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(54) Title: TOOL FOR DRILLING THROUGH LOOSELY-PACKED MATERIALS

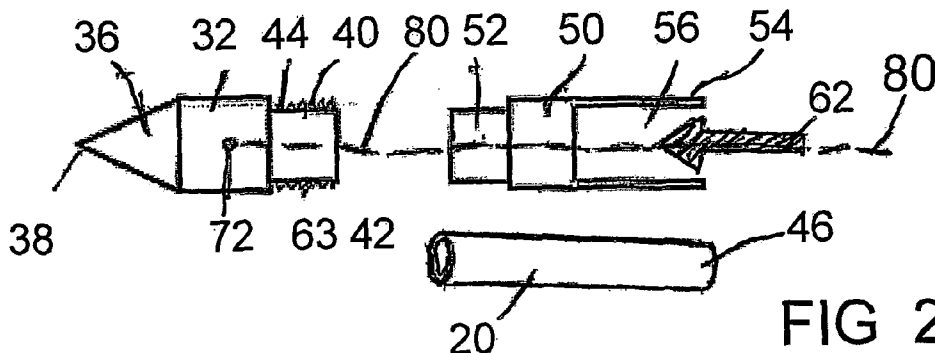


FIG 2

(57) Abstract: There is described a method of laying pipe (20) through a fill (12) of loosely packed materials, where the pipe is installed between a pointed front section (36) and a rear section (50) of a tool, and the rear section is subjected to a drive force in the longitudinal direction, so that the pointed section and the pipe is pushed into the loosely packed materials. The method is characterized by that in the event that the progress is halted due to an inadvertent hindrance in the loosely packed materials, the tool and the pipe connected thereto is pulled back by exerting a tractive force on a tractive means (80) connected to the pointed front section. Preferably the tractive means is a line (80) in the shape of a wire and/or a chain, fixed to the front section (32), where the line runs within the pipe connected to the rear section (50), and the tractive force is controlled by the tool operator.



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Tool for drilling through loosely-packed materials

5 The present invention relates to a method for construction of a pipe through a fill of loosely packed materials, where the pipe is installed between the pointed front section and the rear section of a tool, and the rear section is subjected to a drive force in the longitudinal direction, so that the pointed section and the pipe is pushed into the loosely packed materials, as stated in the preamble of claim 1. The invention also relates to a tool for bringing about
10 drilling through a fill of loosely packed materials.

The invention specifically relates to a tool that can be connected to a pipe to be laid through the fill, where the pipe is used for either leading fluids such as gas and liquids, such as water, sewer, combustible gasses and so forth, or the pipe is to be used for laying cables of different types. The expression fill is meant to encompass a mound of loosely packed materials for the
15 construction of roads, the layout of railroad lines, and so forth. Loosely packed materials encompass a detritus or gravel volume that can be made up of a combination of everything from fine grained sand to coarse ballast and stones.

As mentioned in the introduction, it is presently known to lay down pipes and cables that are to cross through a fill as mentioned above, by drilling through the fill, without removing the
20 asphalt layer or road surfaces. As concerns known solutions of this type, please see US patents no. 2,902,832 and US-1,894,446.

But in many such cases this operation must be carried out by breaking up and removing the entire top layer, and then digging a trench through the fill. The necessary pipes and cables are then laid in said trench before it is filled up and a new road surface is laid on top. One of the
25 problems that arise is that such road surfaces are almost newer level with the existing road surface, and a virtually uncorrectable hump in the road results.

The government thus poses very high requirements to what kind of purposes that can qualify for permissions to dig a trench through a road fill.

The invention relates to the above mentioned method, which comprise of drilling through the fill without the need to break up the top layer. In many instances one does not have a general
5 view of the loosely packed materials in the fill, and there may be boulders therein that may not be penetrated by drilling tools. In such instances it may be that both the point and the elements it pulls must be left behind in the fill.

One object of the present invention is to bring forth a solution for handling a situation where it turns out that the point cannot be guided all the way through the fill due to an inadvertent
10 hindrance in the fill.

Thus, it is an object of the present invention to bring forth a tool to bring about drilling through a fill, for laying pipes, cables, etc.

The method for laying pipe through a fill of loosely compacted materials is characterized by that in the event that the progress is stopped due to an inadvertent hindrance in the loosely
15 packed materials, the tool and the pipe connected thereto is pulled back by exerting a tractive force on a tractive means connected to the pointed front section.

According to a preferred embodiment of the invention a retractile means such as a line connected to the front section is utilized, and the line runs within the pipe connected to the rear section, and the retractile force is controlled by the tool operator. According to another
20 embodiment a line such as a wire or a chain, or a combination of these, is used.

The remaining preferred embodiments of the method of the present invention are given by the dependent claims 4-5.

According to an aspect of the present invention the tool is characterized by comprising a means connected to the pointed front tool section, and means to exert a tractive force on said
25 means, in order to, in the event that the progress is halted due to an inadvertent hindrance in the fill, retracting and removing pipes and tools from the fill.

The preferred embodiments are given by claims 7 through 12.

According to an aspect of the invention the method and tool according to the present invention is used to bring about a boring through the fill, and particularly to locate pipes
30 through a fill, which is used to lead fluids such as gas and liquid, for example water, sewer, combustible gasses and so forth, or the pipe is used to lay cables of different types.

According to the mentioned US-1,894,446, which comprises solutions for pounding pipes through fills of loosely packed materials, a wire 36 is used, which is arranged in coils, in order to anchor the rig to the point where the pipe is to be inserted into the fill. Further, the
35 US-patent states that this wire is also used to retract the rig from the construction zone, and thus pull out the entire pipe construction of screwed together pipe part sections, when there is

an impassable hindrance in the fill. This solution can however not prevent pipe parts from coming loose from each other inside the fill during the retraction.

Thus, the present invention comprises a further development of the objects of the US patent, by locating the fastening point of the wire at the end of the pipe assembly, by point 32. The

5. present invention has considerable benefits.

The present invention will now be explained in more detail with reference to the following figures, wherein:

Figure 1 shows a road fill that is drilled through transversely, where a pipe is positioned.

10 Figure 2 shows a perspective drawing of the two parts of a tool according to the present invention.

Figure 3 shows how a pipe is mounted to the two tool parts according to the present invention.

Figures 4 and 5 outline how a pipe divided into sections is mounted to the tool, in cases where the pipe is relatively long.

15 Figure 6 shows more detailed how a chain comprises line 80 and is connected to the parts. The median of the road is shown at 11. A steel pipe 20 (or of a different metal) of the types mentioned earlier runs through the fill. As an example pipe 20 is continued as hose 22 continuing on to a not shown area.

20 The invention relates to a method and an apparatus for leading the pipe through the road fill. The apparatus 30 has two parts, a front end 32 and a rear end 50 as drawn on figure 2. As a basis the two parts 32, 34 have a cylindrical shape. The front end 32 forms a pointed front part 36 with point 38. In addition, the front end 32 has a rear cylindrical massive tap shape 40. The tap 40 is constructed to receive the front end 42 of a pipe 20, which is threaded onto tap 40. The outer diameter of tap 40 approximately corresponds to the inner diameter of pipe
25 20. A ring shaped flange 44 with a "height" corresponding to the thickness of the wall of the pipe is formed by the transition to front end 32. Pipe 20 is introduced onto tap 40 so that the pipe end 42 will but up against flange 44. Pipe 20 preferably comprises internal threads, and is screwed onto the outside thread tap 40. The tap threads are given by 43 on figure 2.

30 The rear end 50 of the apparatus comprises a corresponding forward cylindrical massive tap shape 52. The tap 52 is oriented to receive the rear end 46 of a pipe 20 that is threaded onto tap 40. The outer diameter of tap 40 corresponds approximately to the inner diameter of pipe 20, such that the pipe can be pressed onto the rear end of the apparatus (a press fit). As for the pipe connection at the front end, the rear end 50 is fastened to the pipe with a screw connection.

35 As is apparent on the figures the rear end 54 forms a hollow space 56 for mounting a rotary percussion drill 58, shown schematically by arrow 62. The rotary percussion drill 62, which is not closer shown herein, comprises a hydraulic tool for chiseling rocks, and is used to

transfer powerful strikes with high frequency against the rear end 50, and the energy is transferred by the massive pipe 20 to the front end 36. The front end is thus struck through the fill and forms a boring 63 through the fill that the pipe lays in, and partially smashes and/or pushes aside smaller rocks it encounters in the fill.

5 Figures 3 and 4 draw schematically the fill 12 and the over laying road 10, that is not to be influenced by laying the pipe through the fill. Around front end 36 there is schematically shown stones 70 in fill material 12, which is influenced by the strikes.

The pipe is thus pushed inwards with the front end in the front. When the pipe is pushed through the fill, the tool is dismantled, and the pipe laying is continued by other means. The
10 pipe 20 is left passing through the fill, and may also be utilized for laying (as a draw pipe) conducts and cables of all imaginable types and purposes.

On the figures, and especially figure 6, it is drawn how the tool is equipped with a pull line 80, for the instances where there is an inadvertent hindrance that makes it so one cannot manage to strike the pipe and the point through the fill. The pull line is fastened to the pointy
15 front end 32 by point 72, and can comprise a wire or a chain, or a combination of wire and chain. It stretches backwards through the pipe parts 20 and backwards to the rear tool part where the operator may carry out a controlled retraction by pulling on the line. This retraction is preferably carried out by machinery.

During such an operation with retraction, it is important that the parts do not come loose from each other internally, which may lead to that the pipe parts may become wedged stuck in the
20 fill, and become impossible to remove. Therefore the wire must be kept very taut during the retraction. At the same time this tautness is ensured by connecting the wire/chain at the very front of the tip 32.

According to a preferred embodiment, the wire/chain-links are mounted with a in advance
25 sufficient tautness, so that the pipe parts cannot fall apart and get wedged in the loose matter during the retraction.

Figure 6 show in more detail how the chain comprises line 80, and is connected to the parts. It is clear that a pipe that is mounted in between the two parts of the tool cannot be too long before one risks the formation of deformations as a result of the high frequency strikes. Thus,
30 it is possible to divide the process into more steps, by starting with a smaller pipe 20A that is struck into the fill until it has gotten so far in as suggested on figure 4. Then a next pipe length 20b is connected to the first pipe length 20A, and the rotary percussion drilling continues. The joint is shown by 64 on figure 4. In such a manner new pipe sections are continually added to the prior one until one has gotten through the fill. The pipe sections may
35 for instance be connected by a screw connection, as is well known in the field. It has however become apparent that threads for screw connections may be easily deformed when the montage is "struck" through the volume of the road fill. Thus it is preferred that the pipe parts

are connected by a press fit. Such a press fit between two adjoining parts may be opened easier than two sections that are screwed together, and the screw threads are deformed.

When the pipes must be joined, it is preferred to use pipe sections that for example have a maximum length of ca. 3 meter. But this length will depend on the consistency of the fill volume 12, and how large of a part of the fill volume that is larger rocks of ballast size and larger.

The tool according to the present invention, with the two parts, is constructed of steel, with a quality that makes it so they can withstand large loads from the rotary percussion drilling as described above. The area around the tip is especially hardened in order to withstand powerful strikes against stones without incurring damage. This should be so to both crush the stones and push them aside during the progression and lying of the pipe through the fill materials.

According to the present invention the mounting of the two tools with the pipe mounted in between, is mounted to a rig or a framing that places the pointed front end against the fill volume to be penetrated.

According to the present invention it is also possible to use the pipe in order to bring forth a clean boring 63 through the fill, and then retract the pipe, by using the technique as mentioned, especially in connection with figure 6. This may occur if the fill volume consists of a more compact mass, with a more fine grained consistency, so that stable inner walls are formed in the drilled hole 63.

In experiments with the present invention a tool for laying pipe was used, which had a diameter of about 110mm, 180mm, and up to 400mm, during the construction work at a road fill, without encountering any problems. During the experiments the hydraulically operated rotary percussion drill of a digger was used. Both the tool and the pipe has been mounted to a framed rig and adapted so the rotary percussion head of the digger could be mounted to the back end of the tool. Thus, one has been able to establish a stable support for the entire mounting of pipes, front and rear tool parts. By the aid of the rotary percussion head one has been enabled to push the mounting forward against and into the fill volume, and the striking of the machine was started with a suitable strike frequency as needed, as is well known for such machines.

The big advantage of this invention is that the tool can be operated with standard construction equipment that comprises a rotary percussion unit, as is available at most construction sites, and that is easy to get hold of when an procedure for laying pipe through a already existing fill arises, without damaging or breaking the "sensitive" road surface.

Patent Claims

1. Method of laying pipe through a fill of loosely packed materials, where the pipe is installed between a pointed front section and a rear section of a tool, and the rear section is subjected to a drive force in the longitudinal direction, so that the pointed section and the pipe is pushed into the loosely packed materials, characterized by that in the event that the progress is halted due to an inadvertent hindrance in the loosely packed materials, the tool and the pipe connected thereto is pulled back by exerting a tractive force on a tractive means (80) connected to the pointed front section.
2. Method according to claim 1, characterized by the use of a tractive means having the form of a line (80) fixed to the front section (32), where the line runs within the pipe connected to the rear section (50), and the tractive force is controlled by the tool operator.
3. Method according to claims 1-2, characterized by the use of a such as a wire or a chain, or a combination of these.
4. Method according to any of the previous claims, where the pipe is divided into a plurality of sections by screw connections between the parts, or by a press fit, characterized by that
 - a) a first section is mounted in the tool, and is introduced a given length into the fill volume by said drive force, where after
 - b) the rear tool part is removed from the first pipe section, and a second pipe section is connected with the first section, where after the rear tool part is mounted on the second section, and the units are driven further into the fill, and
 - c) step b) is repeated with the necessary number of new pipe sections until the front section with the first pipe section breaks through the fill volume on the other side.
5. Method according to any of the previous claims, characterized by that the rear section is subjected to, at the same time, a drive force and an impact of a given frequency, and particularly that the impact is produced by a paving breaker, such as mounted on construction machinery etc, for example a digger.
6. Tool for laying pipe through a fill of loosely packed materials, where the pipe may be installed between a pointed front section and a rear section of a tool arranged to be subjected to a drive force in the longitudinal direction, so that the pointed section and the pipe is pushed into the loosely packed materials, characterized by that it comprises a tractive device (80) connected to the pointed front tool section, including means to exert a tractive force on the device, in order for the pipe and tool to be retracted out of the loosely packed materials in the event of the forward progress being halted due to a inadvertent hindrance in the loosely packed materials.

7. Tool in accordance with claim 6, characterized by that the device is a line (80) fastened to the front section (32), and the line runs internally through the pipe connected to the rear section (50), and the tractive force is controlled by the tool operator.
8. Tool in accordance with claims 6-7, characterized by that the line is a wire or a chain,
5 or a combination of these.
9. Tool in accordance with claims 6-8, characterized by that the pipe parts are mutually arranged to be joined by a screw connection, or by a press adapter, for respectively the front and rear tool parts.
10. Tool in accordance with claims 6-9, characterized by that front section (32) forms a front part (36) with a pointed (38) end, as the front part has undergone a hardening in order to withstand powerful strikes.
11. Tool in accordance with claims 6-10, characterized by that the transition of the front end to the pipe fastening tap (40) forms a ring shaped flange (44) with a "height" corresponding to the wall thickness of the pipe, in order for the pipe end (42) to abut the
15 flange (44) at threading/press entry.
12. Tool in accordance with claims 6-10, characterized by that the rear end (50) comprises a front tap (52) constructed to receive the rear end (46) of a pipe (20) press adapted onto a tap (40), optionally by fastening it to the pipe with a screw connection.
13. Use of the method and the tool according to the invention in order to bring about a
20 boring (63) through the fill.
14. Use of the method and the tool according to the invention for positioning a pipe through a fill, which is used to lead fluids such as gas and liquids, for example water, sewer, combustible gasses and so forth, or the pipe is used for laying cables of various types.

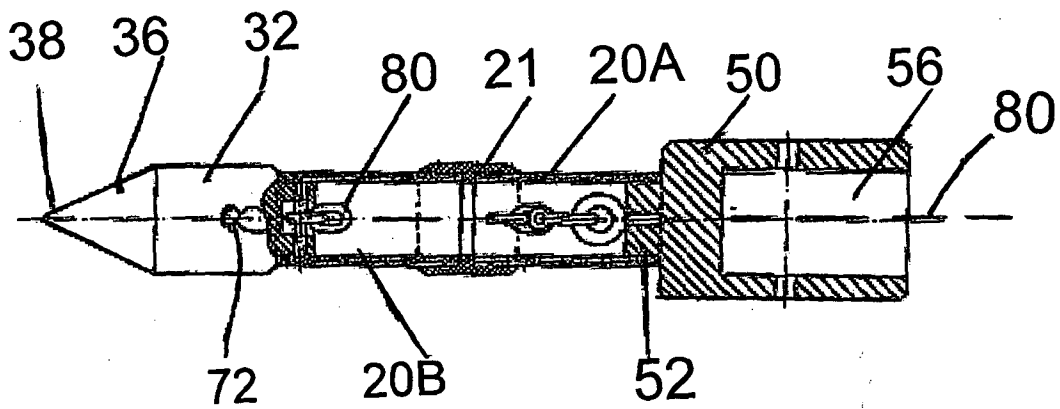
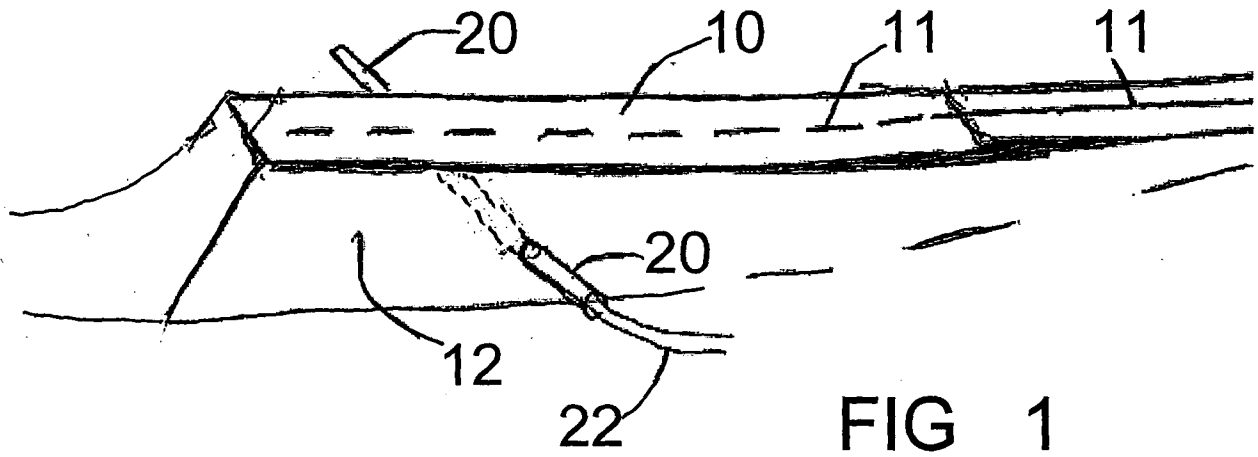
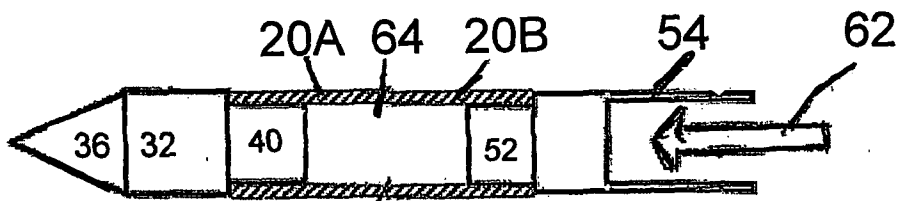
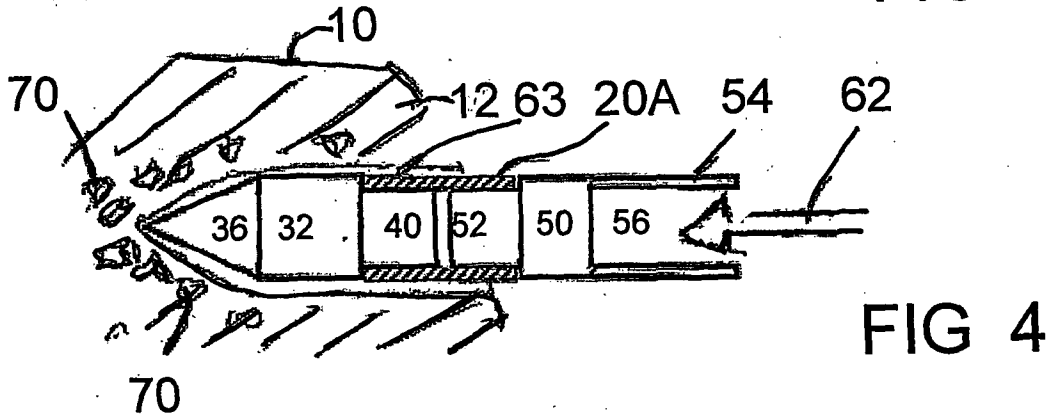
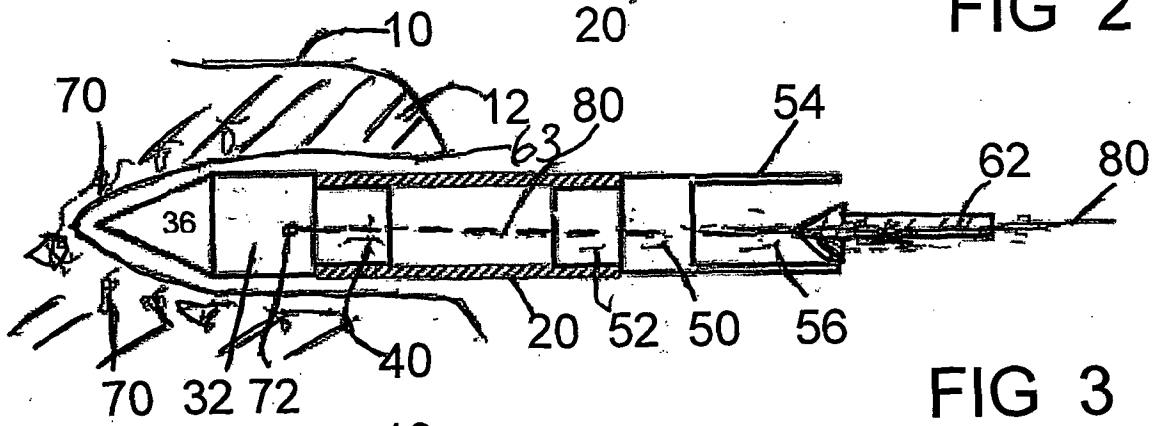
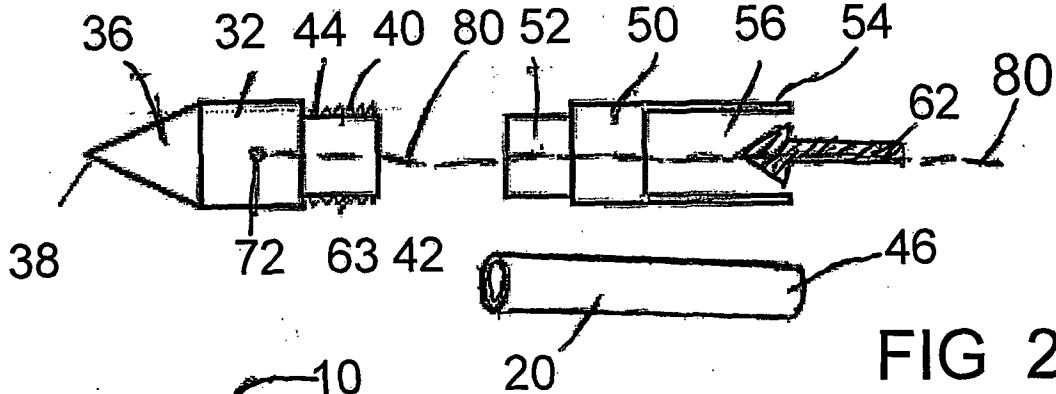


FIG 6



INTERNATIONAL SEARCH REPORT

International application No.
PCT/NO2008/000414

A. CLASSIFICATION OF SUBJECT MATTER				
<p>IPC: see extra sheet According to International Patent Classification (IPC) or to both national classification and IPC</p>				
B. FIELDS SEARCHED				
Minimum documentation searched (classification system followed by classification symbols)				
IPC: F16L, E21B				
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched				
SE,DK,FI,NO classes as above				
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)				
EPO-INTERNAL, WPI DATA, PAJ				
C. DOCUMENTS CONSIDERED TO BE RELEVANT				
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.		
Y	US 3599731 A (DONALD E. LAWLIS), 17 August 1971 (17.08.1971), column 3, line 70 - column 4, line 32, figures 1-3,6, abstract --	1-14		
Y	US 1894446 A (V.S. MCKENNY), 17 January 1933 (17.01.1933), page 4, line 20 - line 57; page 4, line 80 - line 90, figure 6 --	1-14		
Y	US 20070212169 A1 (CRANE), 13 Sept 2007 (13.09.2007), figure 3, abstract, paragraphs (0021)-(0022) --	1-14		
<input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C. <input checked="" type="checkbox"/> See patent family annex.				
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23 March 2009		25-03-2009		
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INTERNATIONAL SEARCH REPORT

International application No.

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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	GB 409319 A (JOSEPH CLARK), 25 April 1934 (25.04.1934), page 4, line 42 - line 80, figures 1-3 ---	1-14
A	US 6585453 B2 (ROBINSON), 1 July 2003 (01.07.2003), column 3, line 20 - line 37; column 5, line 18 - column 6, line 28, figure 2, abstract -----	1-14

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Cited literature, if any, will be enclosed in paper form.

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/NO2008/000414

US	3599731	A	17/08/1971	NONE		
US	1894446	A	17/01/1933	NONE		
US	20070212169	A1	13/09/2007	NONE		
GB	409319	A	25/04/1934	NONE		
US	6585453	B2	01/07/2003	US 20030017008	A	23/01/2003