



Europäisches Patentamt
European Patent Office
Office européen des brevets



(11) **EP 1 367 215 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
03.12.2003 Bulletin 2003/49

(51) Int Cl.7: **E21B 12/06**

(21) Application number: **03011902.8**

(22) Date of filing: **27.05.2003**

(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) Inventor: **Casagrande, Mauro**
33077 Sacile (PN) (IT)

(74) Representative: **Petraz, Gilberto Luigi et al**
GLP S.r.l.
Piazzale Cavedalis 6/2
33100 Udine (IT)

(30) Priority: **30.05.2002 IT UD20020117**

(71) Applicant: **CASAGRANDE SpA**
I-33074 Fontanafredda (PN) (IT)

(54) **Auger cleaning device**

(57) Device and method to clean screw-type tools (11). The device comprises a cleaning element (40) equipped with a scraper element (25) able to be arranged between two adjacent spirals (11a) of the tool (11), in order to remove material retained between the spirals (11a). The cleaning element (40) comprises motor means (30) to make the scraper element (25) rotate around a longitudinal axis (X) of the tool (11). The device comprises sensor elements (18, 19) to detect a movement of axial translation of the cleaning element (40) with respect to a nominal working position, and to condition the drive of the motor means (30) to rotate the scraper element (25) around the longitudinal axis (X) in order to keep it in a constant axial position and corresponding to the nominal working position.

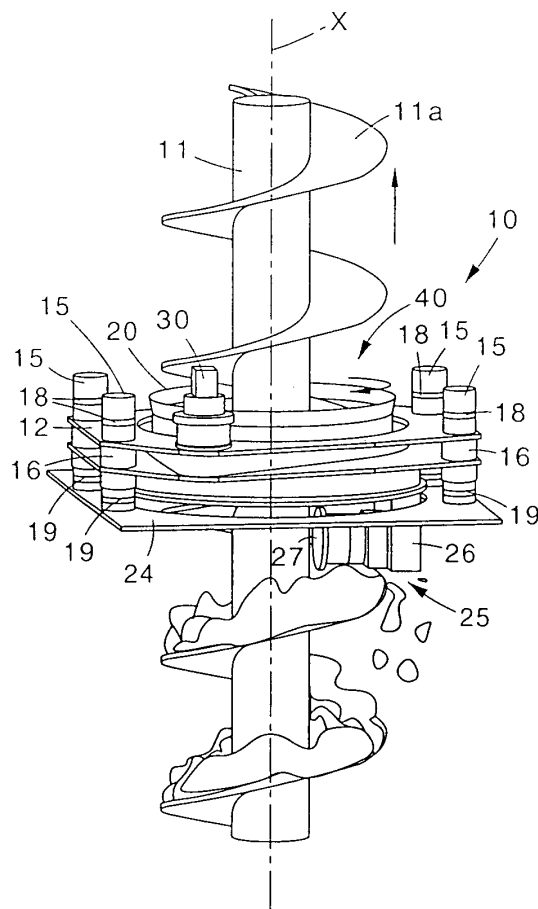


fig. 1

Description

FIELD OF THE INVENTION

[0001] The present invention concerns a device to clean screw-type tools, for example drills with a continuous screw used to drill the ground, lay pipes or otherwise.

[0002] To be more exact, the device according to the invention is able to remove the material and detritus which remain retained between the profiles of the screw, particularly, but not exclusively, during the drilling of clayey ground.

[0003] The invention also concerns the method to clean a screw-type tool which uses the device.

BACKGROUND OF THE INVENTION

[0004] In the state of the art, during drilling with continuous screw drills, particularly when drilling clayey ground, some earth or residue of drilled material remains retained between the spirals of the screw. It is important to remove such material, for example when the screw is raised, in order to prevent dangerous falls of the material from great heights, or to put the screw into suitable conditions of use for subsequent drillings. The drilled material is also removed from the spirals of the screw to prevent considerable masses of material reaching great heights and compromising the stability of the excavating machine.

[0005] In the state of the art, in order to clean such drills, devices are used wherein a scraper element is arranged between two adjacent spirals, or threads, of the screw, in order to remove the residual material before or after the drilling operation.

[0006] Such conventional devices, an example of which is disclosed in EP-A-744.525, normally consist of a non-motorized scraper element, that is, arranged idle on the plane of the spirals of the screw. The scraper element exploits the component of tangential force, resulting from the reaction orthogonal to the plane of the tool, to follow the translation of the screw and rotate in order to keep itself at the same height, in such a manner that, following the movement of the screw, it does not interfere with the drive members of the screw or the ground, and can perform its cleaning action.

[0007] Such conventional devices, due to the irregular and unbalanced action of the forces and frictions at play, and depending on the size of the screw, do not allow an easy control of the equipment, and limit the speed of the movements of the tool, apart from causing risks of damage.

[0008] The state of the art includes a motorized cleaning device able to cooperate with a screw when the screw translates axially without rotating. This cleaning device has a scraper element associated with motor means which make it rotate at a speed synchronized with the speed of axial translation of the screw.

[0009] This conventional device has the disadvantage that it needs the attention of an operator to manage the drive of the motor, particularly to guarantee the perfect synchronism (which is practically impossible to obtain without a continuous control in feedback) between the rotation of the scraper and the linear movement of translation of the screw. In fact, if the cleaning device is also subjected to a movement of vertical translation, this can create damage to its supporting structure and/or interference with other apparatuses in the vicinity, and in any case does not ensure an efficient cleaning action.

[0010] Another disadvantage is that cleaning devices of a conventional type are vertically movable along the longitudinal axis of the tool. This disadvantage does not allow the device to be attached to various rotation heads.

[0011] A further disadvantage of cleaning devices of a conventional type is that they are mainly specific for particular types of screw; therefore, in most cases, every type of screw requires a specific cleaning device, which entails long times and high costs to replace and prepare the cleaning device which is suitable for the specific screw.

[0012] EP 0 844 364 A2 discloses a cleaning device for screw-type tools comprising a non-motorized scraper element placed, in use, between two adjacent spirals of the screw. This scraper element is associated to a support element slideably mounted on a bar; the support element is comprised between two helical springs associated at their ends to respective force sensors. When there is an unbalance between the rotational and translational speed of the screw, the scraper element is subjected to an upward or downward movement with respect to the spirals of the screw. This movement can be detected either visually by an operator or automatically by the detection of the force sensors associated to the helical springs. When a downward or upward movement of the scraper element is detected, the rotational or translational speed of the screw is modified to restore the balance in the movement of the screw so as to maintain the scraper element in its correct and possibly fixed position between two adjacent spirals of the screw.

[0013] This solution is rather complex and scarcely reliable because the correction of the position of the scraper element with respect to the screw is not carried on directly but involves a regulation of the movement of the screw itself which is difficult and slow to reach. Moreover, this solution entails a complex and expensive regulation circuit due to the necessity to finely control the amount of the values of correction of the speed of the screw to first restore and then maintain the correct position of the scraper element.

[0014] Furthermore, the cleaning element can not be used when the screw is only rotating, or only translating, because the cleaning element is not provided with own driving means and therefore cannot follow such a movement of the screw maintaining itself between two adjacent spirals.

[0015] Moreover, this cleaning element has the further disadvantage that, during the cleaning step, the screw must be rotated in the inverse sense (i.e. in an unscrewing sense) when is extracted from the ground; this can entail the detachment of material from the tip of the screw and the fall of this material in the hole just made.

[0016] The present Applicant has devised and embodied this invention to overcome the shortcomings of the state of the art and to obtain further advantages.

SUMMARY OF THE INVENTION

[0017] The present invention is set forth and characterized essentially in the main claims, while the dependent claims describe other innovative characteristics of the invention.

[0018] The purpose of the invention is to achieve a cleaning device for screw-type tools which does not need the attention of an operator to be activated and to function, and which is not affected by the irregular and unbalanced action of the forces and frictions at play, or the size of the tool and/or the shape and pitch of the screw.

[0019] Another purpose is to guarantee that the cleaning element is subjected to minimum axial displacement even when the tool is translating, thus ensuring that a substantially fixed vertical position is maintained without requiring any control of the synchronism, which is difficult and expensive to do, and without requiring a fine control of the balance in the movement of the screw tool.

[0020] A further purpose is to provide a cleaning element which is able to be used also when the screw tool is only rotating or only translating.

[0021] Another purpose is to guarantee that the cleaning element maintains, during its action on the screw tool, an axial position substantially fixed with respect a point of reference, which can be fixed or movable, for any combination of the rotational and translational speed of the screw.

[0022] The cleaning device for screw-type tools according to the invention is provided with at least a cleaning element consisting of at least a scraper element associated with support means.

[0023] The scraper element is suitable to be arranged, in use, between two spirals of the screw, so as to remove, in association with the rotary and/or translatory movement of the tool, the material retained between the spirals. The scraper element is associated with own motor means which make it selectively rotate around the axis of rotation of the tool.

[0024] In accordance with the purposes indicated above, the cleaning device according to the invention comprises sensor means able to detect a movement of axial translation of the cleaning element, in one direction or the other, with respect to a nominal working position, in relation to a displacement caused by the translatory movement of the screw not balanced by the rotating

movement. The sensor means are suitable to condition the drive of the motor means, in terms of the direction and/or speed of rotation, so that the scraper element directly follows the movement of the tool and remains in a substantially constant vertical position, delimited between two pre-determined end positions, and eventually related to a point of reference of the machine on which the screw is mounted.

[0025] In a preferential embodiment, the cleaning device according to the invention comprises linear guide means able to allow the cleaning element, consisting of the scraper element and its support means, to translate linearly for a short travel defined between said two end positions, according to the direction of movement of axial translation of the tool.

[0026] The guide means, in a preferential embodiment, consist of column elements solid with a support, such as a feeding head for vertical tubes or a slider.

[0027] In one form of embodiment, the sensor means comprise feeler means of a mechanical, optical, magnetic or other type suitable for the purpose.

[0028] The feeler means are associated with the guide means and are able to detect when the cleaning element, translating axially, reaches or approaches the upper or lower end of said guide means. When this happens, the feeler means are able to condition the drive of the motor means in order to return the cleaning element, and hence the scraper element, to the initial position, therefore keeping it substantially always at the same height.

[0029] According to one solution of the invention, the cleaning element consists of a first substantially annular element, functioning as a base, provided with a central hole inside which the tool is arranged. The first element is free to translate axially along the guide means but is blocked rotationally by the guide means themselves.

[0030] A second element, substantially annular and also axially holed, is associated to the first element by means of a rotation member such as an annular bearing or similar, and acts as a support for the scraper element. The second element is not only movable axially together with the first element, but is also free to rotate around the longitudinal axis of the tool, and with respect to the first element, due to the presence of said rotation member.

[0031] The scraper element itself consists, in a preferential embodiment, of a roller element supported, by means of rotation means such as for example bearings or brasses, by an arm facing radially towards the axis of the tool and sized so that it can locate the roller element between two adjacent spirals of the screw.

[0032] In a preferential embodiment, the radial arm is mounted on the second element by means of a bolt-type joint, which allows a rapid and easy replacement according to the size and conformation of the screw; it also allows a rapid dismantling of the equipment and easy maintenance operations.

[0033] Motor means are mounted on the first element

and are connected to the rotation member to make the second element rotate, together with the scraper element supported thereby, around the axis of the tool, normally following the direction of rotation thereof.

[0034] The cleaning device according to the invention functions as follows.

[0035] If the screw rotates only, without translating axially, the second element, together with the scraper element, is made to rotate by the motor means in substantially normal working conditions, keeping the scraper element in contact with the profile of the screw and facilitating the rotation thereof. In this way the scraper element remains in a substantially constant vertical position.

[0036] The roller in turn rotates on the axis of the supporting arm, rolling on the plane of the spirals of the screw, in order to perform its function of removing the material, together with the relative supporting arm.

[0037] If the screw is subjected to a movement of linear translation, apart from or without rotation, the whole cleaning element not only rotates normally as driven by the motor means, but is also subjected to a translation force which displaces it along the guide means. When it reaches one or another of the limit positions defined along the guide means, the sensors detect this condition and activate the motor means to modify the working conditions, following, in one direction or the other, the translatable movement of the tool and hence returning the cleaning element to the initial operating position.

[0038] To be more exact, depending on whether the upper or lower limit position has been reached, the speed of rotation of the motor will be increased, or the direction of rotation will be inverted, so that the roller element, rolling on the plane of the spirals of the screw, returns to the initial position wherein the motor returns to its condition of normal rotation.

[0039] Thanks to this intervention of the motor means, conditioned by the sensor means, the functioning of the cleaning element is considerably improved since the action of the scraper element is always commanded automatically and follows automatically the movement of the tool.

[0040] Another advantage of the present invention is that the material scraped from the screw is discharged at a substantially constant height, which allows to provide a member to convey the scraped material, so as to prevent the latter from falling back in proximity of the excavation zone.

BRIEF DESCRIPTION OF THE DRAWINGS

[0041] These and other characteristics of the present invention will be apparent from the following description of a preferential form of embodiment, given as a non-restrictive example with reference to the attached drawings wherein:

- fig. 1 is an axonometric projection of a cleaning de-

vice according to the invention in a first operating step;

- fig. 2 is an axonometric projection of the cleaning device in fig. 1 in another operating step;
- fig. 3 is a lateral section of a first detail of fig. 1;
- fig. 4 is a lateral section of a second detail of fig. 1.

DETAILED DESCRIPTION OF A PREFERENTIAL EMBODIMENT

[0042] With reference to the attached drawings, a device 10 to clean screw-type tools, such as drills 11 or similar, is applied to a conventional-type machine, not shown in greater detail in the drawings, for example of the type able to drill ground or lay pipes.

[0043] The cleaning device 10 comprises a cleaning element 40 consisting of a first, axially holed element 12, able to function substantially as a base, and a second element 20, consisting of an axially holed box-like structure 21 able to function as a support for a scraper element, indicated in its entirety by the reference number 25.

[0044] The cleaning element 40 is mounted on guide elements, consisting in this case of four column elements 15 arranged at the corners of said first element 12. The column elements 15 are solid with a support, consisting in this case of a plate 24 attached, for example, to the drilling machine.

[0045] The first element 12 consists in this case of a pair of plates 12a, 12b arranged parallel to each other and having an axial hole 13 for the passage of the screw of the drill 11; peripherally said plates 12a, 12b have holes 14 for insertion on the guide column elements 15.

[0046] The first 12 and the second element 20 are connected together by means of a rotation member, consisting in this case of an annular bearing, of a conventional type and therefore not shown in the drawings, attached to an annular sheet 23 of the second element 20.

[0047] A motor 30 is mounted by means of a positioning hole 31 on the first element 12 and is able to make a pinion (not visible in the drawings) selectively rotate which engages on the outer circumference of the annular bearing, in order to make the second element 20 rotate with respect to the axis of rotation X of the drill 11 and the first element 12 itself.

[0048] The box-like structure 21 which constitutes the second element 20 has an axial hole 22 for the passage of the screw of the drill 11 and, at the upper part, an edge, flared towards the outside, which has the function of centering the drill 11.

[0049] The scraper element 25 substantially consists of a supporting arm 26, mounted below the second element 20 and facing radially towards the axis X of the drill 11; the arm 26 is able to support, on bearings or brasses 28, a roller 27 which is inserted between two adjacent spirals 11a of the screw and rests and rolls on the plane of said spirals 11a.

[0050] The whole cleaning element 40 is free to slide axially along the guide elements 15 when it is subjected to a force of linear translation caused by a translatory movement of the drill 11. For this purpose, at the corners of the plates 12a, 12b there are guide bushings 16 able to maintain the plates 12a, 12b united and also to allow the linear sliding of the first element 12 along the guide columns 15.

[0051] Near the ends, upper and lower, of the guide columns 15 there are end-of-travel means, respectively upper 18 and lower 19. When they detect an axial displacement of the cleaning element 40 caused by a component of vertical thrust of the drill 11, the end-of-travel means act on the motor means 30 to make them increase their speed, or invert the direction of rotation, in order to keep the cleaning element 40 always substantially at the same vertical height for any combination of translational and rotational speed of the drill 11. This vertical height can be related to a fixed position with respect an external point of reference, which can be itself fixed or movable, of the machine where the drill 11 is mounted; for example, the point of reference can be a precise position of discharging of the material removed from the spirals of the drill 11, or can be a zone which is easily visible and controllable by an operator of the machine.

[0052] To be more exact, the device 10 as described heretofore functions as follows.

[0053] If the drill 11 has an exclusively rotational movement, the motor 30 makes the second element 20 rotate, by driving the annular bearing, and hence the scraper element 25 mounted on the second element 20, with a speed corresponding to a substantially stationary condition and with a direction of rotation which follows that of the drill 11.

[0054] When axial translation is also imparted to the drill 11, for example in the event that it starts to grip in the ground during drilling, the spirals 11a tend to displace the scraper element 25 downwards, and consequently cause the first element 12 to translate on the column elements 15 until it reaches the lower end-of-travel elements 19.

[0055] When this position has been reached, the end-of-travel elements 19 command the direction of rotation of the motor 30 to be inverted, so that the scraper element 25, by the roller 27 rolling on the plane of the spirals 11a, returns to its initial position.

[0056] Thanks to this movement, the end-of-travel elements 19 no longer intervene and the motor 30 starts to function again in substantially normal working conditions until a new translatory movement of the cleaning element 40 causes a new intervention of the end-of-travel element 19.

[0057] If the drill 11 translates upwards, for example during the steps when it is removed from the ground, this movement causes an upward displacement of the scraper element 25, and therefore of the first element 12 on the column elements 15. This upward movement causes the upper end-of-travel elements 18 to be

reached, which intervene and command the speed of rotation of the motor 30 to be increased in order to make the scraper element 25 return downwards in correspondence with its initial position.

[0058] Thanks to these interventions of the end-of-travel elements 18, 19, the cleaning element 40, if stressed by a component of vertical thrust due to the movement of the screw of the drill 11, can move only for a short travel defined by the desired distance between the two end-of-travel elements 18, 19; once these limit positions have been reached, it is automatically, and substantially instantaneously, returned to its nominal working position.

[0059] According to a variant, elastic means are provided, not shown in the drawings, able to keep the first element 12 and the second element 20 normally in a rest position substantially central with respect to the travel defined between the two end-of-travel elements 18 and 19.

[0060] It is clear, however, that modifications and/or additions of parts can be made to the device 10 as described heretofore, without departing from the field and scope of the present invention.

[0061] It is also clear that, although the present invention has been described with reference to specific examples, a person of skill in the field shall certainly be able to achieve many other equivalent forms of cleaning device for screw-type tools and relative cleaning method, all of which shall come within the field and scope of the present invention.

Claims

1. Device to clean screw-type tools (11), comprising at least a cleaning element (40), equipped with at least a scraper element (25) able during use to be arranged between two adjacent spirals (11a) of said tool (11), in order to remove material retained between said spirals (11a), in association with a movement of said tool (11), the cleaning element (40) comprising motor means (30) able to make said scraper element (25) selectively rotate around a longitudinal axis (X) of said tool (11), **characterized in that** it comprises sensor elements (18, 19) able to detect a movement of axial translation of said cleaning element (40) with respect to a nominal working position, and to condition the drive of said motor means (30) to rotate said scraper element (25) around said longitudinal axis (X) in order to keep it in a substantially constant axial position and corresponding to said nominal working position.
2. Device as in claim 1, **characterized in that** it comprises guide means (15) able to allow said cleaning element (40) to translate axially between two limit positions defined by said sensor means (18, 19).

3. Device as in claim 2, **characterized in that** said sensor means (18, 19) comprise end-of-travel means associated respectively above and below with said guide means (15).
4. Device as in claim 3, **characterized in that** the upper end-of-travel element (18), when activated by the axial displacement of said cleaning element (40), is able to determine the increase in speed of rotation of said motor means (30) in order to follow the movement of the tool and to return said scraper element (25) substantially to its initial position.
5. Device as in claim 3, **characterized in that** the lower end-of-travel element (19), when activated by the axial displacement of said cleaning element (40), is able to determine the inversion in direction of rotation of said motor means (30) in order to follow the movement of the tool and to return said scraper element (25) substantially to its initial position.
6. Device as in any claim hereinbefore, **characterized in that** said cleaning element (40) comprises at least a first element (12), functioning as a base, able to slide linearly on said guide means (15) and clamped in rotation, and a second element (20), functioning as a support for said scraper element (25), connected to said first element (12) by means of a rotation member in order to be made to rotate around the axis (X) of said tool (11) and with respect to said first element (12).
7. Device as in claim 6, **characterized in that** motor means (30) are mounted on said first element (12) and are able to be connected to said rotation member in order to make said second element (20) rotate.
8. Device as in claim 6, **characterized in that** said scraper element (25) comprises a supporting arm (26) solid with said second element (20) and facing radially towards the axis (X) of said tool (11), said arm (26) being able to support, by means of rotation means (28), a roller element (27).
9. Device as in claim 8, **characterized in that** said supporting arm (26) is mounted on said second element (20) by means of a bolt-type joint.
10. Device as in claim 6, **characterized in that** said second element (20) comprises a box-like structure (21) provided with an axial hole able to allow the passage of said tool (11), said box-like structure being flared at the top towards the outside, with the function of centering said tool (11).
11. Device as in claim 6, **characterized in that** said first element (12) consists of at least a plate (12a, 12b) provided with an axial hole (13) able to allow the passage of said tool (11).
12. Device as in claim 11, **characterized in that** said plate (12a, 12b) has bushings (16) able to cooperate with said guide means (15) during the axial translation of said cleaning element (40).
13. Device as in any claim hereinbefore, **characterized in that** it comprises elastic means able to keep said cleaning element (40) normally in an intermediate rest position between said sensor means (18, 19).
14. Method to clean screw-type tools (11), using at least a cleaning element (40) comprising at least a scraper element (25) able during use to be arranged between two adjacent spirals (11a) of said tool (11), in order to remove material retained between said spirals (11a), in association with a movement of said tool (11), the cleaning element (40) comprising motor means (30) able to make said scraper element (25) selectively rotate around a longitudinal axis (X) of said tool (11), **characterized in that** it provides to detect an axial displacement of said cleaning element (40) with respect to a substantially fixed nominal working position, and the commanded intervention of said motor means (30), when said cleaning element (40) reaches at least a limit position different from said nominal position, to rotate said cleaning element (40) around said longitudinal axis (X) in order to return it in correspondence with its initial position.
15. Method as in claim 14, **characterized in that** sensor means (18, 19) detect that a limit position, respectively upper and lower, of said cleaning element (40) has been reached, and command respectively an increase in speed and the inversion of the direction of rotation of said motor means (30) in order to return said cleaning element (40) to its initial position.

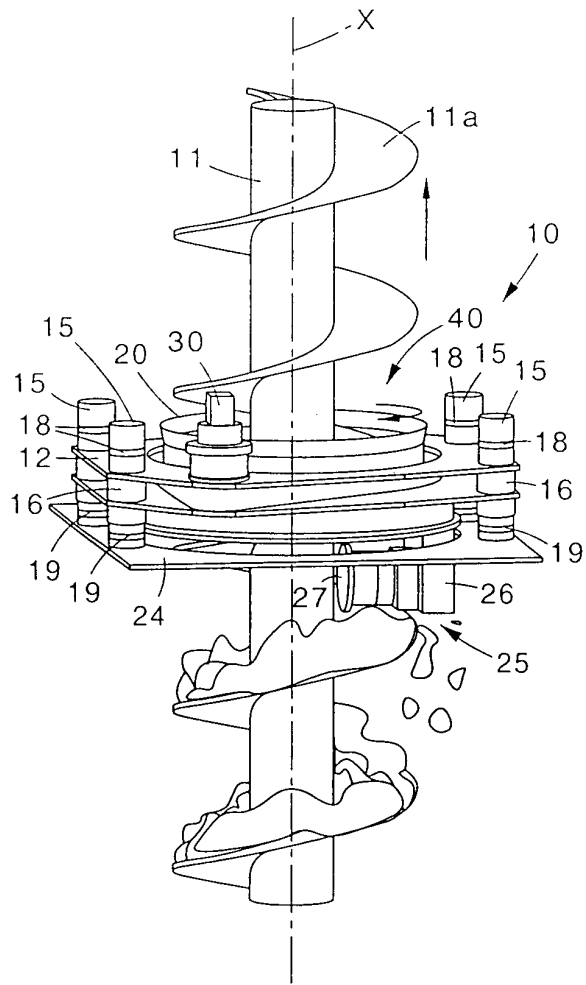


fig. 1

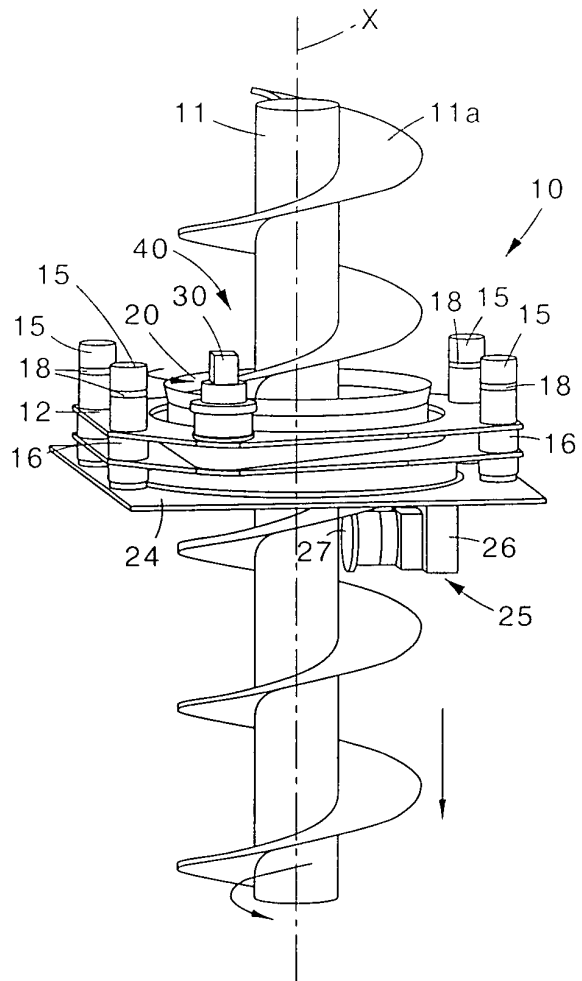


fig. 2

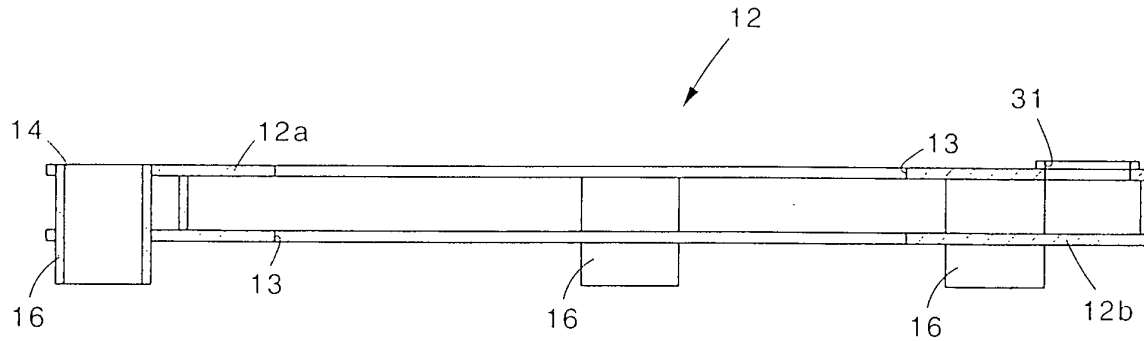


fig. 3

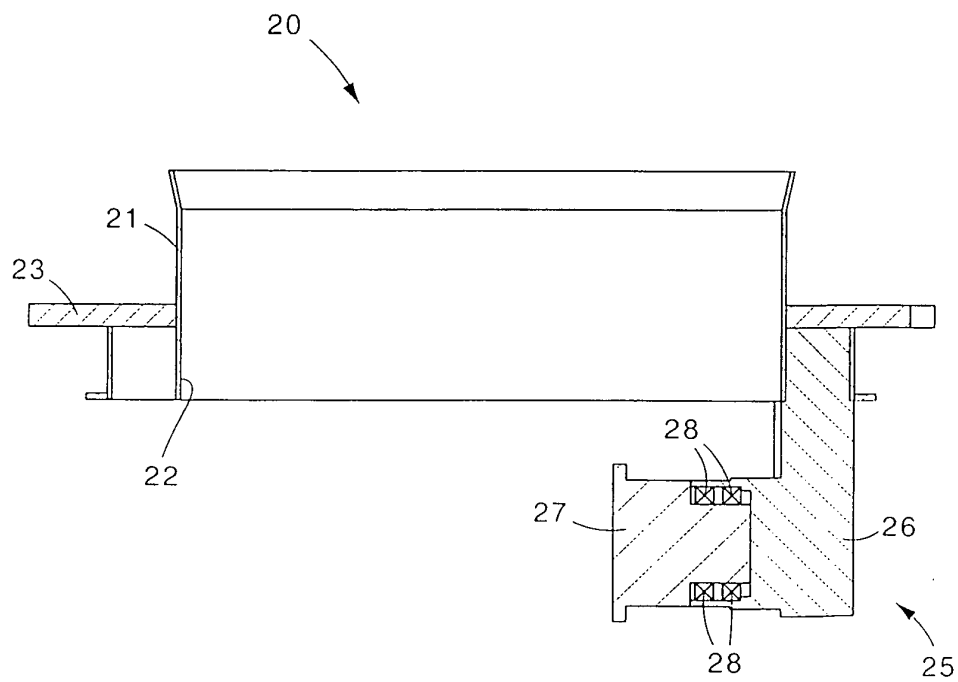


fig. 4



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 03 01 1902

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
A	EP 0 844 364 A (DELMAG MASCHINENFABRIK) 27 May 1998 (1998-05-27) * column 2, line 25 - line 33 * * column 8, line 10 - line 21 * * column 9, line 18 - column 10, line 20 * ---	1,14	E21B12/06
A	EP 0 744 525 A (SOILMEC SPA) 27 November 1996 (1996-11-27) * claims 1,3; figure 1 * ---	1,14	
A	US 4 650 012 A (BOLLINGER KARL ET AL) 17 March 1987 (1987-03-17) See abstract * column 2, line 18 - line 22; figure 1 * ---	1,14	
A	EP 0 427 454 A (DAWSON CONST PLANT LTD) 15 May 1991 (1991-05-15) * column 1, line 19 - line 41; figure 1 * * column 3, line 11 - line 20 * * column 3, line 56 - column 4, line 17 * ---	1,14	
A	DE 84 37 600 U (BAUER SPEZIALTIEFBAU GMBH) 8 September 1988 (1988-09-08) * page 2, line 11 - line 23; figure 2 * * page 5, line 8 - line 14 * -----	1,14	
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 9 September 2003	Examiner Dantine, P
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

EPO FORM 1503 03 02 (P04C01)

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

EP 03 01 1902

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

09-09-2003

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0844364 A	27-05-1998	DE 29620235 U1	02-04-1998
		DE 59704714 D1	31-10-2001
		EP 0844364 A2	27-05-1998
EP 0744525 A	27-11-1996	IT T0950415 A1	25-11-1996
		DE 69603544 D1	09-09-1999
		DE 69603544 T2	23-03-2000
		EP 0744525 A1	27-11-1996
		ES 2136341 T3	16-11-1999
US 4650012 A	17-03-1987	FR 2563861 A1	08-11-1985
		DE 3515689 A1	07-11-1985
		DE 8512857 U1	26-03-1987
		GB 2158130 A ,B	06-11-1985
		HK 47788 A	08-07-1988
		IT 1184530 B	28-10-1987
		JP 61036489 A	21-02-1986
		SG 19988 G	08-07-1988
EP 0427454 A	15-05-1991	AT 92584 T	15-08-1993
		DE 69002583 D1	09-09-1993
		DE 69002583 T2	25-11-1993
		EP 0427454 A2	15-05-1991
DE 8437600 U	08-09-1988	DE 8437600 U1	08-09-1988