowered, as will be hereinafter described.

[0041] A drive means may be embodied in a variety of forms. The drive means shown in the drawings illustrates a primary drive means embodied as a two stage telescopic hydraulic cylinder 11, and, an electric drive motor 10. It will however be appreciated by persons skilled in the art that other versions of drive means may be embodied to achieve similar functions.

[0042] Also shown in the drawings is the inclusion of a linear bearing 12 on each side of the device 1 which permits vertical raising/lowering of the upper surface 6 whilst substantially preventing rotation of movement of the upper member 3 relative to the base member 2 but whilst still permitting rotational movement of the intermediate member 4. The linear bearing 12 typically includes three components, namely a base component 13,

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an intermediate component 14 and an upper component 15 each of which slidably connect to substantially prevent rotational movement of the upper member 3 relative to base member 2.

[0043] Also shown in the drawings is the provision of a gear device 16 which includes a first gear or smaller gear 17 which is operatively attached to the linear bearing 16 and is adapted to be driven by drive motor 10, and, a second gear 18 which is operatively attached to the intermediate member 4 and which operatively engages with the first gear wheel 17, and which is adapted to rotate the intermediate member 4 as the drive means 10 is rotated. This gearing device 16 is preferably driven by an electric drive means 10.

[0044] A hydraulic cylinder 11 is also provided which substantially vertically raises or lowers the upper member 3 relative to the base member 2. Illustrated is a two stage telescopic hydraulic cylinder, but it will be appreciated that other appropriate drive means may be alternatively provided.

[0045] To operate the device, a controller is preferably provided which is operable by a user to control the raising or lower of the jacking device and to operate the drive means.

[0046] As shown in Figs. 7 and 8, the controller may control the operation of one or more jacking devices, via a user operated input device. The user operated input device may be a keyboard, computer, PDA or other input device into which a user may input instructions. It may be provided local to the jacking device or remotely, via a wired or wireless communications device.

[0047] The controller may control the simultaneous operation of a plurality of jacking devices 1, and for each device control the pair of drive means 10 and 11 to thereby effect substantially vertical movement of the upper member 3 relative to the base member 2 via a first drive means 11 and, cooperative rotational movement of the intermediate member 4 via a second drive means 10.

[0048] The first drive means 11 is preferably embodied as a hydraulic cylinder, and the second drive means 10 is preferably embodied as an electric drive motor. Alternatives will be apparent to persons skilled in the art.

[0049] In use, the basic operation may typically be as follows. As hydraulic pressure is supplied to the telescopic cylinder 11 from a high pressure circuit, low pressure may be applied to the screw drive motor 10.

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[0050] Any load is lifted substantially by the hydraulic cylinder 11 whilst the screw drive motor 10 rotates the intermediate member 4 to "follow" the hydraulic cylinder 11 by screwing itself out of the lower base member 2 and simultaneously extending the upper member 3.

[0051] Once in the elevated position, the hydraulic cylinder 11 slightly retracts whilst the screw is held stationary so the load is now bearing on the screw thread alone. This effectively packs the load by automatic mechanical means.

[0052] To lower the load, the hydraulic cylinder 11 is first operated to travel up slightly to relieve the load from the screw threads and to allow it to begin to rotate in the down direction. At this point, the cylinder 11 then switches to the down direction with the screw thread staying just ahead of it. If at any stage the hydraulic cylinder 11 or hoses should fail, the load will be instantaneously transferred to the screw threads while traveling in either direction.

[0053] It will therefore be understood by a person skilled in the art that once in the locked position, in the event of any failure, which can occasionally occur in hazardous situations, the sudden or slow failure of the system should be overcome. Maintenance and repair personnel and equipment can therefore be safely brought underneath any heavy load with the risk of any accidental falling of the load being substantially minimized.

[0054] It will be appreciated that in use, a plurality of such jacking devices may be simultaneously used. Control circuitry may be used to simultaneously operate the various drive means, etc such that correct proportional balancing of the load via a number of these jacking devices may be achieved. Various sensors or monitors may be used to ensure that each of the devices either operates in unison or as otherwise required, to take into consideration variations such as unequal load distribution, environment factors such as wind, etc.

[0055] It will be appreciated by persons skilled in the art that numerous variations and modifications may be made to the jacking device as hereinbefore described. All such variations and modifications which become apparent to persons skilled in the art should be considered to fall within the spirit and scope of the invention as broadly hereinbefore described.

CLAIMS:

1. A jacking device, including:
 - a base member, including a base surface adapted to engage a substrate surface, and, a base screw thread;
 - an upper member, having an upper surface adapted to engage a load to be raised or lowered, and, an upper screw thread;
 - at least one intermediate member, positioned between said base member and said upper member, each intermediate member including first and second screw threads adapted to engage a respective screw thread of an adjacent member; and
 - drive means, adapted to permit movement of at least one of said members relative to its adjacent member to thereby raise or lower said upper surface.
2. A jacking device as claimed in claim 1, wherein said drive means includes a primary drive means and a backup drive means, each drive means being selected from an electric drive motor, a hydraulic or pneumatic cylinder and/or other drive means.
3. A jacking device as claimed in claims 1 or 2, wherein said device is substantially tubular in shape, wherein said base screw thread is provided on an inner surface of said base member, wherein said upper screw thread is provided on an outer surface of said upper member, and, wherein said first and second screw threads are provided on the inner and outer surfaces of the or each intermediate member.
4. A jacking device as claimed in any one of claims 1 to 3, further including a linear bearing which substantially prevents rotational movement of said upper and base members as said drive means is operated.
5. A jacking device as claimed in claim 4, further including a gear device, adapted to permit rotation of said intermediate member as said drive means is operated.
6. A jacking device as claimed in claim 5, wherein said gear device includes:

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a first gear wheel operatively attached to said linear bearing, and adapted to be driven by said drive means; and,

a second gear wheel operatively attached to said intermediate member, and be operatively engaged with said first gear wheel, which is adapted to permit rotation of said intermediate member as said drive means is rotated.

7. A jacking device as claimed in claims 5 or 6, wherein said gear device is driven by an electric drive means.

8. A jacking device as claimed in any one of claims 1 to 7, including a hydraulic cylinder drive means to substantially vertically raise/lower said upper surface relative to said base surface.

9. A jacking device as claimed in any one of claims 1 to 8, including:
a controller, operable by a user, to control the raising/lowering of said jacking device and to operate said drive means.

10. A jacking device as claimed in claim 9, wherein said controller controls the simultaneous operation of a pair of drive means to thereby effect substantially vertically movement of said upper surface relative to said base surface via a first drive means, and, permit cooperative rotational movement of said intermediate member via a second drive means.

11. A jacking device as claimed in claim 10, wherein said first drive means includes a hydraulic cylinder and said second drive means includes an electric drive motor.

12. A jacking device as claimed in claim 11, wherein, when said upper surface is moved to a final position, said hydraulic cylinder retracts slightly such that said screw threads substantially support any load on said jacking device.

13. A jacking device as claimed in claim 11, wherein, when said upper surface is to be

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moved, said hydraulic cylinder is raised slightly to relieve any load provided on said screw threads, and then said hydraulic cylinder and said drive motor are substantially simultaneously operated to effect raising/lowering of said jacking device.

14. A jacking device as claimed in any one of claims 9 to 13, wherein said controller is operable by said user via a keyboard, PDA or other input device operatively connected to said controller via a communications channel, including via a wired or wireless channel provided either locally to or remotely from said jacking device.

15. A jacking device as claimed in any one of claims 9 to 14, operatively connected to at least one other jacking device, the jacking devices being controlled to separately or simultaneously operate to lift a load.

16. A method of jacking a load, including the steps of:

positioning at least one jacking device, as claimed in any one of claims 1 to 15, intermediate a substrate surface and said load;

operating a controller to control the raising or lowering of an upper surface and thereby raise or lower said load.

17. A method of jacking a load as claimed in claim 16, wherein a plurality of jacking devices are positioned intermediate the substrate surface and said load, and, wherein said controller receives input information from a user and each of said plurality of jacking devices to control the raising or lowering of said load.

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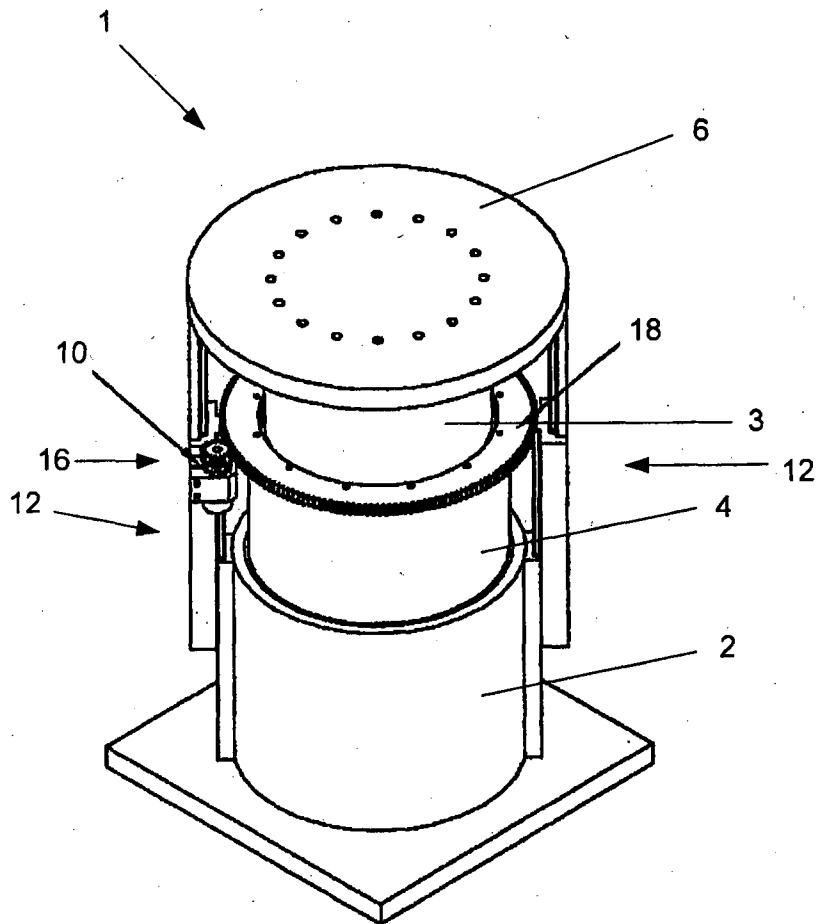


FIG. 1

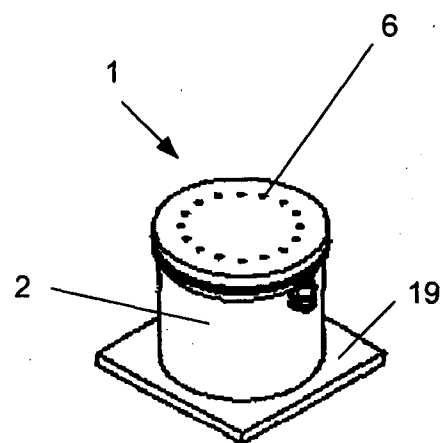


FIG. 2

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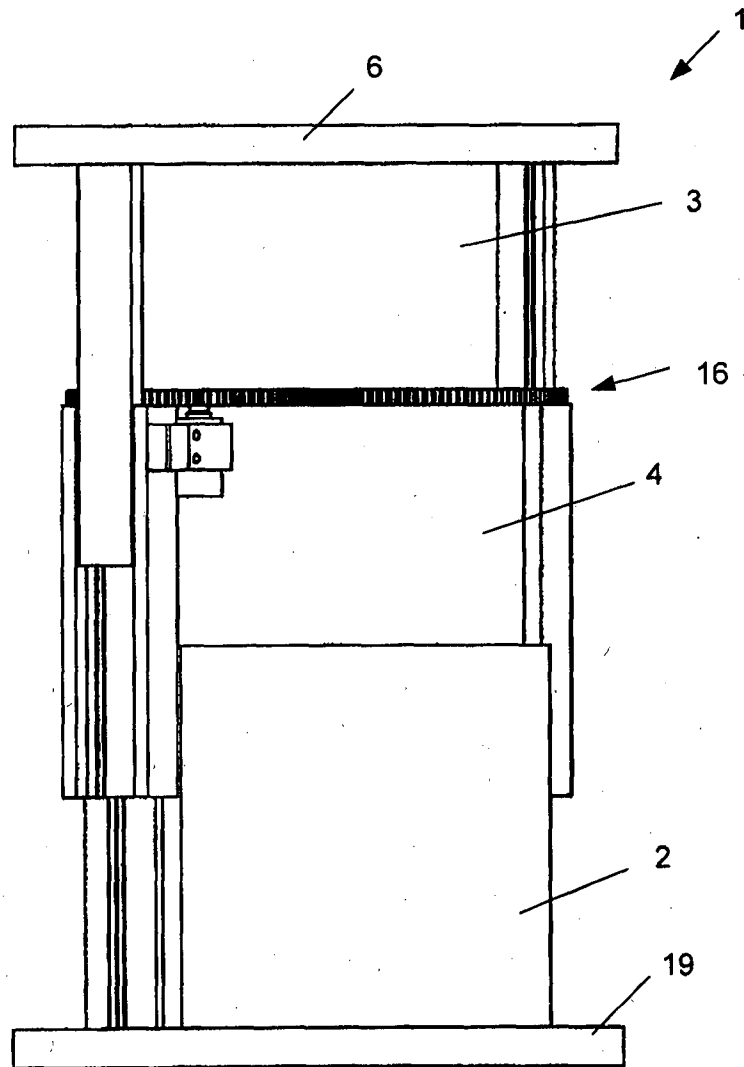


FIG. 3

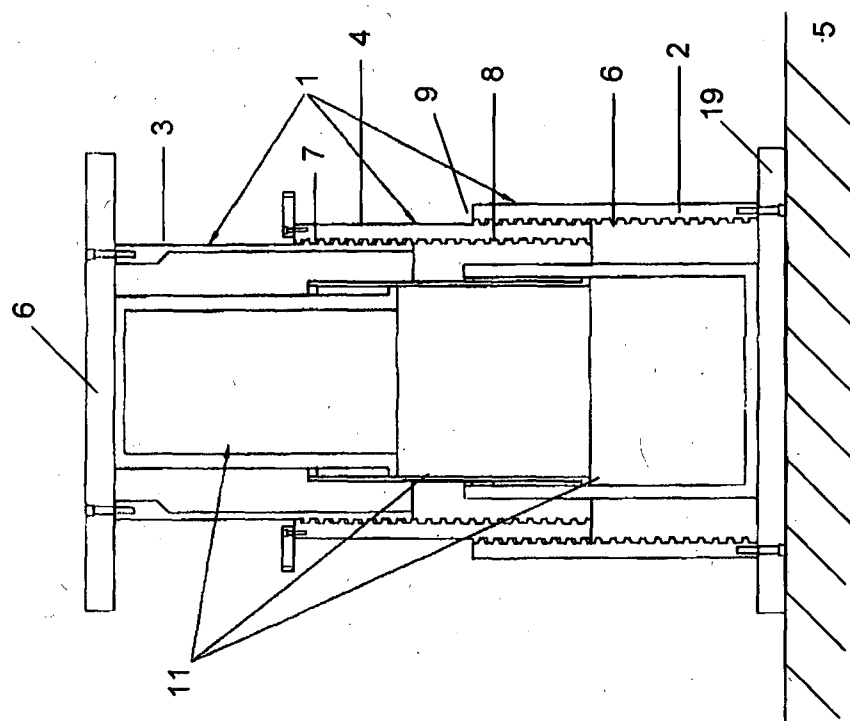


FIG. 5

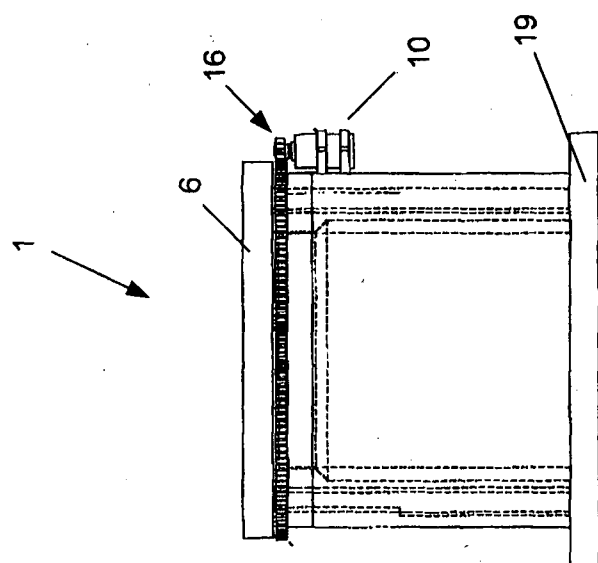


FIG. 4

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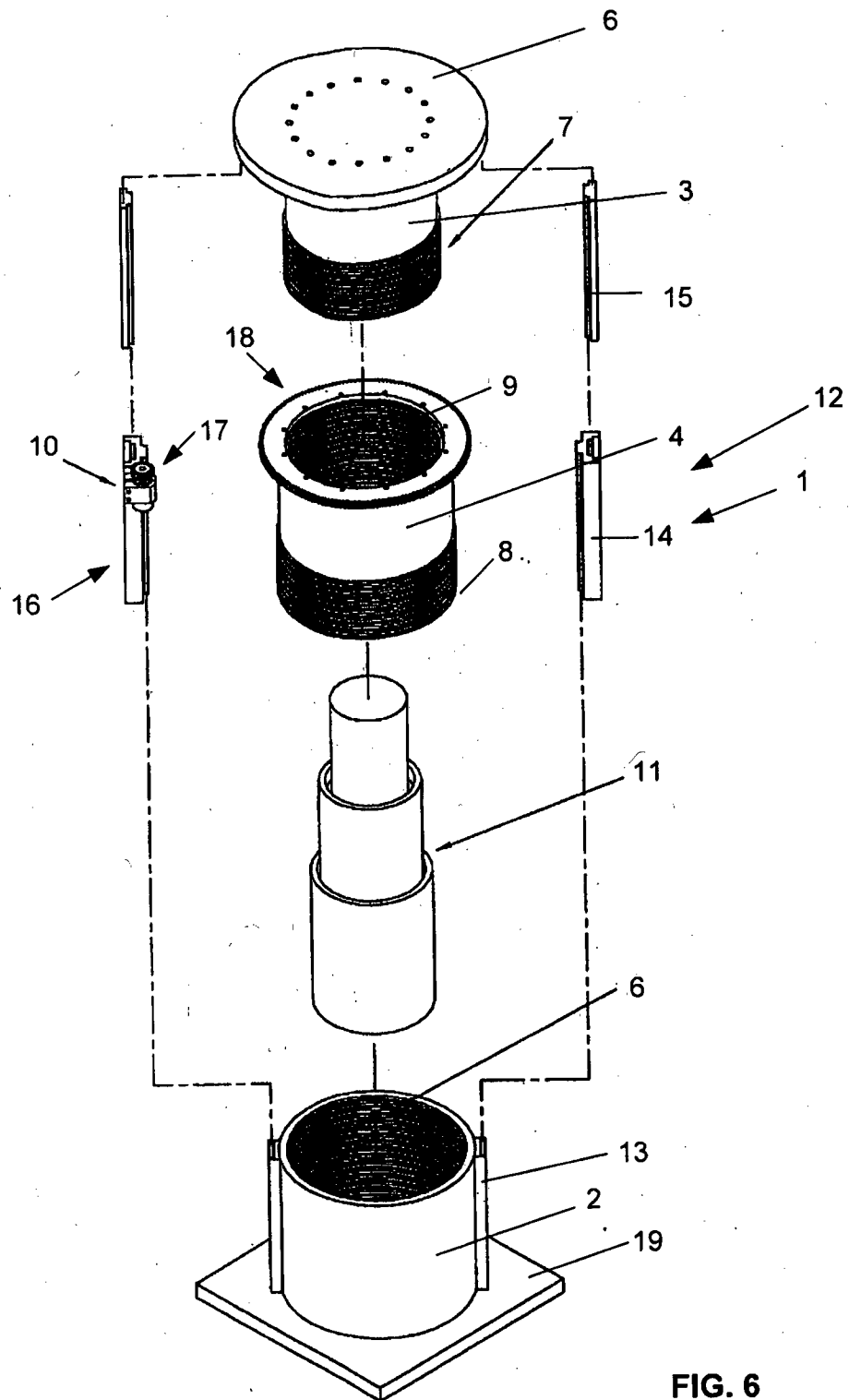


FIG. 6

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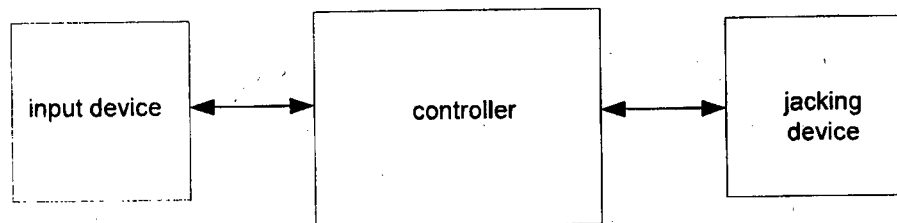


FIG. 7

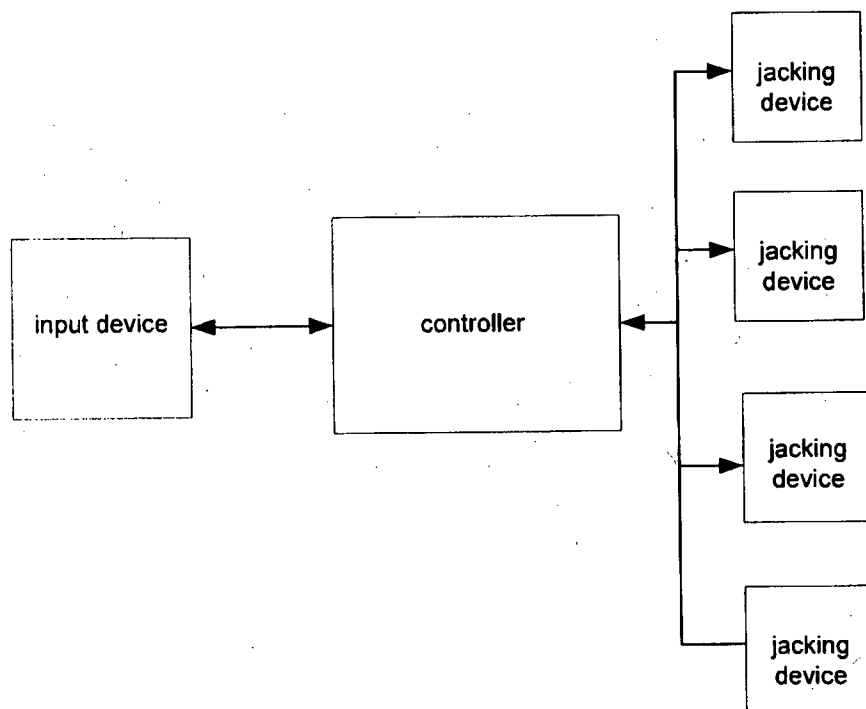


FIG. 8

INTERNATIONAL SEARCH REPORT

 International application No.
PCT/AU2013/000802

A. CLASSIFICATION OF SUBJECT MATTER

B66F 3/10 (2006.01) B66F 7/14 (2006.01) B60S 9/00 (2006.01)

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)

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)

EPODOC & WPI - IPC CPC B66F3/08/LOW OR B66F7/14/LOW OR B66F11/00 OR B60S9/00 OR B60S9/06/LOW OR B66F17/00 AND KEYWORDS - SCREW THIRD PISTON AND LIKE TERMS

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
	Documents are listed in the continuation of Box C	



Further documents are listed in the continuation of Box C



See patent family annex

* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed		"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family	
Date of the actual completion of the international search 29 August 2013		Date of mailing of the international search report 29 August 2013	
Name and mailing address of the ISA/AU AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA Email address: pct@ipaustalia.gov.au Facsimile No.: +61 2 6283 7999		Authorised officer Sachin Marwaha AUSTRALIAN PATENT OFFICE (ISO 9001 Quality Certified Service) Telephone No. 0262256136	

INTERNATIONAL SEARCH REPORT C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		International application No. PCT/AU2013/000802
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2012/0132873 A1 (FEW) 31 May 2012 Figures 1, 4 and 6, paragraphs [0022]-[0026] and [0031]	1-3, 9, 14-17
X	EP 0538208 A1 (MAGGIORI E) 21 April 1993 Abstract, figure 1, col. 1 lines 22-30	1-3, 9, 14-17
X	SU 931698 B (NOVCH POLY) 05 June 1982 & Derwent Abstract Accession No. 1983-E6922K Abstract, figure 1	1-3, 8-17
X	CN 201458645 U (SHUHAI et al) 12 May 2010 & English Abstract retrieved from EPODOC database and English translation retrieved from European Patent Office Website Abstract, figures 1 and 3, paragraphs [0022]-[0023]	1-7, 9, 14-17
A	US 6142501 A (FOGO et al) 07 November 2000 Abstract, figure 1	1-17

INTERNATIONAL SEARCH REPORT Information on patent family members		International application No. PCT/AU2013/000802	
This Annex lists known patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.			
Patent Document/s Cited in Search Report		Patent Family Member/s	
Publication Number	Publication Date	Publication Number	Publication Date
US 2012/0132873 A1	31 May 2012	US 2012132873 A1	31 May 2012
EP 0538208 A1	21 Apr 1993	EP 0538208 A1	21 Apr 1993
		IT RM910793 A1	19 Apr 1993
		IT 1250121 B	30 Mar 1995
SU 931698 B	05 Jun 1982	None	
CN 201458645 U	12 May 2010	None	
US 6142501 A	07 Nov 2000	None	
End of Annex			
Due to data integration issues this family listing may not include 10 digit Australian applications filed since May 2001. Form PCT/ISA/210 (Family Annex)(July 2009)			